

THE NATURAL RATE OF INTEREST RULE

ERWIN ROSEN AND ADRIAN RAVIER

ABSTRACT: Considerable research has been conducted on central bank monetary policies. Particular attention has been focused on policies that have the potential to ensure “sound money,” the symptoms of which are full employment and economic stability. Debate has centered on employing rule-based strategies to improve the monetary policies of the Federal Reserve Bank (“the Fed”). This article reviews the Fed’s performance with particular emphasis on its contribution to the 2008 crisis and then suggests an alternative policy which, had it been in place would have dampened the most recent boom and bust. This alternative is the application of a monetary rule that follows Wicksell’s monetary equilibrium doctrine. Although the proposed rule would not eliminate short-term price fluctuations, it should create consistent, inflation-free economic stability, a condition for sustained growth which the U.S. has not seen since the Fed’s inception.

KEYWORDS: business cycle, central banking, crisis, economic fluctuations, Fed, interest, interest rates, monetary policy, natural rate of interest, Knut Wicksell

JEL CLASSIFICATION: E31, E32, E42, E52, E58

Erwin Rosen (erwin.rosen@gmail.com) holds a Doctorate degree in Political Economy from the Swiss Management Center University of Switzerland. Adrián Ravier (aravier@ufm.edu) holds a Ph.D. in Applied Economics from the University Rey Juan Carlos in Madrid and is Professor and Research Fellow of the School of Business at Francisco Marroquín University, Guatemala. The authors gratefully acknowledge the insightful comments made on an earlier draft of this paper by Andrew Reed and Nicolás Cachanosky. The authors retain sole responsibility for any remaining shortcomings.

INTRODUCTION

In 1945 Keynes wrote: “The monetary authorities can have any rate of interest they like.... They can make both the short and long-term [rate] whatever they like, or rather whatever they feel to be right....” (Rochon, 1999, p. 163). The U.S. Federal Reserve (the “Fed”) has taken full advantage of this freedom to set rates, but the results have been both disappointing and revealing.

Since the creation of the Fed, there have been eighteen recessions, of which at least four have been severe: the 1929–1933 Great Depression, the 1973–1975 recession, the 1981–1982 recession, and the 2008 recession (Amadeo, 2011). To some extent, these recessions have all been the result of inflationary policies caused by discretionary money manipulation. This assessment is neither revolutionary, nor unique. It has been the main topic of discussion throughout the history of the Fed, and the 2008 crisis again focused attention on the issue. Most recently, Selgin et al. (2012, p. 48) published an extensive study on the effectiveness of the Fed to coincide with its centennial. It concluded that significant changes in the Fed’s strategy for managing the money supply were needed.

The purpose of this paper is to respond to these authors’ call for change by postulating a monetary rule that follows Wicksell’s monetary doctrine. The goal of the rule is to match the market interest rate for loanable funds to the natural rate of interest, hereafter referred to as the “NRI” (Wicksell, 1898, p. 102). Such a strategy would induce behavior resembling that which occurs under a free and unregulated banking system. Applying this rule would keep the money supply in close proximity to the equilibrium at which supply and demand coincide. This would create an environment of inflation-free economic stability, which the Fed’s monetary policies have so far failed to produce.

Attaining this goal will be shown to be no easy task. Notwithstanding this challenge, we believe that the proposed rule should be a guide for monetary policy, since the success or failure to achieve economic stability will also be shown to depend mainly on how close the market interest rate is to its natural level, and not to the current strategy of targeting an arbitrary and desirable level of inflation.

We begin this work with a review of the Fed’s performance, paying special attention to its role in the 2008 crisis. This review demonstrates the weakness of the Fed’s monetary policies. We

then demonstrate the effectiveness of the NRI rule in generating inflation-free economic stability, first using historical data on free banking and then by simulating the application of the rule in the years prior to the 2008 crisis. Finally, we suggest a mechanism whereby the Fed might implement the rule.

THE CASE AGAINST THE FED'S MONETARY POLICIES

Since its inception, the Fed has faced two significant weaknesses: susceptibility to political pressure and inadequate economic knowledge. Economists, particularly those affiliated with the Austrian School of Economics, have been pointing out these problems for close to a century, emphasizing the need to stop government interference with the market in general and its manipulation of the money supply in particular (Rosen, 2010). The latter, however, we consider only an unrealistic aspiration, at least in the foreseeable future, as there is every reason to believe that central banking will continue. The objective therefore becomes how best to minimize its unfortunate negative impact on the economy.

In articles published in 1936 and in 1945, Hayek discussed the problems generated by government interference in the market as part of his critique of socialist political systems. He explained that the knowledge necessary to run the economy is not all scientific or technical, and therefore it cannot be collected by a central entity. In fact, the necessary knowledge is dispersed among all those participating in market transactions. This 'tacit' knowledge is acquired by market participants in a myriad of ways, much of it spontaneously and even subconsciously. In Hayek's opinion, the market is a process of entrepreneurial discovery, in which the entrepreneurs' knowledge and intentions converge over time until they are perfectly coordinated, thus making it impossible for this information to be captured by a central authority. Although in his work Hayek was referring to the general market, the handling of money is merely a special case. The Hayekian knowledge problem makes it impossible for the Fed to realize its objectives on the basis of its proprietary knowledge alone. The term 'discretionary' is used to underline this inherent weakness of Fed policies based on in-house knowledge.

In a 1968 paper, Friedman arrived at same conclusions. Although he did not propose the abolition of the Fed, he criticized it by

pointing out that the discretionary monetary policies of the Fed were erroneous in 1919–1920, in 1929–1933, in 1937–1938, in 1953–1954, and in 1959–1960.¹ To this list we can now add the errors that precipitated the recessions of early 2000 and 2008. These policy failures were interrupted from the mid-1980s to the 2000s by a period frequently referred to as ‘the Great Moderation’, during which a dramatic drop in GDP volatility took place. Many economists have cited this drop in volatility as evidence that the Fed had finally learned how to manage the money supply ‘properly’. However, this claim has been refuted by statistical studies that show influences unrelated to action taken by the Fed were the reason for the unanticipated moderation (Selgin et al., 2012, p.16)

According to Friedman, the Fed did not only frequently make incorrect decisions, but also tended not to implement what would otherwise be considered desirable policies in an effective manner. In such cases it tended to act too late, and then when it finally did act, to go too far (in the ‘correct’ direction) and then finding itself in a position where a policy reversal was inevitable. According to Friedman, these overreactions have typically been the result of the Fed’s inability to time the natural delays between Fed actions and their economic consequences. Friedman’s main point, as he explained in a 1972 article, is that the expectations of the central bank are just too high. Our knowledge, he pointed out, is insufficient, and even when it is adequate, political considerations interfere with the process.

¹ Austrian and Chicago School economists are in agreement that the Fed has erred consistently; however, they do not necessarily concur on the causes of the crisis. For example, referring to the Great Depression, Friedman et al. (2008) understood that the cause of the crisis was the “great contraction” executed between 1929–1933, however, Robbins (1934), Anderson (1949), Rothbard (1963) and Cachanosky (1989) hold that the problem originated earlier, more specifically in the credit expansion developed during the period between 1924 and 1928. In 1912, over twenty years before this crisis, Mises (1912, pp. 365–366) explained the concern as follows:

Certainly, the banks would be able to postpone the collapse; but nevertheless, as has been shown, the moment must eventually come when no further extension of the circulation of fiduciary media is possible. Then the catastrophe occurs, and its consequences are the worse and the reaction against the bull tendency of the market the stronger, the longer the period during which the rate of interest on loans has been below the natural rate of interest and the greater the extent to which roundabout processes of production that are not justified by the state of the capital market have been adopted.

Although these issues cannot be fully eliminated, the use of rule-based monetary policies has the potential to avoid most of the undesirable consequences of discretionary central bank policies.

First, a rule has the potential to thwart political interference. Realizing this potential requires a commitment—not only from monetary policy makers, but also from politicians—to consistently apply the rule no matter what. This is certainly not a minor issue: monetary policies have traditionally been susceptible to political influence. Buchanan (1987), who made a career of researching the impact of government and politics on macroeconomics, considered political pressure on the Fed such a significant problem that he suggested its employees have their compensation fixed in nominal dollars in order to discourage them from bowing to political pressure favoring inflationary policies.

Second, reliance on a rule mitigates the knowledge problem as mechanical implementation could be accomplished without input from ‘experts’. In fact, in the 1968 article referred to above, Friedman, felt that even a computer, without any human help, could perform the task of implementing the constant money growth rule he was proposing.

Third, even if by chance the policy makers make correct assessments from the information available and are able to execute the appropriate policy, time lags will inevitably frustrate their ability to take action in a timely manner (Friedman, 1961). By the time the necessary data is collected, analyzed, and acted upon, the economy may well have moved on to another state, making the discretionary remedy inefficient or even counterproductive. This was a major factor behind Friedman’s suggestion of a constant money supply growth rule.

As an additional and significant bonus, a well-defined rule eliminates monetary uncertainties, allowing the business community to anticipate future central bank moves with accuracy and confidence, both of which are key to assuring business effectiveness (Simons, 1936).

Taylor (2011) studied the U.S. economy over the period 1950 to 2010, during which the Fed tried various monetary policy strategies. He showed that a strong correlation exists between rule-based policies and good economic performance (low inflation

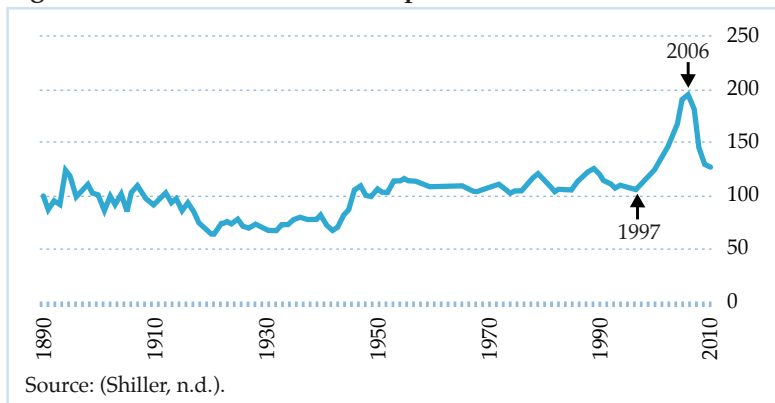
and unemployment levels), and just the opposite during times that the Fed used a discretionary approach to setting monetary policy.

Even ex-Chairman of the Fed, Alan Greenspan, concurs with economists who have been critical of the Fed's discretionary policy approach. In October 2007, during a televised interview on the Daily Show, Greenspan lamented that in his 50 years as an economist he could not claim any improvement in his forecasting skills and, for that matter, he did not know anyone who could. Implicit in Greenspan's statement is the fact that the economy is too complex to totally understand or forecast.

The 2008 crisis provides a classic example of the consequences of discretionary intervention by the Fed. The crisis originated in the United States when a major real estate bubble burst. White (2008a) demonstrated that the real estate market heated up over the period from mid-2003 to mid-2007, the four years before the crisis broke. While sales of goods and services were growing between 5 to 7 percent per annum during this period, real estate loans at commercial banks grew at levels of 10 to 17 percent or twice as fast.

The bubble began to show signs of deflating in early 2006 as prices rose to the point where purchasing a home became out of reach for most Americans, even under the very attractive terms available at the time: almost no down payment coupled with unusually low interest rates. However, as can be seen in Figure 1, the dramatic drop started in the period between late 2007 and early 2008.

Figure 1. Real Home Price Index pre-2008 Crisis



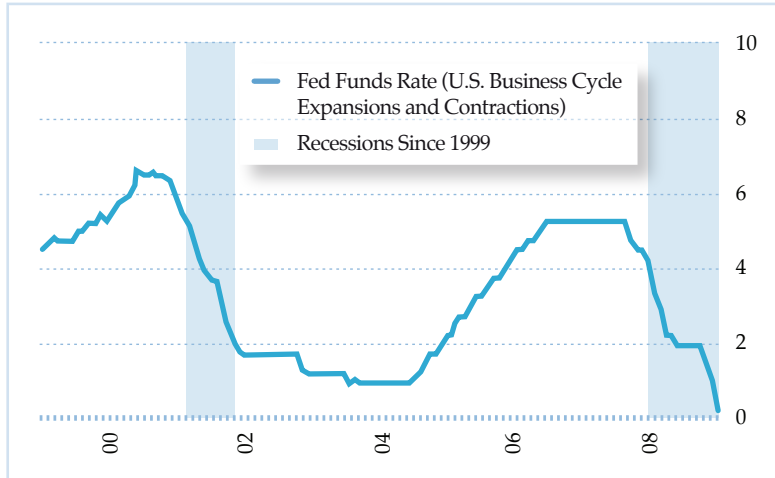
The abrupt collapse of the U.S. real estate market had a direct impact on financial markets. While in the middle of 2003 housing prices began increasing sharply, early in 2006 they took a sudden turn and declined as sharply, producing severe delinquencies and foreclosures (Taylor, 2008). This led to major financial turmoil, not only in the United States, but also around the world.

Research conducted on the 2008 crisis points to different perpetrators, from flawed financial innovations such as collateralized debt obligations (CDOs) to weak regulations, from the lack of CDO regulation to the operation of a shadow banking system, and the weakening of the existing banking system structure all compounded by government actions that allowed Fannie Mae and Freddie Mac to expand mortgages to borrowers who could not afford them by loosening down-payment standards on mortgages. But above all, the bulk of the studies reserve the blame for the Fed and its monetary policy.

In March 2001, the United States went into recession. This was the result of the technology related “dot-com bubble” that burst in the spring of 2000. This event caused the NASDAQ to fall 3,934 points, or 78 percent, between March 2000 and October 2002.² To stimulate the economy, Greenspan lowered interest rates. As illustrated in Figure 2, the Fed Funds rate³ had begun 2001 at 6.25 percent and ended that year at 1.75 percent, a very drastic action. The Fed did not stop there. It lowered the rate further in 2002 and 2003, and in mid-2004 it reduced the rate to a record low of 1 percent.

² The NASDAQ Composite Index reached its highest point on 10 March, 2000 at 5048.62. On 9 October, 2002 it fell to its lowest level, 1114.11 points. (Yahoo Finance, 2000–2002).

³ The Fed Funds rate is the overnight interest rate at which banks lend funds held at the Federal Reserve to other banks and is one of the primary tools that the Fed uses to intervene in the market.

Figure 2. Fed Funds Rate in the 2000s

Many leading economists (e.g. Taylor [2008], Schwartz [2009], Krugman [2009], Stiglitz [2010], Ravier et al. [2012]) faulted Greenspan's discretionary monetary policy and consider it a key factor in the creation of the 2008 real estate bubble. Given this historical reality and the fact that the Fed has not been effective in applying discretionary strategies, implementation of a rigid, rule-based monetary policy deserves consideration as an alternative. The question then becomes, which rule?

The suggestion is made here that the most desirable arrangement is one in which the monetary system is as close to equilibrium as possible, i.e., the state where the behavior of the economy is not impacted by money considerations. Under these conditions, the resulting interest rate would be the natural rate of interest, as defined by Wicksell.

THE USE OF THE NRI RULE AS A MONETARY POLICY

The concept of the Natural Rate of Interest (NRI) originated with the Swedish economist Knut Wicksell. In 1898, he defined the NRI as the interest rate that is commodity-price-neutral. It is set by real supply/demand factors, and not by financial markets. This can only be the case when the supply of money has no influence on the rate of interest (Wicksell, 1898, p. 102).⁴

From this definition, one can conclude: a) that in an environment where the existing market interest rate matches the NRI, long term prices will be stable, and, b) this money-neutrality can only be expected when savings equal investments or money supply equals money demand.

If the existing market interest rate is below the NRI, it causes demand for money to be higher than the supply generated by savings. This excess demand is financed by an expansion in bank loans, which creates new money. This then pushes up the level of prices, creating inflation. The opposite occurs if the existing market interest rate is above the NRI, in which case, the money supply contracts and prices fall, creating deflation. These two scenarios are artificial and unsustainable. Thus, they cannot bring about the real, long-term economic growth that would be achievable under the NRI rule.⁵

⁴ It is worth noting that there is no complete agreement between Wicksell and Mises on the definition of the natural rate of interest. Mises (1912, p. 355) explains the differences as follows:

Wicksell distinguishes between the Natural Rate of Interest (*naturliche Kapitalzins*), or the rate of interest that would be determined by supply and demand if actual capital goods were lent without the mediation of money, and the Money Rate of Interest (*Geldzins*), or the rate of interest that is demanded and paid for loans in money or money-substitutes. The money rate of interest and the natural rate of interest need not necessarily coincide, since it is possible for the banks to extend the amount of their issues of fiduciary media as they wish and thus to exert a pressure on the money rate of interest that might bring it down to the minimum set by their costs. Nevertheless, it is certain that the money rate of interest must sooner or later come to the level of the natural rate of interest, and the problem is to say in what way this ultimate coincidence is brought about. Up to this point Wicksell commands assent; but his further argument provokes contradiction.

⁵ This logic has been a predominant reason for attracting the Austrian School of Economics to monetary strategies that resemble free banking. See Cachanosky (2013) for recent work closely related to this research.

Validation of this point is to be found in historical data pre-dating central banking, in other words when there was no government interference and 'free banking' existed. Under such conditions, monetary equilibrium is necessarily in effect (Selgin, 1997).

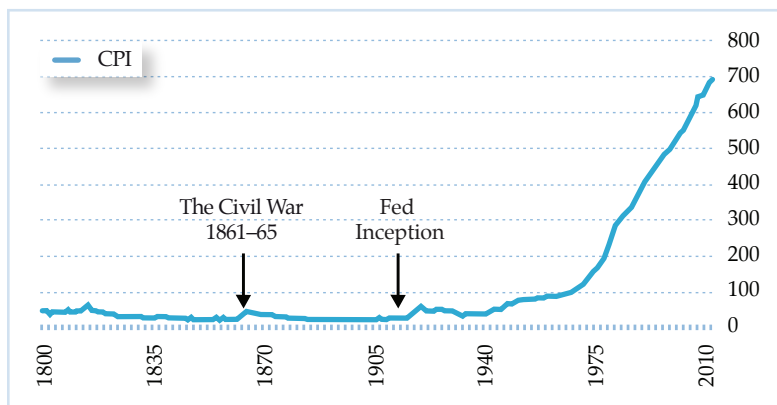
Schuler (1992) and Briones et al. (2005) have identified over 70 instances of unregulated banking, mostly in the nineteenth century.⁶ Of special interest is Scotland, which between 1716 and 1845 was a proven model of banking success, and is frequently employed to showcase the benefits of free banking (see for example, White [1984]).

In the United States, no true free banking existed prior to the Fed's birth in 1913 except for the sporadic, but ineffective, attempts to move in this direction between 1836 and 1913, which took various forms in different states (Briones et al. [2005]). However, the country not only did not suffer from inflation, but for the most part, a slight deflation prevailed, symptomatic of economic growth accompanied by an absence of excess money in the system. In fact, between 1880 and 1900, real (per capita) GDP skyrocketed, going from \$3,379 to \$4,943 (in 2000 dollars), see White (2008b, p. 4).

This has obviously not been the situation since the inception of the Fed in 1913. As shown in Figure 3, inflation has been prevalent throughout the era of central banking and, not surprisingly, the incidences of monetary and economic instability have also increased (Selgin et al., 2012, p. 1).

⁶ On this topic, see also Dowd (1992).

Figure 3. Inflation in the U.S. (As Indicated by the Consumer Price Index)



Thus, there is little doubt that the Fed's monetary policies have been a major cause of monetary instability. Closer examination of the 2008 crisis reveals a vivid example of misguided Fed monetary policies. During the period of time leading up to the start of the 2008 crisis, between early 2001 and mid-2004, the Fed drastically dropped interest rates, coinciding with a raise in real estate activity that reached unsustainable levels, creating a crisis that followed a typical boom and bust business cycle. Had the Fed been following the NRI rule (the free market interest rate), instead of artificially bringing the interest rate down to such extremely low levels, real estate would not have boomed so dramatically and a crisis as severe as the one that occurred in 2008 would have been avoided. To prove this statement, we estimate the NRI and then simulated the behavior of the real estate market with this rate in effect.

The literature offers a number of alternative ways of determining the NRI. From the options available we selected the methodology of Laubach and Williams (2001) because their estimate of the NRI most closely mimics Wicksell's definition. In essence, their model attempts to find the interest rate that closes the gap between actual and potential GDP. The potential GDP, also referred to as "natural gross domestic product," is the highest level of real GDP output that can be sustained over the long term,

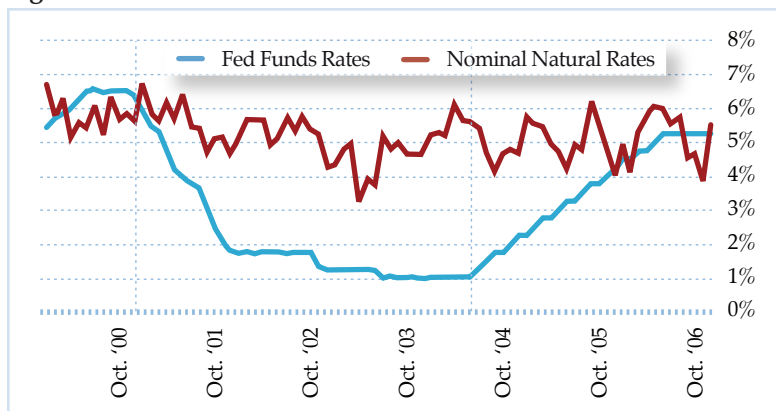
and which should be achieved when the prevailing interest rate and the NRI are equal.^{7, 8}

Using the Laubach and Williams approach, Figure 4 displays estimated nominal NRI and actual Federal Funds rates, during the period in question, between early 2001 and mid-2004. By simple inspection, the disparity between these two figures prior to the crisis is obvious: while the Fed funds rates dropped from 6.5 percent down to 1 percent and then increased to over 5 percent, the estimated nominal NRI fluctuated in a much more stable 4 percent to 7 percent.

Although the NRI is shown in the figure between 2000 and 2006—the entire boom and bust cycle—the only significant period of time is from the end of 2000—the beginning of the boom period—until mid-2004, when it ended, since the actions of the Fed reduced rates drastically during this portion of the cycle, and it is then that the damage was done.

⁷ Using a statistical technique (Kalman filter), the model adjusts the estimate of the natural rate based on how far the model predicts the gap between the potential GDP and the actual GDP. If the gap is negative—meaning that the actual GDP is higher than its potential and that monetary policy is over-stimulating the economy—the natural rate is adjusted upward to bring the economy to a stable condition. Conversely, if the GDP gap is positive and the monetary policy is more restrictive than expected, the natural rate is adjusted downward.

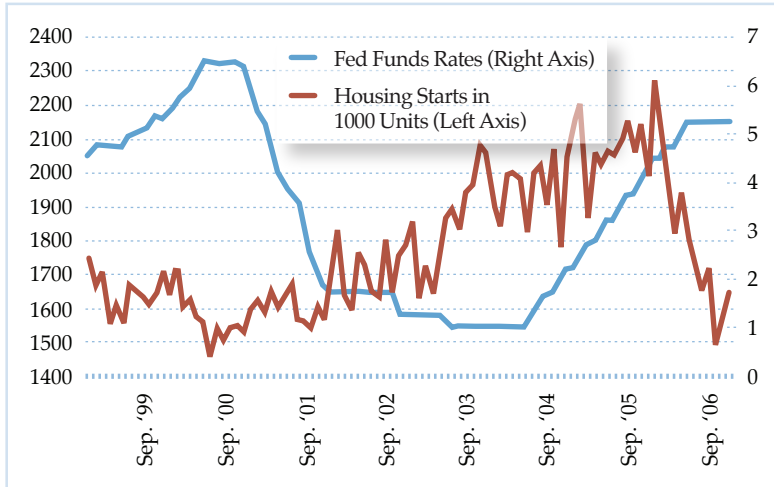
⁸ It should also be noted that the Laubach and Williams model is widely accepted by key central banks and economists associated with the Fed, the European Central Bank, and some South American banks. See Benati and Vitale (2007) from the European Central Bank; Fuentes and Gredig (2007) from the Central Bank of Chile; Humala and Rodriguez (2011) from the Central Bank of Peru; Garnier and Wilhelmsen (2005) from the European Central Bank; Manrique and Marques (2004) from the Bank of Spain; Mésonnier and Renne (2004) from the Bank of France.

Figure 4. Nominal Natural Rates versus Fed Funds Rates in the 2000s

Turning to the historical data, the major rise in real estate prices materialized soon after the fed took aggressive action to lower rates. In Figure 5, the rapid drop in the Fed Funds rate is shown to coincide with the start of the major increase in housing starts.⁹ It is worth noting that the figure also shows that the Fed started to drop rates at the end of 2000, but it was not until late 2002 that the effect was fully reflected in the real estate market; on the downswing of the cycle, the real estate boom continued into the third quarter of 2005, more than a year after the Fed started to raise rates in mid-2004. Such lags typically occur between the onset of an economic problem and the full impact of a monetary policy.¹⁰

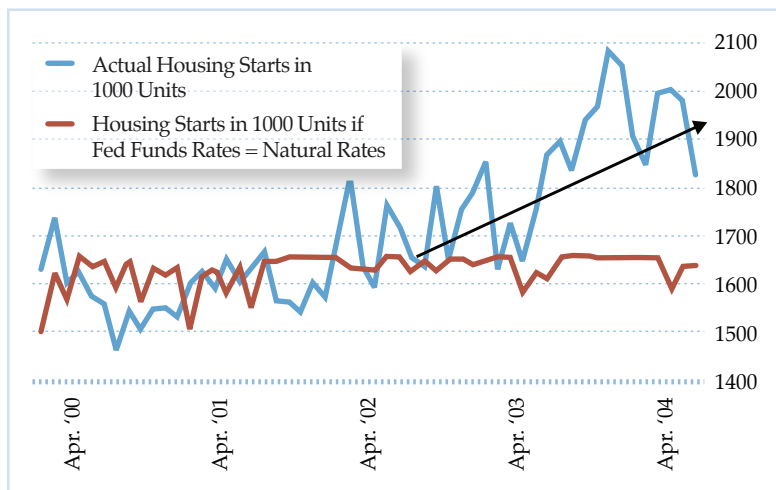
⁹ To evaluate the real estate market, housing starts was selected, as it is perceived to be a better economic leading indicator than real estate prices. According to the Bureau of the Census of the U.S. Department of Commerce, this indicator accounts for approximately a quarter of the country's investment spending and 5 percent of the overall economy. Sustained declines in housing starts slow the economy and can push it into a recession. The opposite, meaning an increase in housing activity, triggers economic growth and, when extreme, can turn into an unsustainable boom. Using regression analysis, a non-linear square fit correlation was used to correlate Fed Funds rates and housing starts between Jan 2000 and June 2004, the end of the boom period. The resulting quadratic equation was then used to estimate the housing starts with natural rates of interest instead of the existing Fed Funds rates.

¹⁰ Economic time lags are an important issue in the development of monetary policy, and were examined in detail by Friedman in the 1961 and 1968 articles already mentioned.

Figure 5. Housing Starts versus Fed Funds Rates in the 2000s

As previously explained, the end-2000 to mid-2004 period is significant since had the real estate boom not occurred, the bust that followed would not have materialized, thereby mitigating or even eliminating all together the financial crisis that followed. Furthermore, as the simulation results presented in Figure 6 illustrate, it is highly likely that the free market generated NRI would have prevented the unsustainable real estate boom.

Figure 6. Housing Starts: Actual versus If Fed Fund Rates Equal to Natural Rates in the 2000s



Application of the Laubach and Williams proxy for the NRI in the period leading up to the 2008 sub-prime crisis and historical experience with free banking show that a monetary system constrained by free markets or an NRI rule is capable of producing price stability and sustainable economic growth. However, a return to free banking is considered unlikely, and the true NRI can only be determined in free markets. But any monetary system involving a central bank is handicapped by the knowledge problem discussed earlier, thus, it will inevitably yield an outcome that is only “second best.”

IMPLEMENTATION OF THE PROPOSED RULE BY THE CENTRAL BANK

As explained earlier, the NRI is evident when monetary equilibrium is achieved ‘naturally’ in a free banking economy. Unfortunately, this figure is not observable. Consequently, for the central bank to implement the rule, it must first be estimated. This poses a problem since no reliable tools are presently available to accurately estimate NRI in real time, which is precisely when it is needed (Laubach and Williams, 2001). A different approach is thus required.

The obvious alternative to the NRI rule is a strategy that holds the nominal income/gross domestic product (NGDP) constant: this is equivalent to holding monetary equilibrium.¹¹ Thus, it indirectly produces the same rule and, equally important, is relatively easy to apply.

First, the NGDP is calculated by determining the money-value of all final goods and services produced in the country, a calculation routinely conducted by governments. The central bank can then select the value it wishes to hold constant—the actual number is not important. Lastly, the rule can then be enforced by adjusting the money supply to maintain the NGDP within an agreed narrow band.¹²

CHALLENGES TO THE RULE

The NGDP constant concept was proposed by Hayek (1931, p. 131) over 80 years ago in the second edition of *Prices and Production* as a way to prevent business cycles. However, it has never really been seriously considered because it can result in mild deflation, which mainstream economists fear may bring about economic disruptions. Their logic, as Krugman (2010) explained, is that deflation feeds on itself. Once deflation starts, prices continue to fall, because people become less willing to spend since they expect prices to fall further, making cash a very attractive, positive real-yield investment. Further, investors are also less willing to borrow even for attractive projects because they must take into account the fact that their loans will have to be repaid in dollars that have a higher purchasing power than the dollars borrowed. It is alleged that this vicious cycle of weak spending and sliding prices can be unstopable, or at least very hard to correct.

However, the fault in this reasoning lies in not distinguishing monetarily created (bad) deflation—typically created by government

¹¹ As explained earlier, monetary equilibrium occurs when M (the quantity of money) is equal to D (the demand of money), or when M times V (the velocity of money circulation) is constant. Resorting to the equation of exchange, M times V is equal to P (price level), times Y (the real output) or NGDP.

¹² The Fed does not control M or V , it can only directly impact M by buying or selling securities, which increases or decreases M , respectively. The Fed can also change the discount rate, but is only a secondary tool.

interference—which in the past has generated negative consequences and so should be prevented in the future, from natural (good) deflation, which should be encouraged.

In fact, any attempt to prevent good deflation will only result in market imbalances, since eventually the adjustments must conform to the reality of supply and demand: economic disruptions are inevitable when the prices of products falling due to an increase in economic productivity are not allowed to reflect their true value.

Another problem raised by mainstream economists involves the impact of wage and price stickiness has on the economy in deflationary times. Specifically, they claim that as deflation occurs, prices—particularly retail prices—start to drop, while production costs—which are likely to be constrained by wage and price contracts—do not. Then, unmanageable business disruptions will inevitably result. However, the fact is that there is no empirical evidence that this phenomenon occurs across the entire economy. In fact, these issues occur only in particular sectors, reflecting competition within the structure of production, and do not affect the aggregate economy to the extent feared by those economists (Selgin, 1995).

Notwithstanding the laundry list of issues concerning deflation presented by mainstream economists, study after study has shown no reason to fear it. Atkeson et al. (2004) studied 17 countries, including the United States, over the period between 1880 and 2000 and found no connection between deflation and depression. In fact, they determined that the correlation between deflation and growth is stronger than with depression. The only direct link between deflation and recession occurred during the 1929–1934 Great Depression.

In another study, Friedman et al. (1971) determined that between 1880 and 1896, while the United States was under the gold standard, the country had an exceptional period of growth with a significant fall in prices. Their data showed that real income rose by about 5 percent per year while the wholesale price level fell about 1.75 percent per year.

Data from China shows that between 1998 and 2001, the country experienced growth and deflation simultaneously. On an annual basis, the real GDP went up on an average of 7.6 percent while retail prices dropped between 0.8 and 3 percent (Salerno, 2003, p. 84).

These studies are unmistakable proof that there is nothing inherently harmful in deflation, as long as it is the natural consequence of improvements, such as technological innovation, from which lower production costs are a beneficial byproduct.¹³

CONCLUSIONS

A wider discussion would address alternatives to eliminating the monopoly on currency and shifting to a free, fully unregulated banking system. However, our goal was narrower. Following Hayek's argument (Hayek, 1960, p. 451) that abolition of central banking is already politically impractical and perhaps even undesirable given how we have become so accustomed to this system, we have focused our effort on finding an optimal monetary solution within an environment in which the central bank is preserved, fully aware that the outcome can be only second best.

Our proposal cannot eliminate market fluctuations that result from changes in the time preference of economic agents, technological innovations or other minor economic variables; in fact these fluctuations are healthy since they generate the price signals necessary to improve efficiency. It can, however, reduce the disruptive market cycles generated by arbitrary and politically driven credit expansions that cause short term interest rates to fall below the natural rate. The hope is that by not allowing the Fed to generate booms, the potential for economic busts can be reduced. Obviously, the degree of reduction will be determined by the ability of the Fed to follow the rule and minimize the unavoidable mistakes inherent in discretionary management of the money supply by a central bank.

¹³ In a series of articles, most significantly in 1990 and 1997, Selgin introduced the "productivity norm" to support the concept of "good" deflation by pointing out that it is the natural outcome of hands-off monetary policy, or free banking. In free banking, two simultaneous monetary actions consistent with monetary equilibrium and the creation of an environment of economic growth, take place in a natural manner. NGDP stays constant as the free market equalizes money supply and demand, while the price level (P) deflates at the rate of productivity growth, meaning at the growth rate in real output (y). This is "good deflation," like that which occurred under the gold standard period in the nineteenth century, versus the undesirable "bad deflation," such as that which occurred during the Great Depression.

Implementation of such a proposal will result in an immediate rise in interest rates to levels matching the natural rate. There is no doubt that this will bring about short term negative consequences, but once the economic system adjusts to the change, the benefits arising from monetary stability will materialize.

REFERENCES

- Amadeo, Kimberly. 2011. "The History of Recessions in the United States," *About.com*. Available at http://useconomy.about.com/od/grossdomesticproduct/a/recession_histo.htm.
- Anderson, Benjamin M. 1949. *Economics and the Public Welfare*. Princeton, N.J.: D. Van Nostrand Co., 1965. Retrieved from http://mises.org/books/economics_public_welfare_anderson.pdf.
- Atkeson, Andrew, and Patrick J. Kehoe. 2003. "Deflation and Depression: Is There an Empirical Link?" *Federal Reserve Bank of Minnesota Research Department Staff Report*, 331. Available at <http://www.mpls.frb.org/research/sr/sr331.pdf>.
- Benati, Luca, and Giovanni Vitale. 2007. "Joint Estimation of the Natural Rate of Interest, the Natural Rate of Unemployment, Expected Inflation, and Potential Output," *European Central Bank Working Paper Series*, 797. Available at <http://www.ecb.int/pub/pdf/scpwps/ecbwp797.pdf>.
- Briones, Ignacio, and Hugh Rockoff. 2005. "Do Economists Reach a Conclusion on Free-Banking Episodes?" *Econ Journal Watch* 2, no. 2: 279–324. Available at <http://econjwatch.org/articles/do-economists-reach-a-conclusion-on-free-banking-episodes>.
- Buchanan, James. 1987. "An Interview with Laureate James Buchanan," *Austrian Economics Newsletter* 9, no. 1. Available at http://mises.org/journals/aen/aen9_1_1.asp.
- Cachanosky, Juan C. 1989. "La crisis del treinta," *Libertas* no. 10. Buenos Aires, Argentina: ESEADE. Available at http://www.eseade.edu.ar/files/Libertas/40_7_Cachanosky.pdf.
- Cachanosky, Nicolás. 2013. "Hayek's Rule, NGDP Targeting, and the Productivity Norm: Theory and Application," *Social Science Research Network*. Available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2373230.

- Dowd, Kevin. 1992. "The Experience of Free Banking," Taylor and Francis e-Library, 2003.
- Friedman, Milton. 1961. "The Lag in Effect of Monetary Policy," *Journal of Political Economy* 69, no. 5: 447–466.
- . 1968. "The Role of Monetary Policy," *American Economic Review*, 58, no. 1: 1–17. Available at <http://www.aeaweb.org/aer/top20/58.1.1-17.pdf>.
- . 1972. "Have Fiscal and/or Monetary Policies Failed?" *American Economic Review* 62, nos. 1, 2: 11–18. Available at <http://www.jstor.org/pss/1821518>.
- Friedman, Milton, and Anna J. Schwartz. 1971. *Monetary History of the United States, 1867–1960*. Princeton: Princeton University Press, 94–95.
- . 2008. "The Great Contraction, 1929–1933." Princeton: Princeton University Press.
- Fuentes, Rodrigo, and Fabián Gredig. 2007. "Estimating the Chilean Natural Rate of Interest," Central Bank of Chile. Available at http://www.bcentral.cl/conferencias-seminarios/otras-conferencias/pdf/variables/Fuentes_Gredig.pdf.
- Garnier, Julien, and Bjørn-Roger Wilhelmsen. 2005. "The Natural Real Interest Rate and the Output Gap in the Euro Area: A Joint Estimation," *European Central Bank Working Paper Series*, 546. Available at <http://www.ecb.int/pub/pdf/scpwps/ecbwp546.pdf>.
- Hayek, Friedrich A. 1931. *Prices and Production*. New York: Augustus M. Kelly. Available at <http://mises.org/books/pricesproduction.pdf>.
- . 1936. *Economics and Knowledge. A Presidential Address to the London Economic Club*. *Economica* 4: 33–54 (February 1937). Available at <http://www.econlib.org/library/NPDBooks/Thirlby/bcthLS3.html>.
- . 1945. "The Use of Knowledge in Society," *American Economic Review* 35, no. 4: 519–530. Available at <http://object.cato.org/sites/cato.org/files/articles/hayek-use-knowledge-society.pdf>.
- . 1960. *The Constitution of Liberty*. Chicago: University of Chicago Press.
- Humala, Alberto, and Gabriel Rodriguez. 2011. "Estimation of a Time Varying Natural Interest Rate for Peru." *25th Meeting of Economists of the Central Bank of Peru* (December 2007). Available at <http://www.cemla.org/red/papers2008/red13-peru2.pdf>.

- Krugman, Paul. 2009. *The Return of Depression Economics and the Crisis of 2008*. New York: W.W. Norton and Company.
- . 2010. "Why Is Deflation Bad?" *New York Times*, August 2. Available at <http://krugman.blogs.nytimes.com/2010/08/02/why-is-deflation-bad/>.
- Laubach, Thomas, and John C. Williams. 2001. "Measuring the Natural Rate of Interest," *Finance and Economics Discussion Series*, 56. Available at <http://www.federalreserve.gov/pubs/feds/2001/200156/200156pap.pdf>.
- Mankiw, N. Gregory. 2006. "Letter to N. Gregory Mankiw." Available at <http://gregmankiw.blogspot.com.ar/2006/08/letter-from-milton.html>.
- Manrique, Marta, and José M. Marques. 2004. "An Empirical Approximation of the Natural Rate of Interest and Potential Growth," *Documentos de Trabajo*, no. 0416. Banco de España. Available at <http://www.bde.es/informes/be/docs/dt0416e.pdf>.
- Mésonnier, Jean-Stephane, and Jean-Paul Renne. 2004. « A Time-Varying Natural Rate of Interest for the Euro Area," Banque de France, Monetary Policy Research Unit, 41-1422 SEPMF, 75049. Available at <http://www.sciencedirect.com/science/article/pii/S0014292106001504>.
- Mises, Ludwig von. 1912. *The Theory of Money and Credit*. New Haven, Conn.: Yale University Press, 1953. Available at <http://mises.org/books/tmc.pdf>.
- Ravier, Adrian, and Peter Lewin. 2012. "The Subprime Crisis," *Quarterly Journal of Austrian Economics* 15, no. 1: 45–74.
- Robbins, Lionel. 1934. *The Great Depression*. London: Macmillan and Co. Available at <https://mises.org/books/depression-robbins.pdf>.
- Rochon, Louis-Philippe. 1999. *Credit, Money and Production*. Northampton, Mass.: Edward Elgar.
- Rosen, Erwin. 2010. "What Is the Current State of Economic Science?" *Mises Daily*, December 22. Available at <https://mises.org/library/what-current-state-economic-science>.
- Rothbard, Murray N. 1963. *America's Great Depression*, 3rd ed. Kansas City: Sheed and Ward, 1972. Available at <https://mises.org/library/americas-great-depression>.

- Salerno, Joseph. 2003. "An Austrian Taxonomy of Deflation—with Applications to the U.S." *Quarterly Journal of Austrian Economics* 6, no. 4.
- Shiller, Robert. n.d. Online Data. Retrieved from <http://www.econ.yale.edu/~shiller/data.htm>
- Selgin, George. 1990. "Monetary Equilibrium and the Productivity Norm of Price-Level Policy," *Cato Journal* 10, no. 1: 265–287. Available at <http://object.cato.org/sites/cato.org/files/serials/files/cato-journal/1990/5/cj10n1-14.pdf>.
- . 1995. "The Case for a 'Productivity Norm:' Comment on Dowd," *Journal of Macroeconomics* 17, no. 4: 733–40.
- . 1997. *Less Than Zero*. London: Institute of Economic Affairs. Available at <http://mises.org/library/less-zero-case-falling-price-level-growing-economy-0>.
- Selgin, George, William D. Lastrapes, and Lawrence H. White. 2012. "Has the Fed Been a Failure?" *Journal of Macroeconomics* 34, no. 3. Available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1713755.
- Schuler, Kurt. 1992. "The World History of Free Banking: An Overview." In Kevin Dowd, ed., *The Experience of Free Banking*, pp. 7–47). London and New York: Routledge.
- Schwartz, Anna J. 2009. "Origins of the Financial Market Crisis 2008," *Cato Journal*, 29, no. 1: 19–23. Available at <http://www.cato.org/pubs/journal/cj29n1/cj29n1-2.pdf>.
- Simons, Henry C. 1936. "Rules vs. Authorities in Monetary Policy," *Journal of Political Economy* 44, no. 1: 1–30.
- Stiglitz, Joseph E. 2010. *Freefall: America, Free Markets, and the Sinking of the World of Economy*. New York: W.W. Norton and Company.
- Taylor, John B. 2008. "The Financial Crisis and the Policy Responses: An Empirical Analysis of What Went Wrong." *National Bureau of Economic Research Working Paper* no. 14631. Available at <http://www.nber.org/papers/w14631>.
- . 2011. "Historical Evidence on the Benefits of Rules-Based Economic Policies." Address before the Joint Luncheon Session of the American Economics Association and the American Finance Association. Available at <http://www.stanford.edu/~johntayl/2011%20Taylor%20AEA-AFA.pdf>.

- The Daily Show. 2007. The Daily Show [Television Series], October 8. Available at <http://bigpicture.typepad.com/comments/2007/10/alan-greenspan-.html>.
- US Business Cycle Expansions and Contractions, National Bureau of Economic Research. Available at <http://www.nber.org/cycles/cyclesmain.html>.
- White, Lawrence H. 1984. *Free Banking in Britain*, 2nd ed. London: Institute of Economic Affairs.
- . 2008a. “How Did We Get into This Financial Mess?” *Cato Briefing Paper* 110. Available at <http://www.cato.org/publications/briefing-paper/how-did-we-get-financial-mess>.
- . 2008b. “Is the Gold Standard Still the Gold Standard among Monetary Systems?” *Cato Briefing Paper* 100. Available at <http://www.cato.org/publications/briefing-paper/is-gold-standard-still-gold-standard-among-monetary-systems>.
- Wicksell, Knut. 1898. *Interest and Prices*. R.F. Kahn, trans. New York: Augustus M. Kelley, 1962. Available at <http://mises.org/library/interest-and-prices>.
- Yahoo Finance. 2000–2002. Available at <http://finance.yahoo.com/echarts?s=%5EIXIC+Interactive#symbol=^ixic;range=20000103,20021231;compare=;indicator=volume;charttype=area;crosshair=on;ohlcvvalue=0;logscale=off;source=>