Central Bank Control over Interest Rates

The Myth and the Reality

Jeffrey Rogers Hummel

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Abstract

Many believe that central banks, such as the Federal Reserve (Fed), have almost total control over some critical interest rates. Serious monetary economists are more sophisticated. They realize that central bank control over interest rates is very far from complete. Nonetheless, central bank officials and many economists are largely responsible for the popular misapprehension. This is because they persistently and misleadingly describe central bank policy as if it determined interest rates. Their focus on interest rates as both the target and indicator of monetary policy stems from the fact that even those holding the sophisticated view of how monetary policy works tend to overestimate the strength and significance of a central bank's limited effect on real interest rates. There is no denying that central banks have some impacts on interest rates, in both the short run and the long run. However, this working paper argues that not only is the popular belief in precise central bank management of interest rates simply wrong, but also even the sophisticated view of central bankers and mainstream monetary economists turns out to be overstated. In fact, continued targeting of interest rates by central banks has even led to some confusion and policy errors.

JEL codes: E43, E52, E58, B1, B22

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Central Bank Control over Interest Rates: The Myth and the Reality

Jeffrey Rogers Hummel

Many believe that central banks, such as the Federal Reserve (Fed), have almost total control over some critical interest rates. They think of this control as some kind of magic wand that allows central banks to set interest rates wherever they please. This belief is widely held among the general public, economics journalists, and politicians across the political spectrum, whether or not they approve of the Fed's current actions or even approve of the Fed itself. The belief is not universal—one can find exceptions, and the current persistence of low interest rates is beginning to undermine it—but it is still pervasive. It is also mistaken.

Serious monetary economists are more sophisticated. They realize that central bank control over interest rates is very far from complete. For example, Ben Bernanke has written in his blog that "If you asked the person in the street, 'Why are interest rates so low?', he or she would likely answer that the Fed is keeping them low. That's true only in a very narrow sense. . . . Except in the short run, real interest rates are determined by a wide range of economic factors, including prospects for economic growth—not by the Fed."[1] Indeed, the widespread impression that central banks can simply fix interest rates anywhere is inconsistent not only with standard economic theory and received economic history but also with what is still taught about how money actually affects interest rates in many mainstream undergraduate and graduate economics texts.

Nonetheless, Bernanke while Fed chair, most other central bank officials, and many economists are partly responsible for the popular misapprehension. This is because they

[1] Ben S. Bernanke, "Why Are Interest Rates So Low?" *Ben Bernanke's Blog*, March 30, 2015, https://www.brookings.edu/blog/ben-bernanke/2015/03/30/why-are-interest-rates-so-low/.

persistently and misleadingly describe central bank policy *as if* it determined interest rates. As George Selgin points out, "Economists and monetary policymakers have tended for some time now to think and speak of monetary policy as if it weren't about 'money' at all. Instead they've gotten into the habit of treating monetary policy as a matter of regulating, not the supply of means of payment, but interest rates."[2]

Thus Bernanke, in the same blog post previously quoted, goes on to muddy matters by stating, "Contrary to what sometimes seems to be alleged, the Fed cannot somehow withdraw and leave interest rates to be determined by 'the markets.' The Fed's actions determine the money supply and thus short-term interest rates; it has no choice but to set the short-term interest rate *somewhere* [emphasis his]."[3] Or consider a speech in March 2013, when Bernanke was still at the Fed: "What monetary policy actually controls is *nominal* short-term rates. However, because inflation adjusts slowly, control of nominal short-term rates usually translates into control of real short-term rates over the short and medium term [emphasis his]."[4] Throughout Bernanke's enlightening memoir, *The Courage to Act*, he invariably invokes interest rates as the sole gauge of whether monetary policy was expansionary or not.[5] Likewise, the money and banking textbooks of former Fed governor Frederic S. Mishkin (which come in many editions and versions that are the industry standard), while otherwise presenting the standard view of how monetary policy may influence interest rates, also claim unequivocally

[2] George Selgin, "Monetary Primer, Part 1: Money," *Alt-M Blog*, April 21, 2016, http://www.alt-m.org/2016/04/21/a-monetary-policy-primer-part-money/.
[3] Bernanke, "Why Are Interest Rates So Low?"
[4] Ben S. Bernanke, "Long-Term Interest Rates," speech at the Annual Monetary/Macroeconomics Conference: The Past and Future of Monetary Policy, sponsored by Federal Reserve Bank of San Francisco, San Francisco, California, March 1, 2013, http://www.federalreserve.gov/newsevents/speech/bernanke20130301a.htm.
[5] Ben S. Bernanke, *The Courage to Act: A Memoir of Crisis and Its Aftermath* (New York: W. W. Norton, 2015).

and inconsistently that the Fed can "determine the federal funds rate," which is the rate at which banks loan each other reserves.[6]

This focus on interest rates as both the target and indicator of monetary policy stems from the fact that even those holding the sophisticated view of how monetary policy works tend to overestimate the strength and significance of a central banks' limited effect on those rates.[7] Confidence in central bank control over short-term rates has led to the widespread belief that the Fed was responsible for the low rates that stimulated the housing bubble before the financial crisis of 2007–2008 and that it continues to be responsible for the even lower rates that have prevailed since the crisis. It is enshrined in the famous Taylor rule, which has become the dominant guide to how central banks can employ their target interest rate (referred to as the *policy rate*) to simultaneously keep inflation in check and yet dampen the business cycle. New Keynesian macroeconomists have gone so far as to create models of the economy that replace the traditional aggregate demand curve with what is called a *monetary response function*, in which the central bank automatically follows some form of Taylor rule, thereby incorporating determination of real rates right into the model. The most sophisticated and elaborate theoretical underpinning for this approach is in Michael Woodford's enormously influential scholarly tome, *Interest and Prices: Foundations of a Theory of Monetary Policy*. Woodford asserts that "the central bank can control

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[6] Frederic S. Mishkin, *The Economics of Money, Banking and Financial Markets*, Business School Edition, 3rd ed. (Boston: Pearson, 2013), 425.

[7] Notable exceptions I would single out include Daniel L. Thornton, whose several articles on the subject include "Monetary Policy: Why Money Matters *and Interest Rates Don't*" (Working Paper Series No. 2012-020A, Federal Reserve Bank of St. Louis, July 2012), http://research.stlouisfed.org/wp/2012/2012-020.pdf; Eugene F. Fama, "Does the Fed Control Interest Rates?" (Chicago Booth Research Paper No. 12-23, Fama-Miller Working Paper, June 29, 2013), available through SSRN at http://ssrn.com/abstract=2124039; John H. Cochrane, "Inside the Black Box: Hamilton, Wu, and QE2," Comments at the NBER Monetary Economics Meeting, March 3, 2011, http://faculty.chicagobooth.edu/john.cochrane/research/papers/hamiton_wu_term_structure.pdf; Deirdre N. McCloskey, "Other Things Equal, Alan Greenspan Doesn't Influence Interest Rates," *Eastern Economic Journal* 26 (Winter 2000): 99–101; and Nick Rowe, "Interest Rate Targeting as a Social Construction," *Worthwhile Canadian Initiative* blog, November 9, 2009, http://worthwhile.typepad.com/worthwhile_canadian_initi/2009/11/interest-rate-targeting-as-a-social-construction.html, as well as Selgin, "Monetary Primer, Part 1: Money."

overnight interest rates within a fairly tight range."[8] As a result, simplified versions of these New Keynesian models have even percolated down to the latest editions of macro texts, such as N. Gregory Mankiw's popular, intermediate-level, undergraduate *Macroeconomics*.[9]

As Milton Friedman succinctly put it as late as 1998, "After the U.S. experience during the Great Depression, and after inflation and rising interest rates in the 1970s and disinflation and falling interest rates in the 1980s, I thought the fallacy of identifying tight money with high interest rates and easy money with low interest rates was dead. Apparently, old fallacies never die."[10] The almost exclusive fixation on interest rates as the central bank's daily operating target emerged—or more accurately reemerged, after having been temporarily discredited by the Monetarist counterrevolution in macroeconomic thought—during the 1980s. Friedman and other Monetarists had advocated that the Fed conduct monetary policy by instead targeting some measure of the money stock. This proposal was grounded in studies demonstrating a fairly predictable relationship between the money stock and such variables as the price level and nominal income (i.e., GDP). But financial deregulation and assorted other factors caused that relationship to break down in the short run, as money demand (and its reciprocal, velocity) began

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[8] Michael Woodford, *Interest and Prices: Foundations of a Theory of Monetary Policy* (Princeton, NJ: Princeton University Press, 2003), 25.

[9] N. Gregory Mankiw, *Macroeconomics*, 8th ed. (New York: Worth, 2013), 435–37; 440–42. For an extreme application of the monetary response function to the evaluation of monetary policy, see Narayana Kocherlakota, "Rules versus Discretion: A Reconsideration" (Brookings Papers on Economic Activity conference draft, Brookings Institution, Washington, DC, September 15–16, 2016), https://www.brookings.edu/bpea-articles/rules-versus-discretion-a-reconsideration/; and George Selgin's critique, "Rules, Discretion, and Audacity: A Critique of Kocherlakota," *Alt-M Blog*, September 22, 2016, http://www.alt-m.org/2016/09/22/rules-discretion-audacity-critique-kocherlakota/.

[10] Milton Friedman, "Reviving Japan," *Hoover Digest*, April 30, 1998 (reprinted from "Rx for Japan: Back to the Future," *Wall Street Journal*, December 17, 1997), http://www.hoover.org/research/reviving-japan. Friedman made the same point just before his death in an interview with Russ Roberts, "Friedman on Money," *EconTalk* podcast, August 28, 2006, http://www.econtalk.org/archives/2006/08/milton_friedman.html. This is fully consistent with Friedman's earlier writings on the subject, cited below. Despite this, Charles A. E. Goodhart, in "The Conduct of Monetary Policy," *Economic Journal* 99 (June 1989): 331, makes an extraordinary assertion about both Friedman and John Maynard Keynes: "When either of these two great economists would discuss practical policy matters concerning the level of short-term interest rates, they had no doubts that these were normally determined by the authorities, and could be changed by them, and were not freely determined in the market."

to behave more erratically than in the past. So central bankers threw up their hands, concluded that monetary targeting was unworkable, and returned to focusing on interest rates.

There is no denying that central banks have *some* impacts on interest rates, in both the short run and long run. But the complexity of and qualifications to those impacts have been swept into a memory hole, submerging a host of additional questions. How strong or weak is the initial effect on real interest rates, and can its strength vary over time or with institutional arrangements? How long does the effect operate after a change in the rate of monetary growth? Does any impact on real rates eventually disappear completely, or can a constant rate of monetary growth make it permanent? Exactly which interest rates are initially affected by monetary policy: only short-term rates, or rates across a broad spectrum of maturities extending even into real assets? In other words, do central banks affect the term structure of interest rates (i.e., the yield curve), and if so, how? Addressing those questions exposes serious constraints on the magnitude, duration, and predictability of the actual control over interest rates that central banks exercise.

In what follows, I argue not only that the popular belief in precise central bank management of interest rates is simply wrong, but also that even the sophisticated view of central bankers and mainstream monetary economists turns out to be overstated. In fact, the continued targeting of interest rates by central banks has even led to some confusion and policy errors.

The Received Theory: Short Run versus Long Run

Friedman did help permanently banish at least one once-popular fallacy about central bank control over interest rates. Nearly everyone now recognizes the crucial distinction between nominal and real interest rates, real interest rates being adjusted either *ex post* for actual inflation

or *ex ante* for anticipated inflation. Central banks can affect nominal interest rates indirectly through their impact on inflation. Although a monetary injection tends *initially* to lower both real and nominal interest rates, if a Fed expansionary monetary policy increases the inflation rate, once the higher inflation is fully anticipated, nominal interest rates will have risen to offset the negative impact on real rates. Similarly, the Fed, through a tight monetary policy, can, despite any initial increase in interest rates, eventually lower nominal rates. Thus, high nominal interest rates can be a sign of either tight or easy money depending on inflationary expectations.

This long-term relationship between inflation and nominal interest rates is generally known as the *Fisher effect*. This theory was named for the American economist Irving Fisher, who explored it at the turn of the 20th century. The Fisher effect was actually identified at least as early as 1811 by the British banker, abolitionist, and member of Parliament, Henry Thornton,[11] yet it received widespread acknowledgment only with the work of Friedman and the Great Inflation of the 1970s. Indeed, it was not until 1992 that John Taylor of Stanford University finally came up with a rule for central-bank behavior that adjusts for the Fisher effect. I will say more about the Taylor rule, but its late development should be a source of both embarrassment and epistemic humility for macroeconomic policymakers and central bankers.[12]

The Fisher effect, of course, is not the current basis for the belief that central banks control interest rates. What the sophisticated consensus has in mind, instead, is a short-run,

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[11] Henry Thornton, *An Enquiry into the Nature and Effects of the Paper Credit of Great Britain*, reprint ed. (London: Allen and Unwin, 1939), appendix 3, 336; Irving Fisher, *Appreciation and Interest* (Cambridge, MA: American Economic Association, 1896); Irving Fisher, *The Rate of Interest: Its Nature, Determination and Relation to Economic Phenomena* (New York: Macmillan, 1907); Irving Fisher, *The Theory of Interest: As Determined by the Impatience to Spend Income and the Opportunity to Invest It* (New York: Macmillan, 1930).

[12] For the forgotten history of the Fisher effect in macroeconomic thought and the effect's surprisingly late acceptance, see David Laidler, "The Fisher Relation in the Great Depression and the Great Recession" (EPRI Working Paper Series No. 2013-2, Economic Policy Research Institute, London, Ontario, March 2013), http://economics.uwo.ca/epri/workingpapers_docs/wp2013/Laidler_02.pdf.

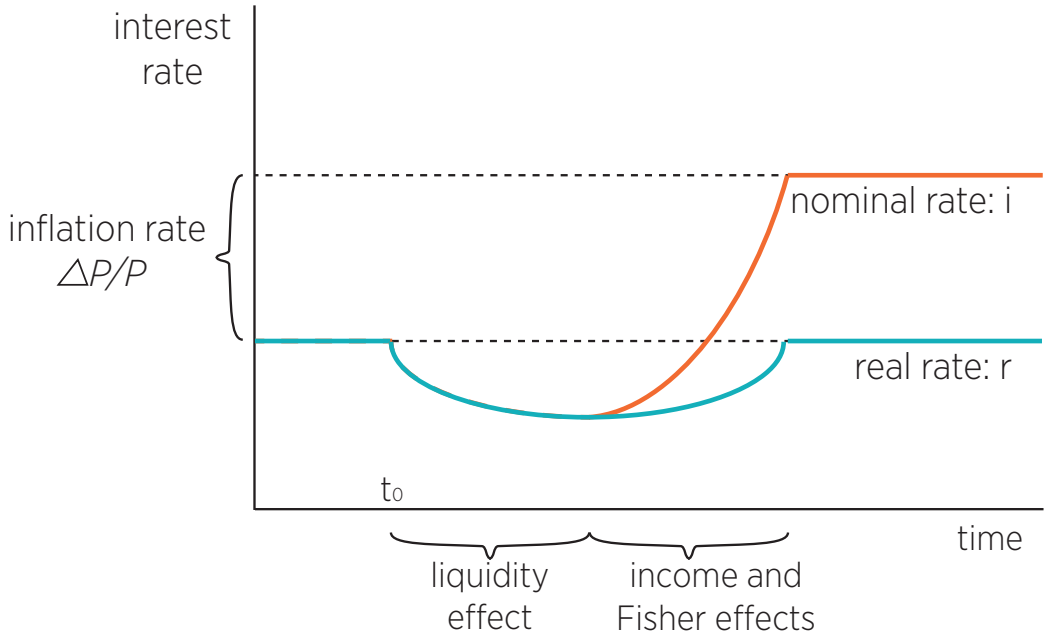
immediate impact that works in the opposite direction on both nominal and real rates, with an expansionary monetary policy lowering interest rates and vice versa. Friedman introduced the term *liquidity effect* for this initial impact in 1969, and the term has become fairly standard among economists and especially in money and banking texts.[13] But Friedman was neither the first nor the only economist to point out that the liquidity effect should be temporary. As lower interest rates encourage increased real investment and income and as the increased money stock simultaneously drives up the price level, real interest rates should return approximately to their previous level in what Friedman called the "income-and-price level effect" and later just shortened to intermediate *income effect*. This analysis became conventional fare in money and banking textbooks. Mishkin's texts, for instance, discuss the liquidity effect, then separate Friedman's income-and-price level effect into two distinct effects, and then use the term "expected-inflation effect" for the Fisher effect.[14] Other texts stick with only three effects: liquidity, income, and Fisher.

Whatever the terminology and number of effects, the result comes out exactly the same. A one-shot jump in the money stock should initially lower both real and nominal rates, but the rates ultimately return to their previous levels. An increase in the growth rate of money will initially lower both real and nominal rates. But real rates eventually go back up toward their previous level by driving nominal rates still higher because of anticipated higher inflation. Figure 1 is a stylized depiction of this sequence after an increase in money's growth rate at time t_0, with an initial inflation rate of zero. Even the obsolete macroeconomic IS-LM model—which unfortunately still

[13] Milton Friedman, "Factors Affecting the Level of Interest Rates," in *Proceedings of the 1968 Conference on Saving and Residential Financing* (Chicago: United States Savings and Loan League, 1968), 11–27. Reprinted in Thomas M. Havrilesky and John T. Boorman, eds., *Current Issues in Monetary Theory and Policy* (Arlington Heights, IL: AHM Publishing, 1976), 362–78. Friedman had already sketched out these views in his 1967 presidential address to the American Economic Association, "The Role of Monetary Policy," reprinted in *American Economic Review* 58 (March 1968): 1–17.
[14] Mishkin, *The Economics of Money, Banking and Financial Markets*, 111–14.

graces so many economics texts as a useless initiation ritual for economics majors—grinds out the same story: an initial fall in the interest rate in response to a monetary expansion and then, if prices are flexible, a rise back to where the interest rate was before. This self-reversing sequence is just a manifestation of the *approximate* long-run neutrality of money, a proposition accepted even by most New Keynesian economists today. In long-run equilibrium, money affects only nominal magnitudes and not real factors.

Figure 1. Interest Rate Response to Increase in Monetary Growth



Source: Author's rendering.

The theoretical long-run neutrality of money opens a significant chink in the popular impression of central bank control over interest rates. If the liquidity effect is a self-reversing phenomenon, then how can the Fed keep real rates below (or above) their equilibrium level for prolonged periods without simultaneously generating accelerating inflation (or accelerating

deflation)? To be sure, nearly all monetary economists today accept this conclusion. But it brings to the fore all the additional questions raised about the strength or weakness of the initial liquidity effect, precisely how long its duration is, and exactly which interest rates are affected.

Unfortunately, there is no agreement about why the liquidity effect operates at all. Friedman's final discussion of this question appeared in 1982, in a book he wrote with Anna J. Schwartz, *Monetary Trends in the United States and the United Kingdom*.[15] (It was the fourth but woefully neglected volume in the National Bureau of Economic Research series that began with Friedman and Schwartz's well-known *Monetary History of the United States* and included their subsequent *Monetary Statistics of the United States* and Phillip Cagan's *Determinants and Effects of Changes in the Stock of Money*.[16]) Therein, Friedman and Schwartz offered two channels for what they relabeled the "impact effect" of monetary policy. They still called the first channel, attributed to John Maynard Keynes, the liquidity effect; but for clarity I will adopt Phillip Cagan's term and call it the *portfolio effect*.[17] It arises from how changes in the quantity of money alter people's total portfolio of assets. An unanticipated increase in the money stock, before driving up the average price level, will raise people's relative holdings of money above their desired level. They will therefore shed the excess by buying other assets, financial and real, to rebalance their portfolios. As the prices of those other assets consequently rise, the yields or

[15] Milton Friedman and Anna J. Schwartz, *Monetary Trends in the United States and United Kingdom: Their Relation to Income, Prices, and Interest Rates, 1867–1975* (Chicago: University of Chicago Press, 1982), 477–500 [those pages are available online at http://www.nber.org/chapters/c11410.pdf].
[16] Milton Friedman and Anna Jacobsen Schwartz, *A Monetary History of the United States, 1867–1969* (Princeton, NJ: Princeton University Press, 1963); Milton Friedman and Anna Jacobsen Schwartz, *Monetary Statistics of the United States: Estimates, Sources, Methods* (New York: Columbia University Press, 1970); and Phillip Cagan, *Determinants and Effects of Changes in the Stock of Money, 1867–1960* (New York: Columbia University Press, 1965).
[17] Phillip Cagan, *The Channels of Monetary Effects on Interest Rates* (New York: National Bureau of Economic Research, 1972).

interest rates on those assets temporarily fall. An unanticipated decrease in the money stock will have the reverse impact.

Friedman and Schwartz distinguished this portfolio effect from what they called the "first-round loanable funds effect."[18] Before Keynes, this impact on loanable funds was the traditional explanation for the initial influence of money on interest rates. In a more generalized form, this effect dates back to the 18th-century Irish-French economist Richard Cantillon and is generically known as a *Cantillon effect*. It hinges on where newly created money is injected into the economy. Because the conventional way is for central banks or private banks to increase the supply of loanable funds, interest rates fall, *ceteris paribus*. The reverse similarly occurs when banks decrease the supply of loanable funds, although for simplicity I will hereafter confine the discussion to monetary increases (unless otherwise stated). This increase in loanable funds is what the Swedish economist Knut Wicksell had in mind when he discussed deviations from the natural rate of interest, and what Friedrich A. Hayek dubbed "forced saving," which subsequently played an important role in Austrian business cycle theory.[19]

Obviously, a Cantillon effect alters interest rates only if the increase in the quantity of money comes through the loan market. John Stuart Mill noted that the result would be different if the new money derives from gold discoveries under a gold standard.[20] Or to offer another example, if the government treasury simply prints up money and spends it, rather than the central bank loaning it out, there is no initial increase in the supply of loanable funds. In contrast, the

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[18] Friedman had actually hinted at the two channels earlier—in his 1967 presidential address, "The Role of Monetary Policy," 5–6—giving priority to the loanable-funds channel.

[19] Knut Wicksell, *Interest and Prices (Geldzins und Güterpriese): A Study of the Causes Regulating the Value of Money* (1898, English trans. reprint ed.; London: Macmillan, 1936), 102–21; Friedrich A. Hayek, "A Note on the Development of the Doctrine of 'Forced Saving,'" *Quarterly Journal of Economics* 47 (November 1932): 123–33, reprinted in F. A. Hayek, *Profits, Interest and Investment: And Other Essays on the Theory of Industrial Fluctuations* (London: George Routledge & Sons, 1939).

[20] John Stuart Mill, *Principles of Political Economy*, 5th ed. (London: Parker Son and Bourn, 1862), book 3, chap. 23, para. 4.

portfolio channel should affect interest rates irrespective of how the money is introduced, even presumably through a Friedman helicopter drop that distributes the new money *pro rata* throughout the population, so long as it is unanticipated. But that also implies that the portfolio channel's impact is dispersed throughout a much wider spectrum of assets, including physical assets, and operates more slowly, whereas the loanable-funds channel pinpoints monetary injections at a very narrow array of assets, solely financial rather than real—in fact, in most cases, solely fixed-rate debt rather than equity—and is therefore more abrupt.

Empirically distinguishing between these two channels is almost impossible, although Cagan uncovered what he believed was some evidence for the priority of the portfolio channel.[21] Most mainstream discussions seem to equivocate between the two ways that money can have an initial impact on real and nominal interest rates, basing their theoretical justifications on a portfolio effect but then basing their policy analysis on a Cantillon effect within financial markets. [22] These two channels have significantly different implications for the strength and breadth of money's impact on interest rates, but regardless of which effect dominates, they are both self-reversing.

As Friedman and Schwartz pointed out, the income effect that brings real interest rates back to their previous level after a monetary injection "does not depend on any doctrinal position

[21] Cagan, *The Channels of Monetary Effects on Interest Rate*. For a challenge to Cagan's conclusion, see William Poole's review of the book in the *Journal of Political Economy* 82 (May/June 1974): 665–68, which essentially charges Cagan with confusing two issues: whether the loanable-funds channel transfers the seigniorage from money creation to the institutions receiving the money as opposed to whether it affects interest rates.

[22] During an extended 2012 online debate over Cantillon effects, those blog participants who denied the relevance of Cantillon effects seemed to overlook the fact that claims that central banks affect interest rates often implicitly invoke a Cantillon effect. For a post providing links to most of the comments in the debate, see David Glasner, "Those Dreaded Cantillon Effects," *Easy Money* blog, December 6, 2012, http://uneasymoney.com/2012/12/06/those-dreaded-cantillon-effects/. A further comment from George Selgin is "Sumner v. Cantillon," *Free Banking* blog, December 9, 2012, http://www.freebanking.org/2012/12/09/sumner-v-cantillon/.

about the way monetary forces affect the economy. Along strict Keynesian income-expenditure lines, the initial liquidity and loanable funds effects produce lower interest rates, and the lower interest rates stimulate business investment." Even with inflexible prices, real income rises, raising the demand for money and for loanable funds. "These shifts will tend to raise interest rates, counteracting the downward pressure from the liquidity and first-round [loanable funds] effects."[23]

Monetarists, such as Friedman and Schwartz, always believed that new money flowed through more than the narrow financial canal circumscribed by Keynesian theory, and thus they never accepted the IS-LM straitjacket as an accurate portrayal of the theoretical differences between the two positions. Friedman argued back in 1968 that "the effect of the monetary change is exerted much more broadly," including on the prices of goods and services.[24] But whatever way the new money eventually spreads throughout the economy, sooner or later prices will rise, increasing the nominal demand for money and restoring interest rates to their long-run equilibrium level. The one difference between the portfolio channel and the loanable-funds channel, hinted at by Friedman and Schwartz and confirmed by Cagan, stems from the fact that the former results from an unanticipated increase in money balances, whereas the latter results from an actual increase in the supply of loanable funds. Thus, a fully expected monetary expansion will more likely dampen the portfolio effect than the loanable-funds effect.

Whether the new equilibrium level of real interest rates is exactly the same as the old depends partly on whether the economy is responding to a one-shot increase in the money stock or to an increase in money's rate of growth. Don Patinkin's *Money, Interest, and Prices* is a classic that appeared before Friedman's initial article on the liquidity effect and used to be

[23] Friedman and Schwartz, *Monetary Trends in the United States and United Kingdom*, 486–87.
[24] Friedman, "Factors Affecting the Level of Interest Rates," 17.

required reading in nearly every graduate monetary theory course.[25] Using a general-equilibrium framework, it remains a definitive demonstration of money's long-run approximate neutrality (with the word "approximate" covering a multitude of potential exceptions, including distribution effects and other *ceteris paribus* conditions). Patinkin persuasively concludes that after a one-shot increase in the money stock, real (and nominal) interest rates will remain unchanged in the long run, so long as there is no exogenous change in any other variable, particularly the velocity of money.

But an acceleration of money's rate of growth, because it will increase the inflation rate, is less straightforward. It is known that higher inflation means that non-interest-bearing money is depreciating faster. Therefore, people will wish to hold smaller real cash balances, creating a once-over increase in money's velocity—that is, a decrease in money demand. Patinkin refers to such changes in velocity as "shifts in liquidity preference" and concludes, from a purely theoretical perspective, that they can increase, decrease, or leave unchanged the real interest rate, depending on how people reallocate their spending. Keynesian economists Robert Mundell and James Tobin have argued, for reasons that need not detain us here, that an increase in velocity will decrease consumption and increase saving, causing real interest rates to fall.[26] As a result, if the inflation rate rises, say, from 3 percent to 8 percent, Mundell and Tobin predict that the

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[25] Don Patinkin, *Money, Interest, and Prices: An Integration of Monetary and Value Theory*, 2nd ed. (New York: Harper and Row, 1965). The first edition was published in 1956, but it was the second edition that received wide attention. It may not be strictly correct to say that Milton Friedman, who was a Marshallian partial-equilibrium theorist, accepted the long-run neutrality of money according to the full Walrasian, general-equilibrium interpretation of the concept. Although Friedman's business cycle theory had changes in the money stock ultimately changing only nominal variables, the second edition of his *Price Theory* (Chicago: Aldine, 1976), 315–21, concluded that money's mere existence altered the equilibrium real interest rate.

[26] Robert Mundell, "Inflation and Real Interest," *Journal of Political Economy* 71 (June 1963): 280–83; James Tobin, "Money and Economic Growth," *Econometrica* 33 (October 1965): 671–84. Harry G. Johnson arrived at the same conclusion employing what is now widely known as the Solow growth model in "The Neo-Classical One-Sector Growth Model: A Geometrical Exposition and Extension to a Monetary Economy," *Economica* 33 (August 1966): 265–87. But Miguel Sidrauski, "Rational Choice and Patterns of Growth in a Monetary Economy," *American Economic Review* 57 (May 1967): 534–44, got rid of this effect altogether with a growth model that made savings endogenous under assumptions that also underlie assorted Taylor rules and will be discussed later.

Fisher effect will push nominal interest rates up by less than 5 percentage points, with real rates slightly lower than before the change in inflation. Most economists regard this Mundell-Tobin effect on real rates, if it exists at all, as very slight, because non-interest-bearing money is a small fraction of people's total wealth. Further complications can arise from the impact of taxes on interest, creating a larger tax wedge as inflation increases and tending to drive nominal rates even higher than otherwise.

Duration and Magnitude of Interest Rate Impacts

Given the apparent theoretical agreement that the central banks' initial impact on interest rates is self-reversing, how long does this process take? A great deal of research has been done on the timing of the Fisher effect, and the conclusion is that institutions matter greatly. Under the gold standard, which anchored the price level over the long run, inflationary expectations took so many years to kick in that, instead of generating a positive relationship between nominal interest rates and rates of inflation, it sometimes (although not always) produced a positive relationship between nominal interest rates and the *level* of prices. John Maynard Keynes named this phenomenon Gibson's paradox, after the British economist Herbert Albert Gibson, who first reported the historical correlation in 1923.[27] But in the post–World War II period, the Fisher effect not only operates quickly enough to produce an obvious correlation between inflation and nominal rates in countries worldwide, but also it appears that sometimes inflationary

[27] Friedman and Schwartz, *Monetary Trends in the United States and the United Kingdom*, 546–69, compare Irving Fisher's explanation for Gibson's Paradox with that of Keynes and Knut Wicksell and end up endorsing Fisher's. See also Robert B. Barsky and Lawrence H. Summers, "Gibson's Paradox and the Gold Standard," *Journal of Political Economy* 96 (June 1988): 528–50; and Scott Sumner, "The Role of the Gold Standard in the Gibson Paradox," *Bulletin of Economic Research* 45 (July 1993): 215–28.

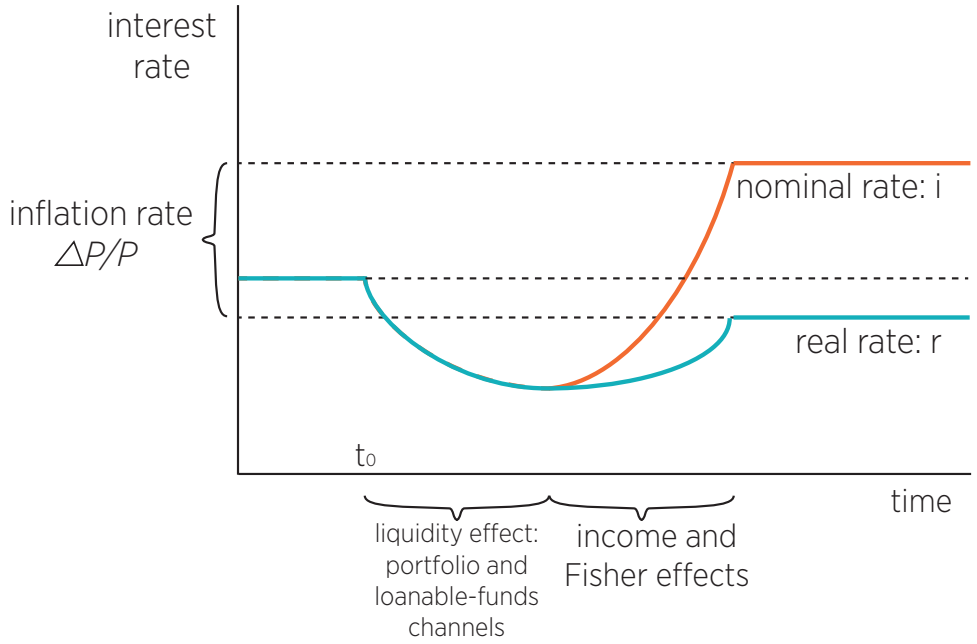
expectations can take hold quickly enough to swamp the liquidity effect, causing nominal rates to rise rather than fall in anticipation of dramatic acceleration in monetary growth.

In contrast, despite numerous theoretical attempts to formally model the liquidity effect, how long it takes the intermediate income effect to return real interest rates to their previous level remains an open question.[28] The 1982 Friedman and Schwartz volume even raises the possibility of a cyclical adjustment that temporarily causes nominal and real rates to overshoot the long-run equilibrium.[29] Yet given the current rapidity of the Fisher effect, it makes little sense to insist that real rates remain very far from long-run equilibrium for prolonged periods. After all, the Fisher effect *ipso facto* is a partial return of real rates to equilibrium. The only way for the portfolio effect to keep real rates down is for the monetary expansion to remain partly unanticipated and therefore the price level not yet fully adjusted. A Cantillon effect operating directly through the loan market not only is more abrupt, but also could be more prolonged because of where it pinpoints the continuous monetary injection. So rather than the stylized scenario shown in figure 1, the result might be the slightly modified scenario of figure 2 (which is also what the Mundell-Tobin effect would produce). But notice, this prolonged lowering of real rates is accompanied by a rise in nominal rates, which still runs counter to simplistic, popular notions about the Fed's control over interest rates.

[28] A few examples of these attempts are Lee E. Ohanian and Alan C. Stockman, "Theoretical Issues of Liquidity Effects," Federal Reserve Bank of St. Louis *Review* 77 (May/June 1995): 3–25; Lawrence J. Christiano, Martin Eichenbaum, and Charles L. Evans, "Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy," *Journal of Political Economy* 113 (February 2005): 1–45; Chris Edmond and Pierre-Olivier Weill, "Models of Liquidity Effects," in *The New Palgrave Dictionary of Economics,* ed. Steven N. Durlauf and Lawrence E. Blume, 2nd ed. (New York: Palgrave Macmillan, 2008), http://www.dictionaryofeconomics.com.libaccess.sjlibrary.org /dictionary.

[29] Friedman and Schwartz, *Monetary Trends in the United States and United Kingdom*, 477–587.

Figure 2. Modified Interest Rate Response to Increase in Monetary Growth



Source: Author's rendering.

Whatever the duration of the initial liquidity effect lowering interest rates, even greater problems confront the conventional view of the magnitude of the effect, however long it lasts. One of the most forceful challenges is a short article by Deirdre McCloskey that appeared in 2000. Pointing out that "a little person in a large market cannot move the price very much," she builds her argument on the microeconomic distinction between a *price taker*—a firm that is so small relative to the size of the market that it has almost no influence on market price—and a *price searcher*—a relatively large firm that can have a significant impact on the price of its product. The Federal Reserve directly controls only the monetary base (that is, the total quantity of dollar reserves in the banks and dollar currency in the hands of the general public). Although the base is critical for affecting the price level, McCloskey observes that it was about $500 billion in 1998 and had risen by about $40 billion over the subsequent year. Estimating the size

of global assets, real and financial, at $280 trillion, and assuming that this amount approximated the size of the total market determining interest rates, McCloskey calculates the elasticity of the demand curve that the Fed was facing in its effort to move those rates as 14,000. She concludes, "That's no influence."[30]

A more conservative and recent statement of the same argument appears in an early draft of a working paper by Eugene Fama. "In recent years total U.S. credit market debt, as reported in Federal Reserve Flow of Funds tables, is in excess of $50 trillion," he writes. He thereby throws out all real assets and all equity finance, ignores the rest of the world, and looks at the Fed relative to the size of only the U.S. credit market. "Prior to the financial crisis of 2008, total financial assets held by the Fed are less than $1 trillion, or less than two percent of the U.S. market. In response to the financial crisis of 2008, total financial assets held by the Fed jump to over $2 trillion and are almost $2.5 trillion at the end of 2010. This is huge by historical standards but still less than five percent of the U.S. market. Several large banks (J.P. Morgan Chase, Bank of America, Citibank, and Wells Fargo) have balance sheets comparable in size to the Fed's. Moreover, the U.S. credit market sits in a large international market that is open to major participants around the world, and big players can and do operate across markets. In this context, it seems implausible that the Fed has a major role in determining U.S. interest rates, except to the extent that it can affect expected inflation. It seems more implausible that in an open international bond market, multiple central banks can separately control interest rates in their local markets."[31] In other words, although central banks can have prolonged influence on nominal interest rates through their control over inflation, the belief that they have control over

[30] McCloskey, "Other Things Equal, Alan Greenspan Doesn't Influence Interest Rates," 99, 101.
[31] This quotation appears in the earlier, August 18, 2012, draft of Fama's working paper, "Does the Fed Control Interest Rates?" cited in n. 1. Fama dropped the statement from the latest, June 29, 2013, version of the working paper, and as far as I can tell the earlier draft is no longer available online.

real interest rates violates the most fundamental and widely accepted principles of microeconomic price theory.

The strength of this criticism, admittedly, depends on which we consider more powerful for the Fed's initial impact on interest rates: the portfolio channel or the loanable-funds channel. The criticism appears almost devastating for the portfolio effect. Simplified models make the nominal demand for money a function of three variables: the price level, real income, and the nominal interest rate. After an unexpected increase in the money stock or in its rate of growth, the price level will not immediately rise and bring people's real cash balances back down to their desired level. It is natural to conclude that, before prices adjust, only a fall in the nominal interest rate can induce people to hold their increased real balances. But this analysis has two weaknesses. First, it ignores the obvious fact that cash balances serve as a "shock absorber," in the words of Friedman and Schwartz, or a buffer that creates an interval in which "the public will hold the excess cash." Just because the price level doesn't instantaneously adjust, why assume the interest rate does so, even if it is not nearly as sluggish as the price level? As David Laidler perceptively puts it, both New Keynesian and New Classical macroeconomists "proceed 'as if' the observed demand and supply for money were always equal to each other. In the Keynesian approach it is interest-rate flexibility that guarantees this, and in the new-classical approach framework, general wage and price flexibility."[32]

Second, and equally important, given the vast array of alternative assets to non-interest-bearing cash (itself a small proportion of total wealth), the required fall in nominal rates cannot

[32] Friedman and Schwartz, *Monetary Trends in the United States and United Kingdom*, 482: David Laidler, *Taking Money Seriously: and Other Essays* (Cambridge, MA: MIT Press, 1990), 28. The Laidler book is one of the most sophisticated discussions of money as a buffer, particularly the first chapter, which is a reprint of Laidler, "Taking Money Seriously," *Canadian Journal of Economics* 21 (November 1988): 687–713, and offers a Lucas-type critique of rational expectations. For an attempt to empirically measure the buffer effect using a vector autoregression (VAR) model, see William D. Lastrapes and George Selgin, "Buffer-Stock Money: Interpreting Short-Run Dynamics Using Long-Run Restrictions," *Journal of Money, Credit and Banking* 26 (Feb 1994): 34–54.

be very large. Friedman and Schwartz observe that "reported interest rates are only a few of a large set of rates of interest, many implicit and unobservable." Among myriad ubiquitous connections, "the interest rate connects stocks with flows, the rental value of land with the price of land." Interest rates also "connect the holders of financial assets to holders of real assets."[33] This coincides with the long-standing insistence of Austrian capital theory that the loanable funds market is just a small segment of the total time market; although the interest rate in the loan market provides an observable benchmark, it is dominated by internal rates of return within the capital structure.[34] In defense of the central bank's influence, Friedman and Schwartz do suggest that "because interest rates connect large stocks to relatively small flows, they can display wide variations as a result of apparently trivial changes."[35] Yet that still leaves unclear why the small flows resulting from changes in base money should be singled out as uniquely powerful over other often larger flows, including the inflow of foreign savings into the United States. For example, in 1998 foreign savings in the United States exceeded $200 billion, five times the base increase noted by McCloskey in the same year.

If we turn to the loanable-funds channel, then a stronger case exists for the magnitude of the central bank's affect on interest rates—yet only for certain securities, those that the central bank is actually purchasing. For the Fed, that means it has the greatest impact on the federal funds rate, the rate at which banks loan each other reserves, and next on Treasury securities. But consider the theoretical quandary this creates. To the extent that the various parts of the loan market are segmented, and the longer it takes for interest-rate changes to be transmitted across

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[33] Friedman and Schwartz, *Monetary Trends in the United States and United Kingdom*, 26–27, 486, 500.
[34] Eugen von Böhm-Bawerk, *Capital and Interest*, 3 vol. ([1884–1926]. English trans. reprint ed., South Holland, IL: Libertarian Press, 1959); Friedrich A. Hayek, *The Pure Theory of Capital* (London, Routledge & K. Paul, 1941); Murray Rothbard, *Man, Economy, and State: A Treatise on Economic Principles*, vol. 1 (Princeton, NJ: Van Nostrand, 1962); Roger W. Garrison, *Time and Money: The Macroeconomics of Capital Structure* (London: Routledge, 2001).
[35] Friedman and Schwartz, *Monetary Trends in the United States and United Kingdom*, 500.

maturities and financial sectors, the more powerful will be the central bank's impact on particular interest rates. But at the same time, the weaker its effect will be on the economy overall. The less markets are segmented and the more rapid the transmission of changes, the weaker will be the impact of central banks on interest rates overall, bringing us back to the McCloskey-Fama challenge.

Several economists have made this telling point. For instance, Daniel L. Thornton of the St. Louis Fed writes, "The degree to which the credit market is segmented is open to debate. The point to be made here is that while market segmentation increases the impact of the Fed's relatively small operation in particular segments of the market, it limits the Fed's ability to affect bond yields through the market more generally." Similarly, John H. Cochrane, formerly of the University of Chicago Booth School of Business and now at the Hoover Institution, applies the analysis to Ben Bernanke's quantitative easing: "If you think segmentation is narrow—limited just to Treasuries—then QE2 can have a bigger effect on Treasury yields, since a given sale or purchases [*sic*] forces the segmented participants to bear more risk. Alas, then, QE2 has no effect on other rates, and thus on the economy as a whole! If you think treasuries are linked to mortgages, corporate bonds, other sovereigns, bank lending, etc. then QE2 has a hope of affecting the rest of the economy. But now even 600b[illion] is just a drop in the bucket."[36]

The combination of the loanable-funds channel and some market segmentation along with inevitable lags is why the Fed, after its creation in 1914, was able to smooth out seasonal fluctuations of short-term interest rates.[37] It was why during World War II the Fed was able to peg the rate on Treasury bills at 0.375 percent in a full-fledged price support and to keep

[36] Thornton, "Monetary Policy: Why Money Matters *and Interest Rates Don't,*" 27; Cochrane, "Inside the Black Box: Hamilton, Wu, and QE2," 7.
[37] Jeffrey A. Miron, "Financial Panics, the Seasonality of the Nominal Interest Rate, and the Founding of the Fed," *American Economic Review* 76 (March 1986): 125–40.

Treasury bonds at 2.5 percent. It did so by relying on a massive expansion in the monetary base at a time when the Depression decade had already left market interest rates at historical lows and the demand for money exceptionally high, and when wartime controls over prices and resource allocation took the United States in long strides toward a command economy.[38] And it is why central banks in relatively closed economies with exchange controls and high barriers to the international exchange of goods and savings are going to have more influence over interest rates than those operating in a regime of globalization. But it should in no way undermine the overwhelming dominance of real factors in ultimately determining real interest rates.

More importantly, the differences between those two potential channels through which monetary policy might initially affect interest rates reveal a theoretical contradiction between much mainstream monetary theory and central bank practice. Most macroeconomic models quite explicitly (or otherwise implicitly) assume that changes in the money stock operate exclusively through the portfolio channel. But this would require that any impact on interest rates should be balanced somewhat equally across all assets, real and financial, throughout the entire economy. When spread so thinly, any resulting change in interest rates should be very minor. Yet the policy rates of most central banks, in contrast, are the short-term rates of usually a single financial security, such as federal funds in the case of the Fed. In that case, the resulting change of that particular interest rate becomes noticeable, but then any wider effect on other interest rates should be delayed and even more minute. Or to put it simply, if macroeconomists fully embraced the portfolio channel, then the effect on interest rates of a $100 billion increase in the monetary base should logically be much the same whether it is used to purchase short-term Treasury bills, long-term mortgaged backed securities, or any other financial or real asset.

[38] Friedman and Schwartz, *A Monetary History of the United States,* 546–91; Mark Toma "A Duopoly Theory of Government Money Production: The 1930s and 1940s," *Journal of Monetary Economics* 15 (July 1985): 363–82.

Empirical and Historical Evidence

A vast empirical literature, accumulating over the decades since World War II, has attempted to determine the strength of the overall liquidity effect, whether through the portfolio or loanable-funds channel. But none of the literature has been truly decisive or has even tried to show that the liquidity effect persists for extended periods, overriding the long-run neutrality of money.[39] Any correlation between central bank targets and market interest rates can result from either the market following the central bank or the central bank following the market. Bennett McCallum has therefore conceded, "It is probably true that a substantial portion of the meeting-to-meeting variations in the federal funds rate in the United States represents adjustments that are responses to changes in real rates that are brought about by changes in tastes, technology, shocks from abroad, and even perhaps some random behavioral errors by private agents."[40]

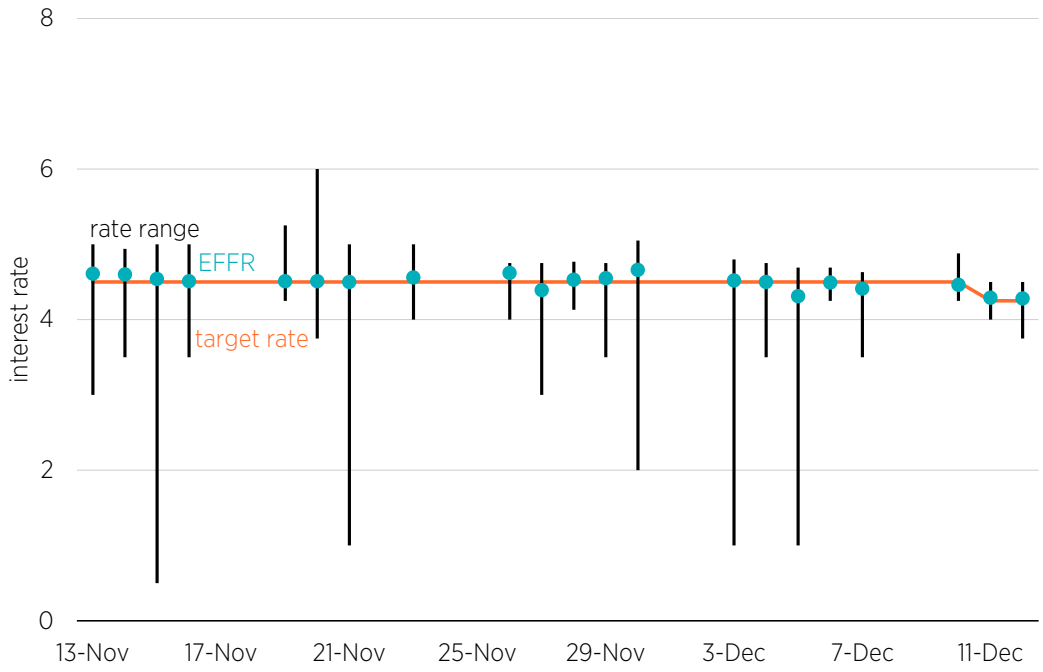
Even during the best of times, the Fed does not always precisely hit its federal funds target, despite what many in the general public seem to assume. See figure 3, which compares the Fed's federal funds target on a daily basis in late November and early December 2007 (solid orange line), a weighted average of all federal funds transactions (what the Fed calls the *effective federal funds rate*, or EFFR) on each day (blue dots), and the corresponding range of actual

[39] Ben S. Bernanke and Ilian Mihov, "The Liquidity Effect and Long-Run Neutrality," *Carnegie-Rochester Series on Public-Policy* 49 (1998): 149–94, assert a short-run liquidity effect but no important deviations from long-run neutrality. An oft-cited article alleging a daily liquidity effect is James D. Hamilton, "Measuring the Liquidity Effect," *American Economic Review* 87 (March 1997): 80–97. His finding is challenged by Daniel L. Thornton, "The Relationship between the Daily and Policy-Relevant Liquidity Effect," Federal Reserve Bank of St. Louis *Review* 92 (January/February 2010): 73–87. William D. Lastrapes and George Selgin, "The Liquidity Effect: Identifying Short-Run Interest Rate Dynamics Using Long-Run Restrictions," *Journal of Macroeconomics* 17 (Summer 1995): 387–404, use a VAR model with data from 1959 to 1993 to demonstrate a minor (no more than 10 basis points) liquidity effect that completely disappears within a year or less. These four articles should lead interested readers to the rest of the relevant literature.

[40] Bennett T. McCallum in a "Comment," 456, on Andrew Atkeson and Patrick J. Kehoe, "On the Need for a New Approach to Analyzing Monetary Policy," in *NBER Macroeconomics Annual 2008*, vol. 23, ed. Daron Acemoglu, Kenneth Rogoff, and Michael Woodford (Chicago: University of Chicago Press, 2009), 389–425.

transactions (vertical black lines).[41] Of course, central bankers are well aware of these slight daily deviations and might claim that figure 3 actually demonstrates how closely the Fed can hit its target. Yet that claim begs the fundamental question: Is the Fed following the market or the market following the Fed? To be clear, over the long run central banks can drastically raise or lower the average level of nominal interest rates through their impact on inflationary expectations. But any of these short-run deviations from the target must instead be largely the result of market impacts on real rates.

Figure 3. Daily Federal Funds Rate, November–December 2007

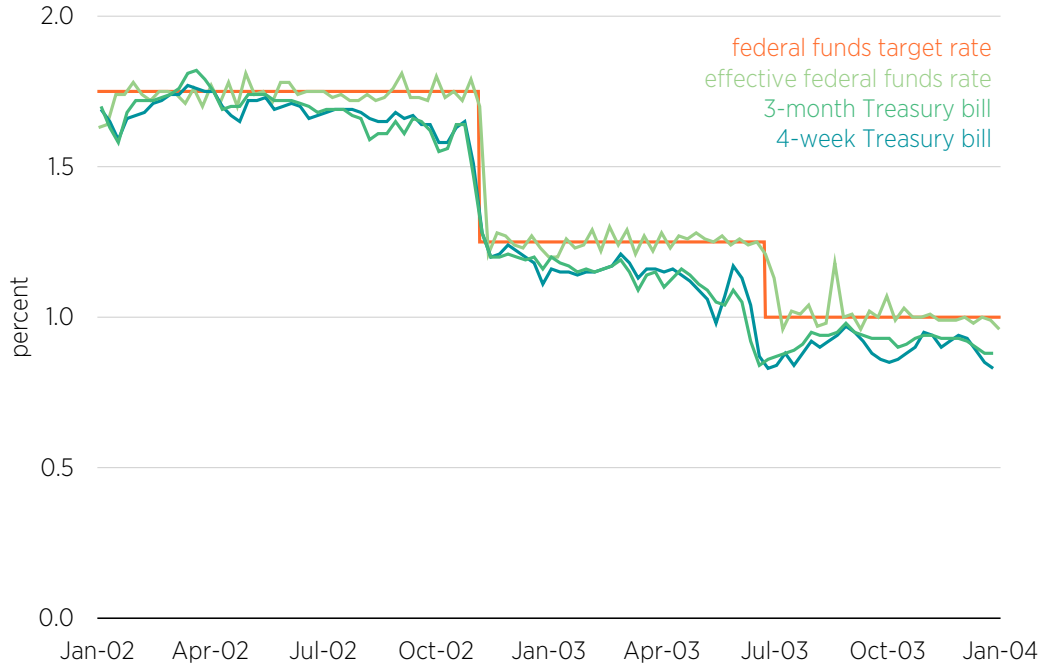


Notes: The solid orange horizontal line indicates the Federal Reserve's federal funds target on each day. The vertical black lines indicate the range of federal funds transactions on a particular day, and the blue dots indicate the weighted average of these transactions on a particular day.

Source: "Federal Funds Data Historical Search," Federal Reserve Bank of New York, https://apps.newyorkfed.org/markets/autorates/fed-funds-search-page.

[41] These data are regularly available from the New York Federal Reserve, http://www.newyorkfed.org/markets/omo/dmm/fedfundsdata.cfm.

Figure 4. Federal Funds Rate and Treasury Bill Yields, 2002–2004



Note: The data sample is from January 1, 2002, to January 1, 2004.

Source: "Effective Federal Funds Rate," Federal Reserve Economic Data, Federal Reserve Bank of St. Louis, https://fred.stlouisfed.org/series/FEDFUNDS.

To get an anecdotal feel for the difficulties in nailing down the direction of causation with short-term real and nominal rates, consider figure 4, covering the period from January 2002 to January 2004. The red line is the federal funds target, the blue line is the effective federal funds rate, and the other two lines are yields on four-week and three-month Treasury bills. Notice that the fall in T-bill yields consistently precedes the fall in the federal funds target. "[T]he evidence says that Fed actions with respect to its target rate," concludes Fama, in one of the most recent empirical studies, "have little effect on long-term [real] interest rates, and there is substantial uncertainty about the extent of Fed control of short-term rates. I think this conclusion

is also implied by earlier work, but the problem typically goes unstated in the relevant studies, which generally interpret the evidence with a strong bias toward a powerful Fed."[42]

Of course, accurate expectations about future Fed policy could, in theory, cause short-term real rates to anticipate changes in the Fed's target rate. Indeed, some believe that expectations can magnify the Fed's influence on real interest rates, in what is sometimes referred to as "open-mouth" operations.[43] Ironically, the ascendancy of the rational expectations hypothesis in the 1970s led to the opposite conclusion. Any anticipated change in monetary policy was viewed as having absolutely no effect on real rates, and some discussions went so far as to imply that the Fed was utterly impotent at affecting any real variable under any circumstances.[44] Today, the economics profession has pretty much rejected this extreme view of short-run monetary neutrality. Indeed, as a result of the 2007–2008 financial crisis, a few have careened to the opposite extreme, believing that unanchored expectations through irrational waves of positive feedback can drive market prices willy-nilly. Between these two extremes, McCloskey gets it exactly right: "Market demands and supplies, after all, depend on expectations, and maybe some denial of price theory can for a while hold back its force. But Greenspan [or more recently, Ben Bernanke and Janet Yellen], like King Canute, cannot hold back the tide of global supply and demand for funds, not for long."[45]

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[42] Fama, "Does the Fed Control Interest Rates?" (June 29, 2013 version), 19–20.
[43] Daniel L. Thornton, "The Fed and Short-Term Rates: Is It Open Market Operations, Open Mouth Operations or Interest Rate Smoothing?" *Journal of Banking and Finance* 28 (March 2004): 475–98; and Daniel Thornton, "Can the FOMC Increase the Funds Rate Without Reducing Reserves?" (Economic Synopsis No. 28, Federal Reserve Bank of St. Louis, October 6, 2010).
[44] An influential survey and critique of this literature is Robert J. Shiller, "Can the Fed Control Real Interest Rates?" in *Rational Expectations and Economic Policy*, ed. Stanley Fischer (Chicago: University of Chicago Press, 1980), 116–56. Note also Phillip Cagan's following "Comment," 156–60, in which he emphasizes the importance of the loanable-funds channel (a Cantillon effect) in explaining the Fed's smoothing of interest rates after its founding and its pegging of Treasury securities during World War II.
[45] McCloskey, "Other Things Equal, Alan Greenspan Doesn't Influence Interest Rates," 100.

This brings us again to the Taylor rule, which supposedly provides guidance as to how central banks can smooth out business cycles. It thereby allegedly confirms their tight control over real interest rates. Actually, I should say Taylor rule*s*—plural—because there are different versions. But they all adhere to the same generalized form: the central banks' target nominal interest rate should equal the underlying equilibrium real rate plus the rate of inflation, with one weighted adjustment for the gap between the actual and desired inflation, and another weighted adjustment for the gap between the economy's potential and actual real output:

target nominal interest rate = equilibrium real interest rate + inflation rate +

α(inflation gap) + β(real output gap)

By including the current actual (or expected) inflation rate, Taylor rules compensate for the Fisher effect. The two adjustments for the inflation and output gaps then employ the liquidity effect. If either inflation or output is too low, the central bank should lower its target interest rate to stimulate the economy. And if either is too high, it should raise its target. There are different ways of calculating these gaps and setting the weights (α and β), but Taylor's estimates of the weights were 0.5 for each. By adjusting for both inflation and output, Taylor rules become a kind of indirect nominal GDP targeting.[46]

[46] John B. Taylor, "Discretion versus Policy Rules in Practice," *Carnegie-Rochester Conference Series on Public Policy* 39 (1993): 195–214, and John B. Taylor, "Estimation and Control of a Macroeconomic Model with Rational Expectations," *Econometrica* 47 (September1979): 1267–86. For Milton Friedman's thoughts on the Taylor rule, see "Tradeoffs in Monetary Policy" in *David Laidler's Contributions to Macroeconomics*, ed. Robert Leeson (New York: Palgrave Macmillan, 2010). Frequently the underlying logic of Taylor rules is obscured by algebraic manipulations that throw the term for the rate of inflation into the term for the inflation gap, increasing that coefficient by 1 (e.g., 1.5 instead of 0.5), or that convert the term for the equilibrium real rate into the equilibrium nominal rate at the desired inflation rate.

In formulating this rule for the Fed, Taylor obviously used the federal funds rate as the target, and he estimated the real federal funds rate at 2 percent in long-run equilibrium (given a particular inflation target in the neighborhood of 2 percent). Taylor derived all of his estimates from historical data but has been quite explicit that the rule is not a positive description of what central banks actually do but a normative prescription for what central banks should do. This hasn't stopped macroeconomists from replacing the traditional aggregate demand curve with a monetary response function in which the central bank in fact automatically follows a Taylor rule, with complete control over real rates.[47] Historically, during the Great Inflation of the 1970s, the actual federal funds rate was very far from what the Taylor rule would prescribe, but during much of the Great Moderation under Alan Greenspan, it was much closer.

The critical weakness in Taylor rules is that the long-run, equilibrium real rate of interest, or what is alternatively called the *natural rate* or *neutral rate*, is unobservable. Yet these rules, at least until recently, often made the assumption that their estimates are not only correct but also are relatively fixed and unchanging over an extended period. And if there are any changes, they will be captured in estimates of the economy's potential output. In short, Taylor rules virtually preclude any factor, other than central banks, from affecting the long-run, equilibrium real rate of interest. None of the expositions of these rules explicitly offer a rigorous, theoretical rationale for

[47] A theoretical underpinning for these New Keynesian models is in Woodford, *Interest and Prices*. Carl E. Walsh's graduate text, *Monetary Theory and Policy*, 3rd ed. (Cambridge, MA: MIT Press, 2010): 344–47, 453–61, essentially assumes the same thing. On the other hand, ever since Friedman's 1967 presidential address, "The Role of Monetary Policy," many monetary economists have concluded that central banks cannot maintain price-level stability and determinacy with strict interest-rate rules unsupplemented with some monetary targeting. Thomas J. Sargent and Neil Wallace, "'Rational' Expectations, the Optimal Monetary Instruments, and the Optimal Money Supply Rule," *Journal of Political Economy* 83 (April 1975): 241–54, formalized Friedman's objection to interest-rate rules, while Woodford is one of the most prominent to reject such conclusions. For an excellent, recent survey of the debate that concludes that interest-rate rules are indeed unstable, see John H. Cochrane, "Determinancy and Identification with Taylor Rules," *Journal of Political Economy* 119 (June 2011): 565–611, and particularly the article's unpublished Appendix B, which is available online at http://faculty.chicagobooth.edu/john.cochrane /research/papers/cochrane_taylor_rule_online_appendix_B.pdf.

this assumption, irrespective of how they empirically estimate their assumed constant real rate. But one standard rationale from macroeconomic theory for a constant natural real rate is what is known as the Ramsay-Cass-Koopmans model. The model derives this constant rate for a closed economy with a fixed number of infinitely lived households, all identical. Each household has the same rate of time preference, the same declining marginal utility of consumption, and the same rate of population growth. Such a derivation almost rules out any fluctuations in the natural rate that might arise from alterations in how individuals discount the future, from how consumption preferences may differ among individuals or alter over time for one individual, or from differences in the distribution of wealth.

This way of estimating the natural rate of interest, therefore, does not extend, as Laidler emphasizes,

> to more complicated structures where agents are diverse in their tastes and opportunities. . . . What if different agents have different outlooks concerning the amount of consumption goods that will be available to them in the future? What if individuals' rates of pure time preference are not constant, but vary with their wealth—poorer people might, for example, be less patient than richer? What if individuals' rates of time preference vary with age, so that demographics affect its average value for the economy as a whole? But if agents are heterogeneous along any or all of the above lines, any economy-wide value for the rate of time preference will vary, among other things, with the prevailing distribution of income and wealth, and will therefore vary with the structure of relative prices.[48]

At one time, complications like those intrigued and troubled economists as diverse as Wicksell, Fisher, Keynes, and Hayek.[49] More recently, David Romer's graduate macro text concedes that "the equilibrium or natural real interest rate presumably varies over time," and therefore a constant rate should be replaced with one that is "time-varying." But the only modifications

[48] David Laidler, "Natural Hazards: Some Pitfalls on the Path to a Neutral Interest Rate" (Backgrounder No. 140, C.D. Howe Institute, Toronto, July 2011), 17–18.
[49] Knut Wicksell, *Value Capital and Rent* ([1893], English trans. reprint ed., London: Allen and Unwin: 1965); Fisher, *The Rate of Interest*; John Maynard Keynes, *The General Theory of Employment, Interest and Money* (London: Macmillan. 1936); Hayek, *The Pure Theory of Capital*.

introduced by some Taylor rule variants, outside of changes captured in measures of estimated potential output, are a weighted variable for the exchange rate (relaxing slightly the assumption of a closed economy) or a lag in the change of the target interest rate (which can create as many problems as it solves).[50]

Taylor rules, with their unrealistic assumption about real interest rates, have reinforced the widespread belief that Alan Greenspan was responsible for the low interest rates that preceded the financial crisis. Indeed, sometimes popular justifications for the charge degrade into meaningless circularity: "Why were interest rates so low? Because of Greenspan's expansionary monetary policy. How do you know Greenspan's policy was expansionary? Because interest rates were so low." This despite a steady fall in the growth rates of all the monetary measures. From 2001, the annual year-to-year growth rate of MZM fell from more than 20 percent to nearly 0 percent by 2006. During that same period, M2 growth fell from more than 10 percent to around 2 percent and M1 growth fell from more than 10 percent to negative rates. As for the measure that the Fed can most tightly control, the monetary base, its growth rate fell from 10 percent in 2001 to less than 5 percent in 2006.[51] Moreover, the increase in the base was overwhelmingly dwarfed in size by the net inflow of savings from abroad. By 2006 alone, that annual inflow was in the neighborhood of $800 billion, far exceeding the mere $200 billion increase in the base for the entire half decade.[52] The total net inflows for 2001 through 2006 came to $3.5 trillion. The common term *global saving glut* may not be the most precise

[50] David Romer, *Advanced Macroeconomics*, 4th ed. (New York: McGraw-Hill, 2012), 545.
[51] St. Louis Federal Reserve: http://research.stlouisfed.org/fred2/.
[52] In 2006 the U.S. current account deficit was $798 billion, whereas the financial account surplus was only $780 billion, reflecting the fact that the international balance of payments is the most imprecise of all macroeconomic aggregates. See Bureau of Economic Analysis, http://www.bea.gov/iTable/index_ita.cfm.

description of this inflow that peaked at 6 percent of GDP, but the sheer numbers suggest that it represents a far better explanation for the period's low interest rates.[53]

Only since the financial crisis, with the continuing persistence of low interest rates, have mainstream monetary economists started taking seriously the fact that the equilibrium real rate can change. This has resulted in a few recent attempts to estimate a time-varying natural real rate and sometimes even to incorporate the estimate into an interest-rate target for central banks. Yet these attempts either are based on closed-economy New Keynesian dynamic-stochastic general equilibrium (DSGE) models with changes in the natural rate emanating almost exclusively from changes in the rate of growth or otherwise dampen any impacts on the real natural rate from global factors or variations in household rates of time preference.[54]

Before the Fed finally raised its federal funds in December 2015, it had several times considered doing so and then been forced to back off. The European Central Bank raised its target rate just half a percent in 2011, then quickly cut it back down. The failure of interest rates to return to precrisis levels has spawned several attempts to explain what market forces have

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[53] Martin Wolf, *Fixing Global Finance*, updated ed. (Baltimore: John Hopkins University Press, 2010) offers one of the most convincing cases for the global-saving glut thesis. The thesis was initially presented by Ben S. Bernanke, "The Global Saving Glut and the U.S. Current Account Deficit," remarks at the Sandridge Lecture, Virginia Association of Economists, Richmond, Virginia, March 10, 2005, http://www.federalreserve.gov/boarddocs /speeches/2005/200503102/default.htm, and subsequently embraced by Alan Greenspan, *The Age of Turbulence: Adventures in a New World*, expanded paperback ed. (New York: Penguin Books, 2008), 378–79, 381, 386–87, 510.

[54] Thomas Laubach and John C. Williams, "Measuring the Natural Rate of Interest Redux" (Working Paper 2015-16, Federal Reserve Bank of San Francisco, October 2015), http://www.frbsf.org/economic-research/files/wp2015 -16.pdf; Thomas Lubik and Christian Matthes, "Calculating the Natural Rate of Interest: A Comparison of Two Alternative Approaches" (Economic Brief 15-10, Federal Reserve Bank of Richmond, October 2015), https://www.richmondfed.org/publications/research/economic_brief/2015/eb_15-10; Vasco Cúrdia et al., "Has U.S. Monetary Policy Tracked the Efficient Interest Rate?," *Journal of Monetary Economics* 70 (2015): 72–83; George Selgin, David Beckworth, and Berrak Bahadir, "The Productivity Gap: Monetary Policy, the Subprime Boom, and the Post-2001 Productivity Surge," *Journal of Policy Modeling* 37 (2015): 189–207; Vasco Cúrdia, "Why So Slow? A Gradual Return for Interest Rates" (Economic Research 2015-32, Federal Reserve Bank of San Francisco, October 12, 2015); Kevin J. Lansing, "Projecting the Long-Run Natural Rate of Interest" (Economic Letter 2016-25, Federal Reserve Bank of San Francisco, August 29, 2016); and Selgin, "A Monetary Policy Primer, Part 8: Money in the Latest Great Muddle," *Alt-M Blog*, January 4, 2017, https://www.alt-m.org/2017/01/04/monetary-policy -primer-part-8-money-latest-great-muddle/.

driven the equilibrium rate down so far.[55] Taylor himself has conceded that "there is no reason why a moving rate could not be incorporated into the [Taylor] rule."[56] But what this development really underscores is the difficulty of using interest rates rather than some monetary measure as the guide to central bank policy. In other words, as Selgin insists, "despite what some experts would have us think, monetary policy is, first and foremost, 'about' money."[57]

Even the dramatic explosion of the monetary base initiated by Ben Bernanke in September 2008 in response to the financial crisis is not the exception it might at first appear to be. As the Fed increased bank reserves and currency in circulation by more than $3.0 trillion over the subsequent six years, it also was for the first time paying banks interest on their reserves deposited at the Fed. Although the rate of 0.25 percent paid on reserves from the beginning of 2009 until December 2015 was quite low, it almost consistently exceeded the yield on Treasury bills, one of the primary securities on the Fed's balance sheet. Thus, at least $2.5 trillion of the base explosion represents interest-bearing money that in substance is government or private debt merely intermediated by the Fed (what economists call *inside money*).[58] This may have

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[55] For just a sample, see Ben S. Bernanke, "Why Are Interest Rates So Low, Part 2: Secular Stagnation," *Ben Bernanke's Blog*, March 31, 2015, https://www.brookings.edu/blog/ben-bernanke/2015/03/31/why-are-interest-rates-so-low-part-2-secular-stagnation/; Bernanke, "Why Are Interest Rates So Low, Part 3: The Global Savings Glut," *Ben Bernanke's Blog*, April 1, 2015, https://www.brookings.edu/blog/ben-bernanke/2015/04/01/why-are-interest-rates-so-low-part-3-the-global-savings-glut/; and Larry White, "Why Are Interest Rates So Low," *Alt-M Blog*, July 6, 2016, http://www.alt-m.org/2016/07/06/why-are-interest-rates-so-low/.

[56] John B. Taylor, "Colliding with Bill Dudley at a Crossroads," *Economics One Blog*, October 16, 2015, https://economicsone.com/2015/10/16/colliding-with-bill-dudley-at-a-crossroads/.

[57] Selgin, "Monetary Primer, Part 1: Money."

[58] John G. Gurley and Edward S. Shaw**,** *Money in a Theory of Finance* (Washington, DC: Brookings Institution, 1960), first coined the terms *inside money* and *outside money*. Their distinction was between money that was issued through financial intermediation (inside), with an offsetting liability side, and money that was an asset only (outside), without an offsetting liability side. They were challenged by Boris P. Pesek and Thomas R. Saving, *Money, Wealth, and Economic Theory* (New York: Macmillan, 1967), who argued that the critical distinction was between interest-bearing and non-interest-bearing money. But Pesek and Saving then leapt to the conclusion that much bank-created money over and above bank reserves counted as outside money. The subsequent tortuous debate was best sorted out by Friedman and Schwartz, *Monetary Statistics of the United States*, 110–18, 128–30, who argued that the bank-created money that Pesek and Saving were implicitly counting as outside money was better thought of as reflecting the valuable charters of banks, often because of the monopoly privileges that banks then enjoyed. It then follows that interest-bearing money issued by the government is indeed inside money, but non-

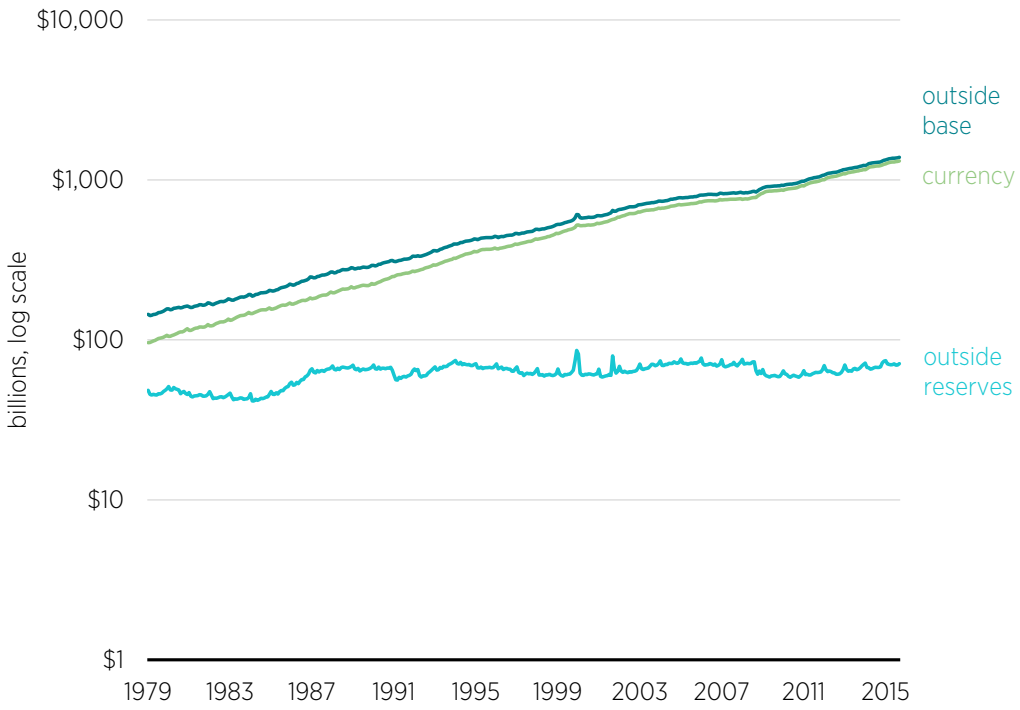
noticeable impacts on some implicit bid and asked spreads within financial markets and on the allocation of credit. But because it involves no net increase in loanable funds nor any major, temporary increase in the net portfolio of people's real wealth, it should have no liquidity effect on interest rates generally through either channel.

Once the Fed began paying interest on both excess and required bank reserves deposited at the Fed, the only part of the monetary base that constituted non-interest-bearing money (*outside money*) was reduced to the vault cash held by banks as reserves and the hand-held currency (including coins) in the hands of the public. That total increased only $500 billion by 2014, and nearly all of that was in the form of currency held by the public. This constituted only a slightly more rapid increase than the increase in the monetary base during the decade before the crisis, when no part of bank reserves earned interest and thus were still genuine outside money. (See figures 5 and 6, depicting the level and growth rate of the outside base and its two components: *outside reserves,* that is, reserves not earning interest, and *currency* held by the public.)[59]

interest-bearing money issued by banks either pays implicit interest (through such features as transaction services) or arises from monopoly privileges and therefore is also still inside money. Of course, a more sophisticated approach would treat interest-bearing reserves as partly inside and partly outside money that should be weighted on the basis of the difference between the interest rate paid on reserves and some higher market rate. But then one would have to view the liquidity services of many other financial assets as making them partly outside money as well. Although this is an enormous, if not totally insurmountable, empirical problem, it is an approach that has been frequently suggested and is similar to what Divisia aggregates try to do with measures of the money stock weighted according to liquidity.

[59] Since the crisis, the growth rate of the non-interest-bearing base (outside money) has risen from less than 2 percent in mid-2008 to as high as 9 percent annually; calculated from St. Louis Federal Reserve, http://research.stlouisfed.org/fred2/. The irrelevance of interest-bearing base money for genuine monetary policy has forcefully been demonstrated in John A. Tatom, "U.S. Monetary Policy in Disarray," *Journal of Financial Stability* 12 (2014): 47–58. One minor difference between Tatom's analysis and mine is that his "adjusted monetary base" subtracts only excess reserves from the monetary base, whereas I subtract all interest-bearing reserves, whether excess or required.

Figure 5. Outside Money in Billions, Log Scale, 2001–2012



Source: Author's calculations, based on the Federal Reserve Bank of St. Louis's FRED website, http://research.stlouisfed.org/fred2/. The outside base is Board of Governors Monetary Base (monthly, not seasonally adjusted, and not adjusted for changes in reserve requirements): BOGMBASE—minus, beginning in September 2008 (to subtract interest-earning reserves), Total Reserve Balances Maintained with Federal Reserve Banks (monthly and not seasonally adjusted): RESBALNS. Currency in circulation is the Currency Component of M1 (monthly and not seasonally adjusted): CURRNS. Outside reserves are currency in circulation subtracted from the outside base.

Figure 6. Year-on-Year Annual Growth Rate of Outside Money, 2001–2012

Source: Author's calculations, based on data for figure 5.

Ironically, some view the payment of interest on reserves as actually increasing central bank control over interest rates. Before the financial crisis, the European Central Bank and the central banks of England, Canada, and Australia had adopted what is known as the corridor or channel system, which sets the interest rate paid on reserves below the interest-rate target as a lower bound and sets the rate at which the central bank will automatically loan money to private banks (in the Fed's case, this is the discount rate) above the target as an upper bound. Banks supposedly will not loan each other reserves at any rate lower than what they can earn by holding reserves, and they will not borrow reserves from other banks at any rate higher than the rate at which they can borrow from the central bank. The New Zealand central bank has instituted a similar system in which the interest rate paid on reserves is right at its interest-rate target. For a

few proponents, these systems raise the prospect of "Divorcing Money from Monetary Policy," to use the title of an article by three economists at the New York Fed. What that means is that they hope that central banks would actually be able to set interest rates (in what is misleadingly called "monetary policy") independently of what happens to the size of the monetary base.[60]

The Fed intended to adopt the corridor system about the time it initiated its massive expansion of the monetary base, announcing that it would set the rate paid on reserves 0.10 percent below its target for the federal funds rate.[61] The success can be gauged by the fact that the effective federal funds rate has since *never* risen to the level of or above the interest rate on reserves, the exact opposite of what was supposed to happen. What helped disguise this unanticipated outcome was that the Fed simultaneously broadened its official target for the federal funds rate to a range bracketed by the rate paid on reserves at the top and zero at the bottom. To be fair, that range was small, only 25 basis points, and because banks had accumulated such large reserves, the primary lenders of federal funds became government-sponsored enterprises and other institutions privileged to participate in this market but not eligible to receive interest on their Fed deposits. Even after the Fed raised the interest paid on reserves to 0.50 percent in December 2015 and 0.75 percent in December 2016, it has been compelled by the consistently lower federal funds rate to keep the lower bound on its target range 25 basis points below that. The additional fact that the interest rate on Treasury bills also remains below the rate paid on reserves should at least suggest that the Fed's control over even very short-term rates is not quite as precise as generally believed.

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[60] Todd Keister, Antoine Martin, and James McAndrews, "Divorcing Money from Monetary Policy," Federal Reserve Bank of New York *Economic Policy Review* 14 (September 2008): 41–56, http://www.newyorkfed.org /research/epr/08v14n2/0809keis.html; Marvin Goodfriend, "Interest on Reserves and Monetary Policy," Federal Reserve Bank of New York *Economic Policy Review* 8 (May 2002): 13–29. For a technical critique of the stability of a regime based on paying interest on reserves, see Thomas Sargent and Neil Wallace, "Interest on Reserves," *Journal of Monetary Economics* 15 (May 1985): 279–90.

[61] Board of Governors of the Federal Reserve System, "Press Release," October 6, 2008, https://www.federalreserve.gov/monetarypolicy/20081006a.htm.

Moreover, all of this evades the fundamental issue. The Fed cannot have much impact on market rates through pure intermediation—borrowing with interest-earning deposits to purchase other financial assets—any more than Fannie Mae or Freddie Mac can.[62] The Fed can do so, even in a highly segmented market, only by altering the quantity of outside money. Only then will it have any temporary effect on the net quantity of loanable funds and the net portfolio of the public's real assets. Today's low interest rates are not ultimately the result of Fed policy but of a decline in the natural real rate.[63]

Conclusion

None of this is to deny the existence of the Fed's initial liquidity effect. As I conceded at the outset, central banks can affect interest rates. Their clearest impact is on nominal rates, through inflationary expectations. They also undoubtedly have some short-run impact on real rates. But for the Fed to delicately control this unobservable rate, it must perfectly juggle countervailing effects on nominal rates, with the Fisher effect pushing in the opposite direction of the liquidity

[62] For an elaboration of this point, see Jeffrey Rogers Hummel, "The Federal Reserve's Exit Strategy: Looming Inflation or Controllable Overhang?" (Mercatus Research, Mercatus Center at George Mason University, Arlington, VA, September 15, 2014), http://mercatus.org/publication/federal-reserve-s-exit-strategy-looming-inflation-or-controllable-overhang.

[63] One economist who has pushed to an extreme the idea that central banks, by paying interest, can control the economy's interest rates is Michael Woodford. In *Interest and Prices*, 31–37, he argues that such control would even apply in a future cashless economy, in which central-bank liabilities are never used as a medium of exchange. He makes the striking claim that such an economy has "no inherent 'equilibrium' level of interest rates to which the market would tend in the absence of central-bank intervention," basing the claim on the fact that the central bank would still define the economy's unit of account (e.g., dollars in the case of the Fed). Woodford's statement is therefore referring to nominal interest rates, but he goes on to say that if prices or wages are inflexible, central banks could exercise short-run control over real rates as well. Even if one accepts his premises, his vision of this economy still entails banks and other institutions to hold some central-bank deposits. Although these deposits would not be used for clearing purposes or for any other transaction, the quantity of these deposits would necessarily play some role in the economy, Woodford's assertion to the contrary notwithstanding. Nor does Woodford directly address the argument of S. C. Tsiang, "A Critical Note on the Optimum Quantity of Money," *Journal of Money, Credit and Banking* 1 (May 1969): 266–80, that such a regime would be so unstable that the only equilibrium would involve the government owning all real assets.

effect. As John Cochrane puts it, "It's a tough job: Even Soviet central planners, who could never quite get the price of coffee right, did not face so daunting a task as finding just the 'right' interest rate for a complex and dynamic economy like ours."[64] A lot of questions consequently remain unanswered, including not only the magnitude and duration of these impacts, but also the array of interest rates affected. Moreover, the size of the overall market as determined by institutional arrangements and other government policies surely can cause the impact to vary.

My objection is not merely to the simplistic but popular belief that the liquidity effect is so powerful that it allows the Fed to put interest rates wherever it wants, irrespective of underlying real demands and supplies in the economy. I am challenging the more sophisticated view of monetary economists and central bankers that treats interest rates as either a reliable indicator or the proper operating target for the conduct of monetary policy. George Selgin has it exactly right when he writes: "It seems to me that in insisting that monetary policy is about regulating, not money, but interest rates, economists and monetary authorities have managed to obscure its true nature, making it appear both more potent and more mysterious than it is in fact. All the talk of central banks 'setting' interest rates is, to put it bluntly, to modern central bankers what all the smoke, mirrors, and colored lights were to Hollywood's Wizard of Oz: a

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[64] John H. Cochrane, "Inflation and Debt," *National Affairs* 9 (Fall 2011): 58–59. But in a strange, seemingly contradictory shift that Cochrane himself admits is "heretical," he subsequently proposed what he calls a Neo-Fisherian approach to monetary policy in "Monetary Policy with Interest on Reserves," *John Cochrane's Blog*, October 16, 2014, http://johnhcochrane.blogspot.com/2014/10/monetary-policy-with-interest-on.html, and "The Neo-Fisherian Question," *John Cochrane's Blog*, November 6, 2014, http://johnhcochrane.blogspot.com/2014/11/the-neo-fisherian-question.html. He essentially argues that with the central bank paying interest on reserves, it can dispense with the liquidity effect and through focusing on the Fisher effect permanently peg the nominal interest rate on the basis of the desired rate of inflation: high for high inflation, low for low inflation. This seems to get the causality exactly backwards, running from the nominal interest rate to the rate of inflation rather than the other way around. For critiques of the Neo-Fisherian approach, see Nick Rowe, "John Cochrane on Neo-Fisherianism, Again," *Worthwhile Canadian Initiative Blog*, December 14, 2016, http://worthwhile.typepad.com/worthwhile_canadian_initi/2016/12/john-cochrane-on-neo-fisherianism-again.html; and Scott Sumner, "Nick Rowe on John Cochrane's Neo-Fisherian Model, " *EconLog Blog*, December 15, 2016, http://econlog.econlib.org/archives/2016/12/nick_rowe_on_jo.html.

great masquerade, serving to divert attention from the less hocus-pocus reality lurking behind the curtain."[65]

Despite their limited impact on real interest rates, central banks do have other far-reaching economic repercussions, sometimes detrimental. The most obvious is their impact on prices, giving them a virtually unconstrained ability to generate inflation, even to the point of hyperinflation. This, in turn, can enhance government revenue and impose other distribution effects throughout the economy. Fortunately, the various ways that inflation contributes to government revenue—seigniorage, bracket creep, and real reductions of government debt—have become minor in developed countries.[66] What has become more serious is that central banks induce moral hazard by serving as lenders of last resort and bailing out financial institutions. They certainly have contributed to business cycles and may possibly, with the right policies, have dampened and even prevented some. Most recently, as argued elsewhere, the financial crisis has inspired the Fed to go beyond mere control over the money stock into determining where credit flows, in what is essentially the new central planning.[67]

But in a globalized world of open economies, the tight control of central banks over real interest rates is a mirage. Although central banks remain important enough players in the loan market that they can push short-term rates up or down slightly, they have become quintessential noise traders. In the final analysis, it is the market that determines real interest rates.

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[65] Selgin, "Monetary Primer, Part 1: Money."
[66] Jeffrey Rogers Hummel, "Death and Taxes, Including Inflation: The Public versus Economists," *Econ Journal Watch* 4 (January 2007): 46–59; Jeffrey Rogers Hummel, "Government's Diminishing Benefits from Inflation," *The Freeman*, 60 (November 2010): 25–29.
[67] Jeffrey Rogers Hummel, "Ben Bernanke versus Milton Friedman: The Federal Reserve's Emergence as the U.S. Economy's Central Planner," *Independent Review* 15 (Spring 2011): 485–518, http://www.independent.org/publications/tir/article.asp?a=824, reprinted in David Beckworth, ed., *Boom and Bust Banking: The Causes and Cures of the Great Recession* (Oakland, CA: Independent Institute, 2012); Jeffrey Rogers Hummel, "The New Central Planning," review of *The Federal Reserve and the Financial Crisis* by Ben S. Bernanke, *Wall Street Journal*, March 29, 2013, A-13, http://online.wsj.com/article/SB10001424127887324662404578334120770679806.html.