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What Is the Monetary Standard?

WP 15-16

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The monetary standard emerges out of the interaction of monetary policy with the structure of the economy. Characterization of the monetary standard thus requires specification of a model of the economy with a central bank reaction function. Such a specification raises all the fundamental issues of identification in macroeconomics.

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The monetary standard emerges out of the way in which the behavior of the central bank interacts with the structure of the economy. The following contrasts an understanding of the monetary standard in the monetarist tradition where economic disturbances are assumed to originate with monetary disturbances with an understanding of the monetary standard in which economic disturbances are assumed to originate in the private sector.

The monetarist tradition assumes that the central bank should follow a rule that provides for a stable nominal anchor and that allows the price system to work freely to determine real variables like output and employment. Apart from the real-business-cycle approach to cyclical fluctuations, a common denominator among alternatives to this monetarist tradition involves "imbalances" of some sort that reflect a weakly equilibrating price system. In the context of debate over the Great Recession, the terminology of "speculative excess" expresses these views. This paper uses the New Keynesian framework in order to highlight differences in understanding of the monetary standard and to clarify the issues that arise in identifying the actual and optimal monetary standard.

Section 1 exposits the Aoki (2001) version of the New Keynesian model in a way that highlights contrasting views on the nature of the monetary standard. Sections 2 and 3 organize, respectively, the kinds of stylized facts that the different approaches attempt to explain. Section 4 offers concluding comments about the kind of central bank transparency that would facilitate learning about the monetary standard.

1. Organizing the data: the monetarist view

Milton Friedman gave predictive content to the quantity theory in a way captured by the divine-coincidence version of the NK model. He assumed that the central bank had to operate with a rule that provided a stable nominal anchor. Beyond that, it had to allow market forces to determine real variables. In terms of the NK model, the central bank controls trend inflation through the way that its rule conditions the price setting of firms in the sticky-price sector. While true that in the NK model there is a structural Phillips curve relationship, in practice, attempts to manipulate a trade-off between inflation and the output gap have foundered. As a matter of practical experience, such attempts inappropriately frustrated the operation of the rule designed to achieve the divine-coincidence result.

If the monetarist view is correct that the price system works well to attenuate cyclical fluctuations in the absence of monetary disturbances, given that recessions are infrequent events, it follows that the central bank possesses a baseline rule that allows the price system to work. The research agenda then is to identify this rule in a way that highlights departures and to ascertain whether those departures are a necessary and sufficient condition for recessions. Historically, monetarists flagged such departures as attempts by the central bank to maintain the exchange rate at a level that overvalued the exports of a country or as attempts by the central bank to control real variables like the unemployment rate. They attributed the associated monetary instability to such attempts.

Most famously, Friedman and Schwartz showed that monetary contractions predicted cyclical peaks. Figures 1 and 2 show annualized M1 growth rates. Following Friedman and Schwartz (1963b), as a visual aid to seeing the alternating intervals of "low" and "high" growth rates, the figures fit step functions to the monthly observations. The figures highlight the monetary decelerations prior to business cycle peaks. For the period 1963 until 1981, Figure 3 shows that the weakening of economic activity that precedes cyclical peaks is associated with the declines in the

steps of the M1 step function. Thereafter, in the United States, money growth ceased to offer a straightforward measure of the stance of monetary policy.[1]

For the post-1981 period, however, as shown in Figure 4, the earlier pattern persists of a weakening economy prior to cyclical peaks. Figures 5 and 6 show how prior to cycle peaks consumption falls off relative to the intra-cycle trend.[2] Figures 7 and 8 show how the FOMC maintained nominal and real interest rates at cyclically high levels going into cyclical downturns despite the weakening economy.[3]

Although the real rate falls in recession, once past the business cycle peak, as shown in Figure 9, the magnitude of the output gap increases rapidly as the inventory cycle unfolds. Standard Fed rhetoric is that because interest rates are at cyclical lows during recessions, monetary policy is easy. However, the relevant characteristic of policy is the inertia the FOMC imparts to the funds rate prior to the cycle peak while the economy weakens. Although the FOMC never talks in terms of trade-offs, effectively at these times it was trying to create a negative output gap in order to lower inflation.[4]

Figures 10 and 11 serve to organize the narrative that motivates FOMC behavior. Going into recessions, inflation (the sold line) is at a cyclical high. Examination of FOMC transcripts shows that the priority of the FOMC at these times was to reduce inflation (Hetzel 2008, 2012; Romer and Romer 1989). As a consequence, the FOMC raised the funds rate until the economy weakened as illustrated by the way in which consumption fell below trend (dashed line). It then maintained a cyclically high rate while the economy weakened. Over the course of the recession, the real rate (diamonds) declined. With the exception of the recovery from the July 1981 to November 1982 cyclical contraction, during the economic recovery short-term real interest rates fell to zero.[5]

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[1] Starting in 1981, the phasing out of Reg Q, which fixed the rates on bank time deposits below market rates, caused real M1demand to become interest sensitive. As a result, it gives off misleading signals about the stance of monetary policy by strengthening when the economy weakened and vice versa. Also, in periods of financial stress, the narrow aggregates like M1 grow rapidly as market participants seek liquidity. More generally, by endowing debt instruments with liquidity, innovation in financial markets has obscured the moneyness represented by various aggregates. Finally, there are pure measurement issues. After the mid-1990s, the Fed did not record the amount of deposits removed from bank balance sheets by swap arrangements and did not record the deposits moved offshore in order to avoid FDIC premia. In 2011, the combination of low interest rates and a change in how the FDIC calculated its insurance premia caused banks to put these "missing" deposits back on their balance sheets.

[2] A single trend line is fitted to the short 1980 recession and the 1981-1982 recession.

[3] Figure 7 uses inflation forecasts from the Livingston survey, which are biannual and become available in 1946. Figure 8 uses inflation forecasts contained in the Board of Governors staff document called the Greenbook prepared before FOMC meetings. They first became available in November 1965 and correspond to FOMC meetings.

[4] In the pre-World War II period, the analogue was the Fed's use of discount rate increases followed by downward cyclical inertia as the economy weakened in order to lower prices (commodity prices or equity prices) considered as elevated through speculative excess (Friedman and Schwartz 1963a).

[5] The Economic Recovery Tax Act of 1981 along with the prospect of reduced inflation, which would reverse the way that inflation interacted with a tax code not indexed for inflation to raise

However, by then it was too late to undue the effects of contractionary monetary policy.

Although the FOMC does not use the language of trade-offs, these episodes represented a departure from the FOMC's standard lean-against-the-wind procedures. By limiting downward movement in the funds rate while the economy weakened, they represented attempts to create a negative output gap in order to reduce inflation. William McChesney Martin characterized monetary policy as "lean-against-the-wind" (LAW).[6] Examination of a wide variety of information about the policy process including records of meetings, speeches, and the intellectual and political environment that has shaped policy makers' understanding of and approach toward policy yields a basic generalization about these procedures (Hetzel 2008). In a measured, persistent way, the FOMC raises the policy rate above its prevailing value when output grows at a sustained rate in excess of potential (rates of resource utilization are increasing and the unemployment rate is falling), and conversely in the case of sustained economic weakness.[7]

As a first pass, because positive growth gaps are associated empirically with optimism about the future while negative growth gaps are associated with pessimism about the future, LAW procedures indicate the appropriate direction of movement in the interest rate. If output is growing unsustainably fast, then the real interest rate must rise in order to limit aggregate demand by increasing the incentive to save (transfer resources to the future). Beyond this first pass, at FOMC meetings, participants report on a wide variety of anecdotal information gleaned from contacts with the business community. The FOMC uses this sort of information as confirming evidence about its assessment of sentiment toward the future. Does above trend growth translate into optimism about the future that causes households to want to take on debt and transfer consumption from the future into the present? Based on these LAW procedures, the FOMC chooses the interest rate target and a message to financial markets about the likely persistence of that target.[8]

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sharply corporate tax rates, reduced expected corporate taxes (Hetzel 2008, 147-9). The revival of corporate investment presumably kept real interest rates at cyclical highs during the economic recovery from the 1981-1982 recession. Along with the failure of the near-zero level of interest rates after December 2008 to revive inflation, this instance illustrates the monetarist criticism of inferring the stance of monetary policy from the level of interest rates.

[6] Economists who perform model simulations find it convenient to use a Taylor rule as a reaction function for the FOMC. However, for a number of reasons, this practice is uninformative if the intention is to identify monetary policy shocks. Although the Taylor rule can capture the correlation between short-term interest rates and cyclicality in economic activity and inflation, it is a reduced-from relationship. It does not capture the functional form of the reaction function used by the FOMC. The FOMC has never found it practicable to reach a quantitative consensus over the output gap as part of its decision-making process. Moreover, the Taylor rule does not capture the way in which the FOMC monitors the behavior of the term structure of interest rates for information about the level of rates required in order to achieve low, stable inflation.

[7] In periods of economic recovery, output grows in a sustained way above trend. The FOMC then assesses whether the upward slope in the yield curve and implied rise in forward rates is an adequate guide to maintaining growth at a gradually declining rate consistent with a return to steady growth that no longer reduces rates of resource utilization.

[8] In the model, R_t should be understood as the level of the term structure of interest rates. The FOMC sets the level through the way in which it changes its funds rate target and the way in which it communicates the likely persistence in those changes. In the post-December 2008 period, the FOMC

During the Great Recession, monetary policy followed the pattern of earlier recessions. The difference was that the unacceptably high inflation in 2007 and 2008 emerged not from prior monetary expansion but rather from a prolonged inflation shock. Illustrative of the increase in commodity prices, Figure 12 shows the sustained rise in the real price of oil that began in summer 2004 and peaked in summer 2008. Figure 13 shows how the inflation shock pushed headline inflation above core inflation in this period.

One characteristic of the Great Recession is the almost simultaneous occurrence of business cycle peaks in the developed countries. One explanation for this common behavior is the similar response of central banks to the prolonged inflation shock. Similarly to the stop phases of past recessions, the central banks of the developed countries kept interest rates at cyclical highs while their economies weakened in order to create a negative output gap that would restrain headline inflation. In terms of the model in Aoki (2001), central banks should have allowed relative prices to change by allowing headline inflation to rise above core inflation. That is, they should have confined policy to stabilizing policy in the sticky-price sector. Aoki (2001, 75) summarized:

> [S]uppose there is an increase in the price of food and energy … putting an upward pressure on aggregate inflation…. The central bank could respond with a sharp contractionary policy and reduce aggregate demand by a large amount so as to decrease prices in the sticky-price sector…. However, our model shows that such a policy is not optimal. The optimal policy is to stabilize core inflation.

An explanation for what made the Great Recession so severe and prevented a V-shaped recovery is the reemergence of the inflation shock in 2010 with the recovery from the recession and the revival of demand for commodities (Figures 12 and 13). Again, central banks limited increases in aggregate nominal demand in order to limit increases in headline inflation above their 2 percent targets. At the same time, the negative impact of the inflation shock on the real disposable income of households likely made households pessimistic about the future and lowered the natural rate of interest.[9] As shown in Figure 13, starting in early 2007, consumption and disposable income declined in tandem.[10]

For the United States, the interest sensitivity of money demand obscures the classic leading indicator property of money for the Great Recession. Figure 15 displays M2 growth and the opportunity cost of holding M2. Given the sharp drop in the opportunity cost of holding M2 starting in 2007, the stability of M2 growth in 2007-2008 indicates contractionary monetary policy. M2 growth should have increased rapidly.[11]

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influenced the term structure through the way in which it communicated the conditions that would initiate lift-off.

[9] As shown in (6), a real rate below the natural rate of interest requires that households expect that the output gap will decline. By 2008, the persistence of the inflation shock may have created this expectation

[10] The shortfall of real personal disposable income below consumption in 1999 and again in 2005 corresponds to increases in energy (oil) prices (Figure 12).

[11] From January 2007 through September 2008, the opportunity cost of holding M2 fell by 2.8 percentage points. Hetzel (2008, Table 14.1) estimated an (semi-log) interest elasticity of demand for real M2 of 1.6. Real M2 demand then increased by 4.5% while M2 increased by 10.6% over this

As shown in Figures 16 to 19, both the Eurozone and the United Kingdom followed the pattern highlighted by monetarists (Hetzel 2013). In both cases, the central banks kept real interest rates at cyclically high levels going into the recession. With a lag of 4 quarters in the Eurozone and two quarters in the UK, growth of nominal GDP declined following the decline in money growth.

2. Organizing the data: the imbalances view

The historical, default view of economic disorder is that it arises in response to the inevitable unwinding of accumulated imbalances in the private sector. Those imbalances in turn arise in a general way from the exercise of market power. Explanations of inflation that turned on cost-push and wage-price-spirals emphasized the monopoly power of corporations and unions. Real bills views, which highlighted the collapse of speculative excess, stressed the exercise of market power in the form of the herd behavior of investors. Investor beliefs about the future shift collectively from excessive optimism to excessive pessimism.

According to the Keynesian consensus of the 1960s and 1970s, shifting investor sentiment created investment booms and busts that powered the business cycle. In a similar spirit, much present work on cyclical fluctuations highlights shifts in investor sentiment toward risk reflected in fundamental shocks to uncertainty and rates of time preference. Similarly, sunspots coordinate changes in investor sentiment toward the future. Discussion centers on whether and how central banks should respond to "asset bubbles."

Galbraith (1993), Kindleberger and Aliber (2011), and Minsky (1986) are exponents of the speculative-excess view. This view emphasizes the correlation between the expansion phase of the business cycle and optimism about the future of households and firms. Given that optimism, they take on debt. In the succeeding contraction phase, there is a correlation between pessimism about the future and attempts to reduce debt.

Economists in the Keynesian tradition give these correlations a causal interpretation by attributing the shock that drives cyclical alternations to "animal spirits:" irrational shifts from excessive optimism to excessive pessimism. The resulting alternation between speculative excess and collapse overwhelms the stabilizing properties of the price system. On the one hand, the stickiness of nominal (dollar) prices prevents the market clearing required in order to maintain full employment. On the other hand, that nominal stickiness endows the central bank with the ability to engage in countercyclical monetary policy.

As noted in section 1, a change from positive to negative in (4) in the term $\left(E_t \hat{B}_{t+1} - \hat{B}_t \right)$ can capture a shift from optimism to pessimism about the future. Current models of financial excess add a financial sector with frictions in order to allow these shifts to cause cyclical fluctuations. Figure 20 plots the yield spreads of the Aaa corporate bond yield and the Baa corporate bond yield with the ten-year Treasury bill yield. The latter especially is used as a measure of how risk in financial markets increases around recessions. The graph itself of course indicates nothing about whether the increase

19 month interval. Assuming the long-run historical value of M2 velocity of one, these figures are consistent with annualized growth in nominal GDP of only 3.1% [(10.6 – 4.5) = 6.1% with 6.1 taken to the 12/19 power]. For a sophisticated study of M2 demand, see Anderson et al (2015).

in risk sentiment is derivative from some other shock or can be taken as a fundamental driver of the business cycle as assumed in theories that highlight the collapse of speculative excess.[12]

In models that transmit increases in risk aversion to the real sector through financial frictions, banks restrict the flow of credit to firms with viable investment projects. As a measure of stress on the banking sector, Figure 21 plots the three-month CD rate minus the three-month Treasury bill rate. It does increase in the deep recessions of 1973-1974, 1981-1982, and 2008-2009. However, in the last recession, the impression is dominated by a single observation at the time of the Lehman bankruptcy. If firm activity is limited through credit rationing, small businesses, which lack access to the commercial paper and capital markets and lack relationships with multiple banks should be most affected. In this respect, the survey from the NFIB (National Federation of Independent Business) shown in Figure 22 is especially informative. One of the monthly survey questions asks businesses to choose from a list of questions their most important problem. The fact that very few mentioned obtaining financing as a problem suggests that in the last recession a credit channel was not a major issue.

Atif Mian and Amir Sufi (2010, p. 55 and 2011, p. 2155) promote a different version of the speculative-excess view:

> Our central argument is that an outward shift in the supply of credit from 2002 to 2006 was a primary driver of the macroeconomic cycle of 2002 to 2009…. The link we show between house prices and household borrowing suggests that housing and household leverage play an important role in macroeconomic fluctuations….

Mian and Sufi (2010, p. 52 and 2011, p. 2155) also show that the effect on expenditure of the rise and fall of house prices in the 2002 to 2005 and 2006 to 2009 periods, respectively, was concentrated among households with weak credit scores.

> [T]he mortgage default crisis started and remains most pronounced in high subprime share zip codes, which correspond to the top quartile based on the fraction of borrowers in the zip code with a credit score less than 660 as of 2000…. In addition, we show that the effect of house prices on borrowing is not uniform across the population but concentrates largely among homeowners with low credit scores and a high propensity to borrow on credit cards…. Indeed, Mian and Sufi (2010) show that changes in household leverage at the county level serve as an early and powerful predictor of the onset and severity of the recession of 2007 to 2009.

Figure 23 shows that prior to business cycle peaks growth in household debt and consumption increase although for the recent recession the growth rate in consumption is mild compared to previous business cycles. Figure 24 shows the decline in home equity wealth prior to the December 2007 cycle peak. Figure 25 shows the growth rate of personal consumption expenditures along with two measures of house prices. The relevant one for evaluating the Mian-

[12] As shown in (6), the real rate equals the natural rate plus a term measuring the expected growth in the output gap. In the prolonged recovery from the Great Recession, the real rate has remained low. Given the implausibility of a continually expected decline in the output gap, estimated DSGE models impute persistent negative shocks to rates of time preference. Those shocks appear as "financial" shocks. However, the real rate may have remained low due to precautionary savings undertaken to guard against left tail risk not captured given the linear character of the model (Guvenen et al 2014).

Sufi hypothesis about the driving role of house wealth in the Great Recession is the FHFA series. It measures house prices for houses with conforming Fannie Mae and Freddie Mac mortgages and omits the houses with the more expensive jumbo mortgages. The high income households that take the jumbo mortgages are not the credit-constrained households that Mian and Sufi focus on.[13]

As shown in Figure 25, the significant rise in house prices that began in 1997 did not obviously affect aggregate consumption. Moreover, the decline in the growth rate of consumption preceded the decline in the FHFA house price index. As shown in Figure 14, once the recession began, growth in real personal consumption expenditures fell below growth in real personal disposable income. That fact is consistent with debt overhang constituting a propagating mechanism.

Mian and Sufi present evidence consistent with the fall in house prices limiting the purchase of automobiles of credit-constrained households. However, that fact is consistent with the hypothesis that an adverse real shock will not translate into a serious recession in the absence of contractionary monetary policy. Moreover, their results highlight the difficulty of identification. An inflation shock that increases the relative price of gasoline and food will affect lower income households disproportionately and depress their purchases of automobiles. Those households are the ones captured by the low FICO scores highlighted by Mian and Sufi.

One way to distinguish between a monetary shock and a shock caused by an exogenous rise and fall of asset prices is that only the former possesses clear implications for inflation. Figure 13, which plots headline and core inflation, reveals a decline in core inflation from 2.2% over the interval August 2004 through August 2008 to 1.5% over the interval April 2013 through September 2015. That decline is impressive because of the stability of expected inflation.

3. Learning about the nature of the monetary standard

The creation of the Federal Reserve System corresponded closely in time to the abandonment of commodity standards in favor of paper money standards. Since 1914, the Fed has engaged in a process of trial and error over how to manage a paper standard. That process created the semi-controlled experiments that allow learning about the optimal monetary standard. However, learning is exceedingly difficult. A major reason is the difficulty in characterizing the systematic character of the policy process and its evolution. The language of discretion allows the Fed to communicate in a way that deflects political attack. Each individual policy action is defensible in terms of the economy's contemporaneously most pressing problem. However, that language obscures the systematic nature of monetary policy and renders learning difficult.

For learning to occur systematically rather than haphazardly, it is important that policy makers be explicit about their understanding of the monetary standard. Because monetary policy emerges out of their implicit understanding, explicitness facilitates communication among policy makers themselves. Explicitness also promotes an exchange of ideas between policy makers and the wider audience of academics, politicians, and the informed public.

[13] The Case-Shiller series is computed for a sample of only 20 unrepresentative cities.

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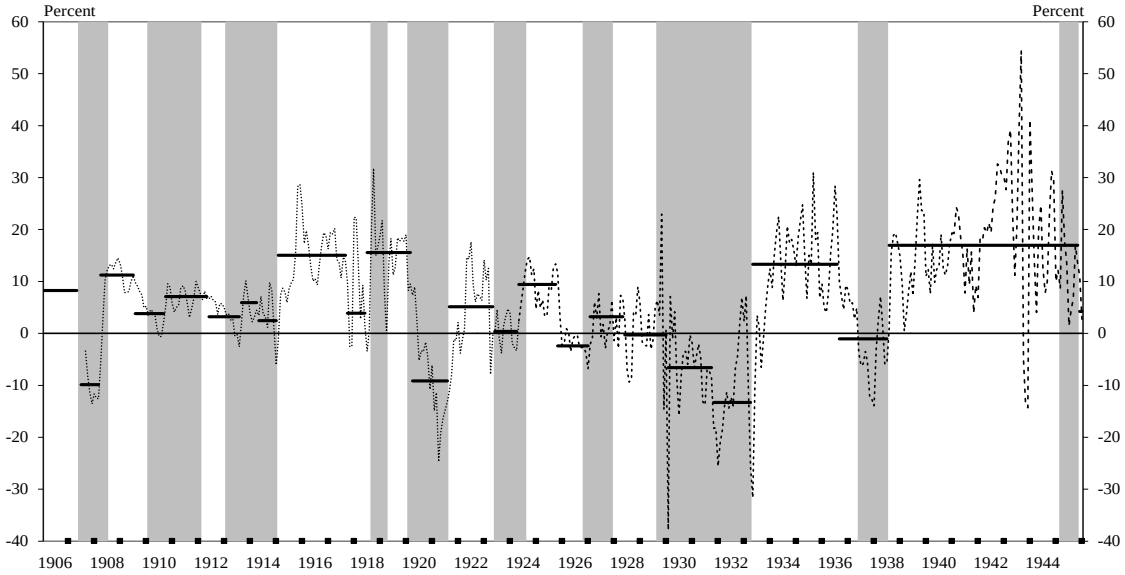
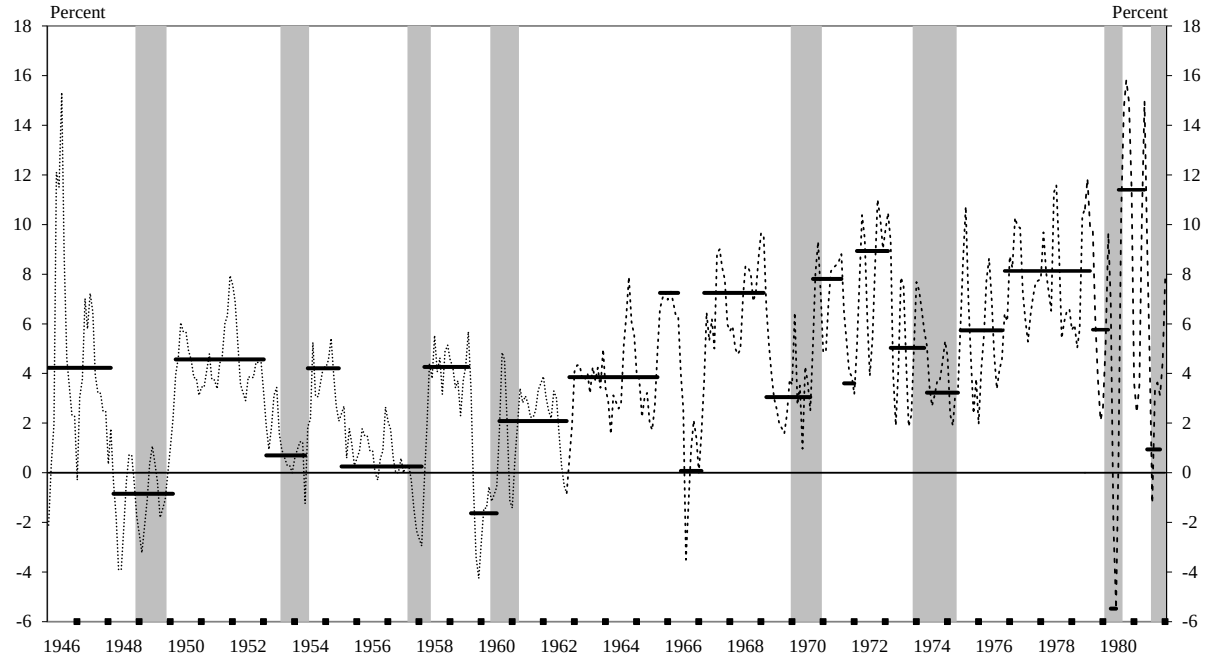
Figure 1
M1 Step Function and Recessions: 1906-1945



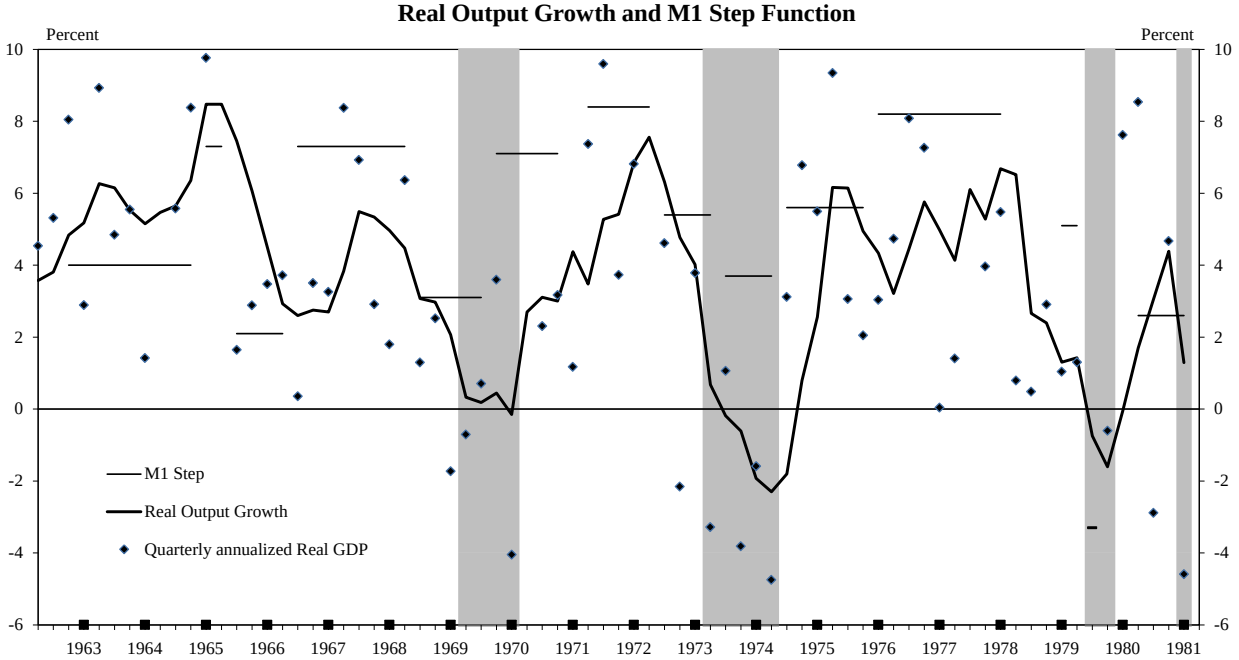
Notes: Series are a three-month moving average of the annualized monthly money growth rates and a step function fitted to monthly annualized growth rates of money. Step function before May 1907 uses annual growth rates based on June observations of M2 from 1900-1907. Observations for money from June 1900 to May 1914 are for M2; observations from June 1914 to December 1945 are for M1. Data are from Friedman and Schwartz (1970). Shaded areas indicate NBER recessions. Heavy tick marks indicate December.

Figure 2
M1 Step Function and Recessions: 1946-1981



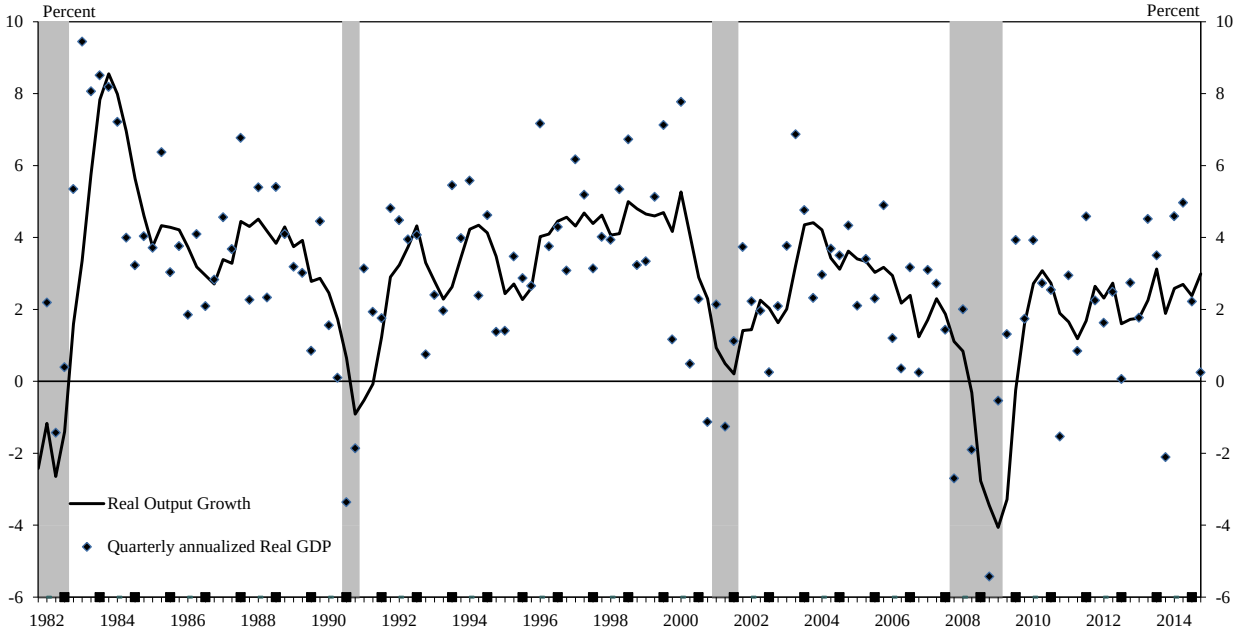
Notes: Series are a three-month moving average of the annualized monthly money growth rates and a step function fitted to monthly annualized growth rates of money. Data on money (M1) from January 1946 to December 1958 from Friedman & Schwartz (1970). From January 1959 to December 1980 data from Board of Governors. January 1981 to December 1981 M1 is "shift-adjusted M1" (Bennett 1982). Shaded areas indicate NBER recessions. Heavy tick marks indicate December.

Figure 3
Real Output Growth and M1 Step Function



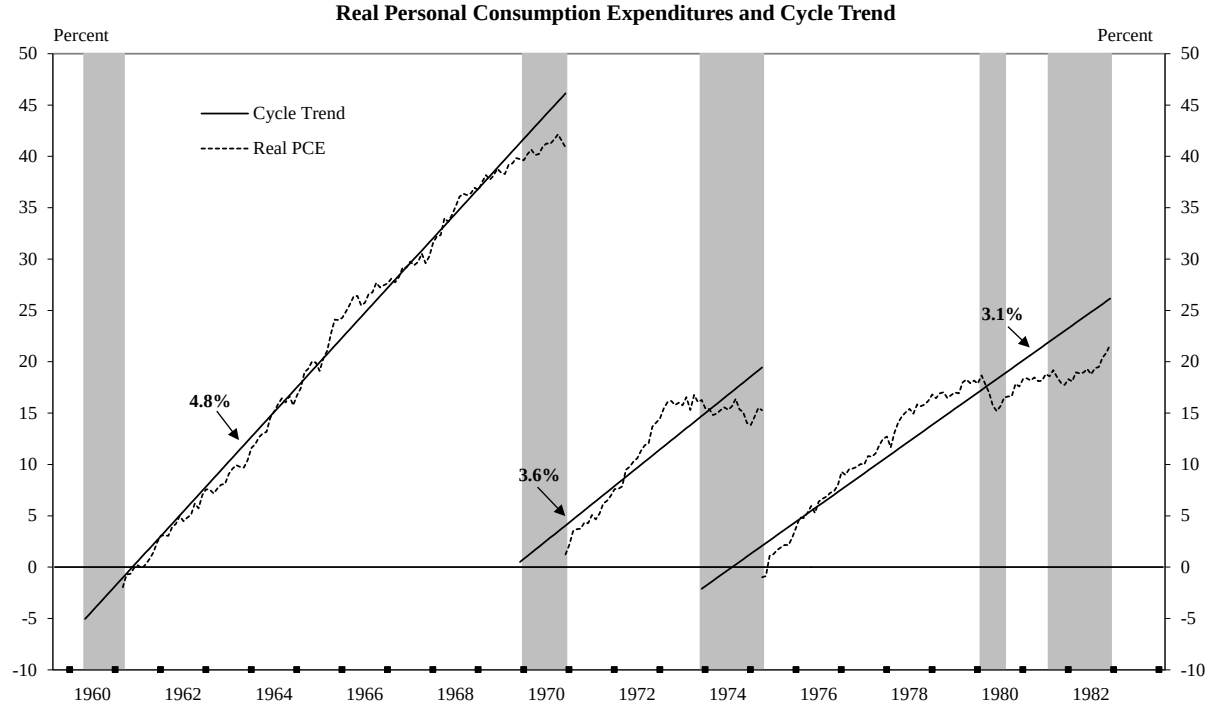
Notes: The M1 steps are an average of the annualized quarterly M1 growth rates. In 1981, M1 is "shift adjusted" (Bennett 1982). Real output growth is 4-quarter percentage changes in real GDP. Quarterly annualized real GDP is annualized quarterly growth rates. Shaded areas indicate NBER recessions. Heavy tick marks indicate fourth quarter.

Figure 4
Real Output Growth



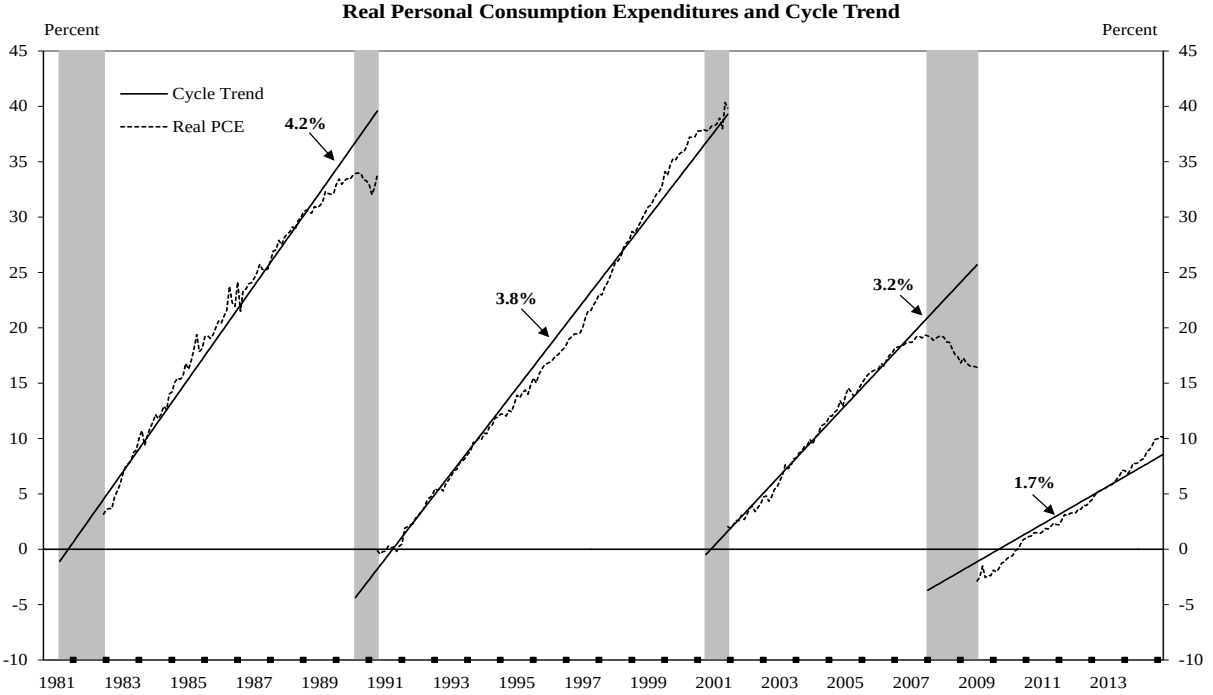
Notes: Real output growth is 4-quarter percentage changes in real GDP. Quarterly annualized real GDP is quarterly annualized growth rates. Shaded areas indicate NBER recessions. Heavy tick marks indicate fourth quarter. Source: Haver Analytics.

Figure 5
Real Personal Consumption Expenditures and Cycle Trend



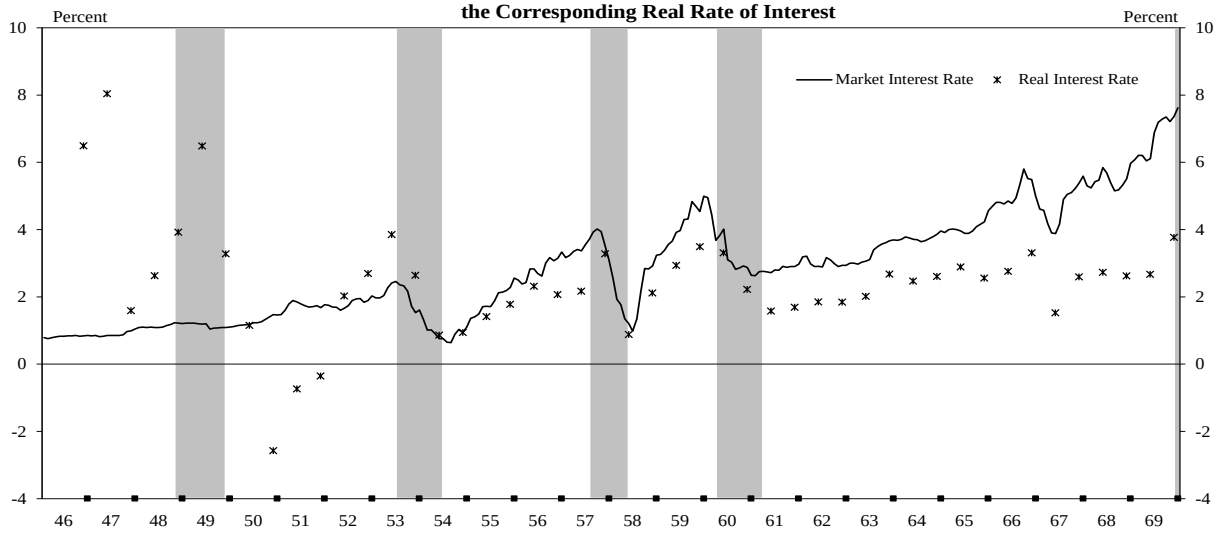
Notes: Observations are the natural logarithm of monthly observations of real personal consumption expenditures normalized using the value at the prior business cycle peak. Trend lines are fitted to these observations between peaks in the business cycle. The trend lines are extended through the subsequent recession. Shaded areas indicate NBER recessions. Heavy tick marks indicate December. Source Haver Analytics.

Figure 6
Real Personal Consumption Expenditures and Cycle Trend



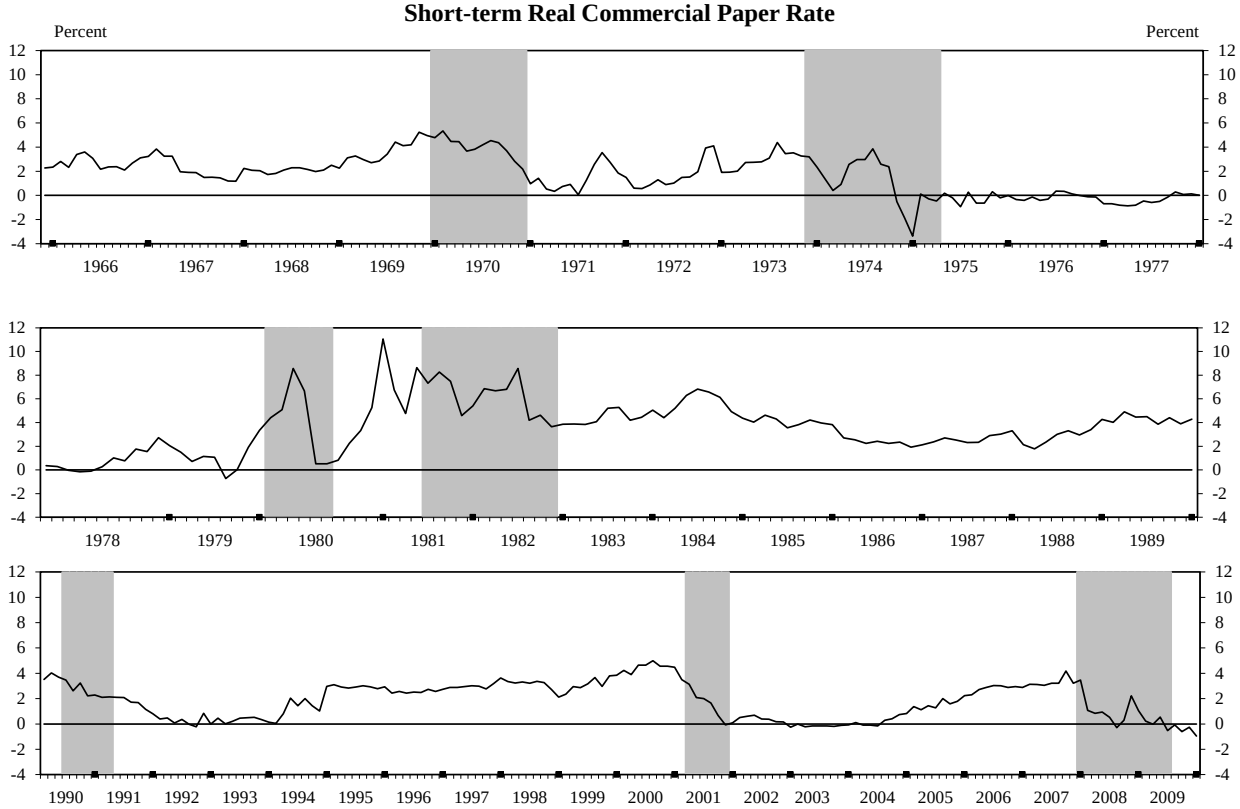
Notes: Observations are the natural logarithm of monthly observations of real personal consumption expenditures normalized using the value at the prior business cycle peak. Trend lines are fitted to these observations between peaks in the business cycle. The trend lines are extended through the subsequent recession. Shaded areas indicate NBER recessions. Heavy tick marks indicate December. Source: Haver Analytics.

Figure 7
The One-Year Market Interest Rate on Government Securities and the Corresponding Real Rate of Interest



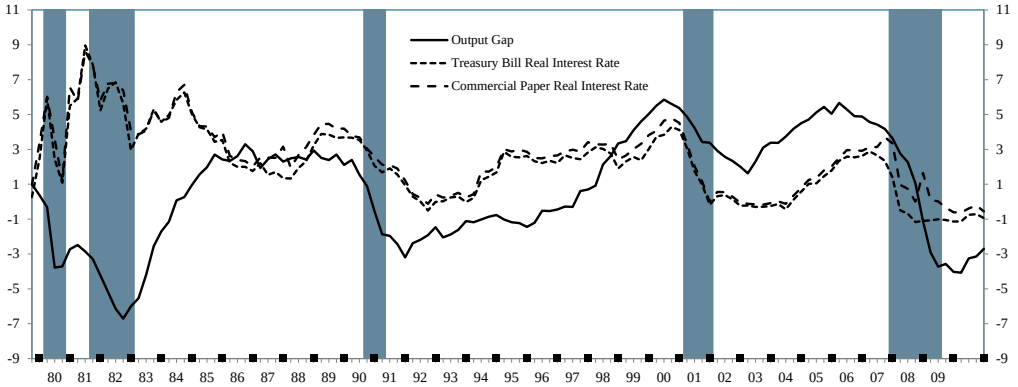
Notes: The market rate of interest is monthly observations of the yield on U.S. government securities from "Short-Term Open Market Rates in New York City" in Board of Governors (1976), *Banking and Monetary Statistics, 1941-1970*. Through July 1959 the series uses "9- to 12- month issues." Thereafter, it uses "one-year Treasury bills." The series for the real rate of interest is the market rate minus predicted CPI inflation from the Livingston Survey. See notes to Figure 4.4 (Hetzel 2008). Shaded areas demarcate recessions. Heavy tick marks indicate the November observation of the market interest rate.

Figure 8
Short-term Real Commercial Paper Rate



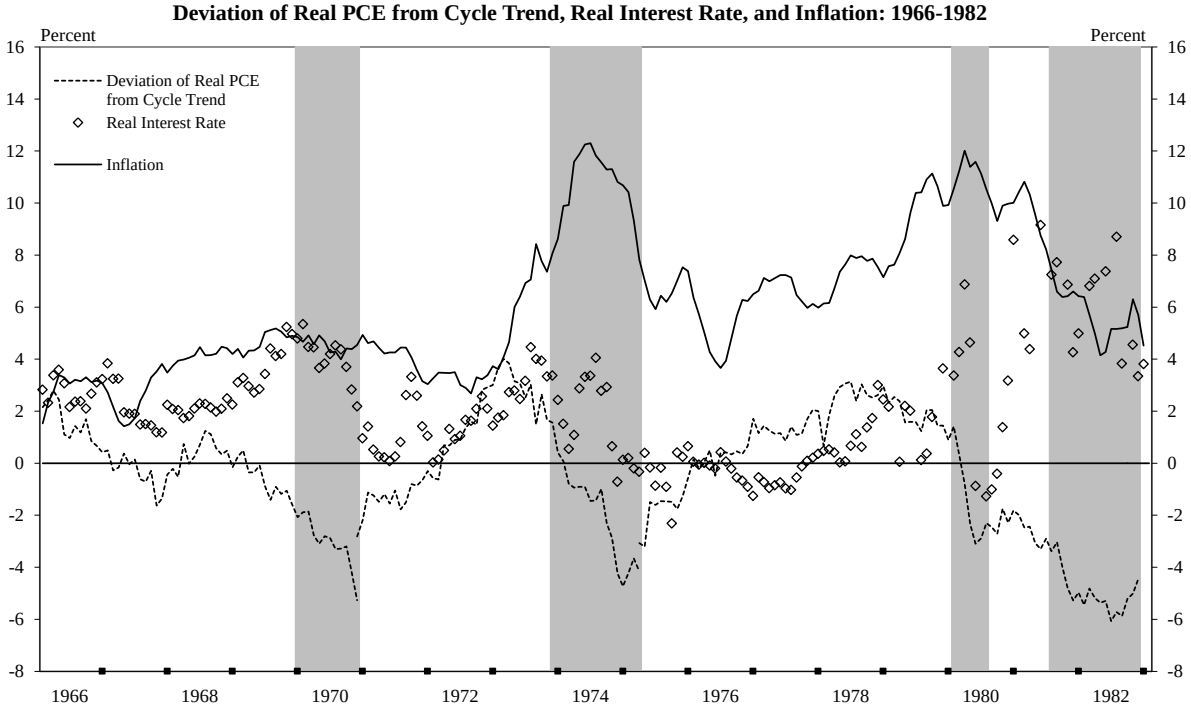
Notes: The real interest rate series is the commercial paper rate minus inflation forecasts made by the staff of the Board of Governors before FOMC meetings. Before January 1980, the inflation forecasts are for headline inflation. Thereafter, they are for core inflation. For a description of the series, see "Appendix: Real Rate of Interest." Shaded areas indicate NBER recessions. Heavy tick marks indicate December FOMC meeting.

Figure 9
Output Gap and Real Rates of Interest



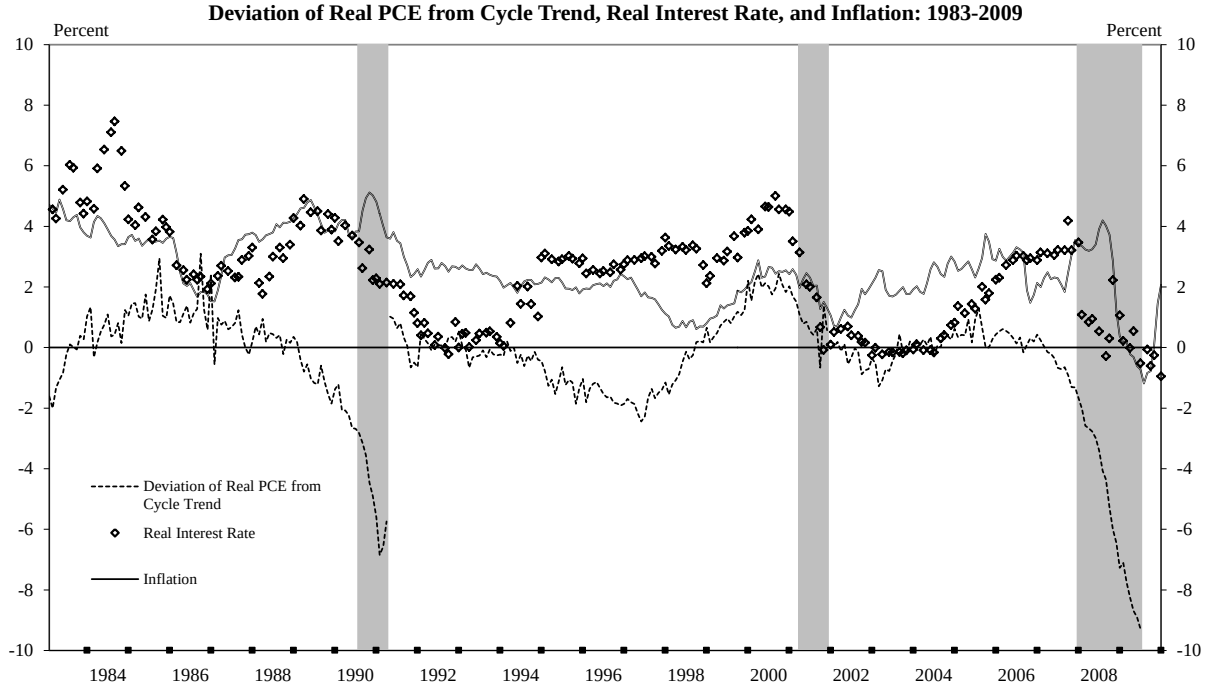
Notes:

Figure 10
Deviation of Real PCE from Cycle Trend, Real Interest Rate, and Inflation: 1966-1982



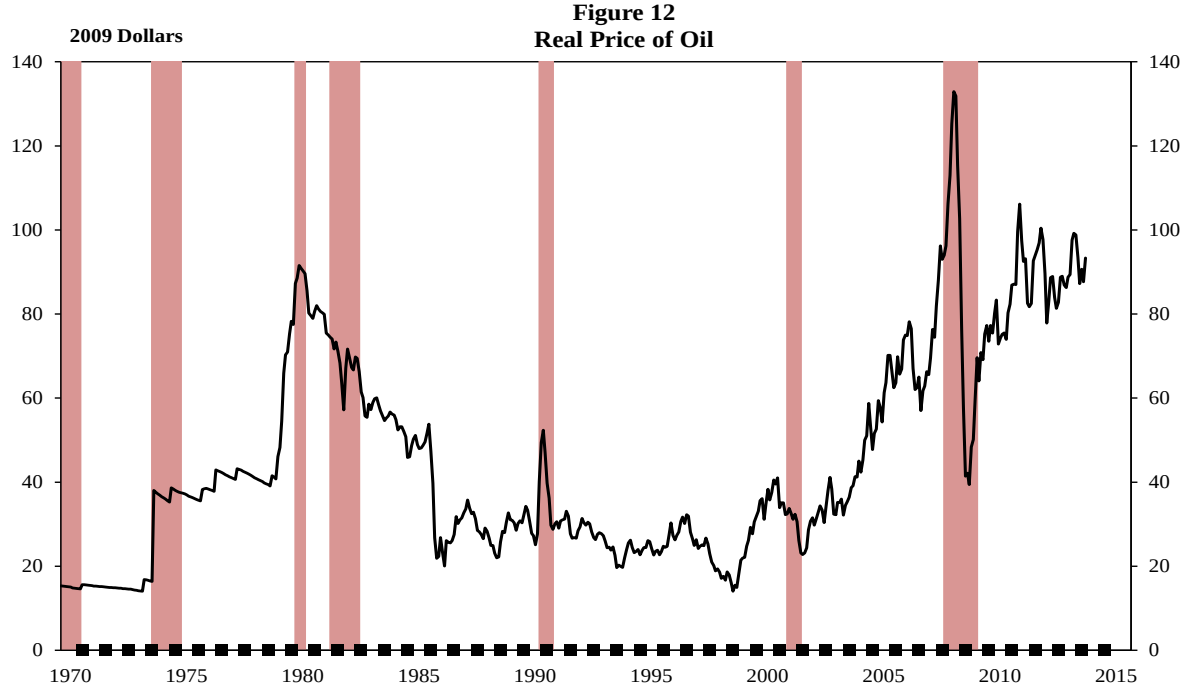
Notes: Deviation of Real PCE from Cycle Trend is the difference between the actual values and trend lines shown in Figure 5. Inflation is twelve-month percentage changes in the personal consumption expenditures deflator. The Real Interest Rate is the commercial paper rate minus inflation forecasts made by the staff of the Board of Governors shown in Figure 8. Shaded areas indicate NBER recessions. Heavy tick marks indicate December. Source: Inflation data from Haver Analytics.

Figure 11
Deviation of Real PCE from Cycle Trend, Real Interest Rate, and Inflation: 1983-2009



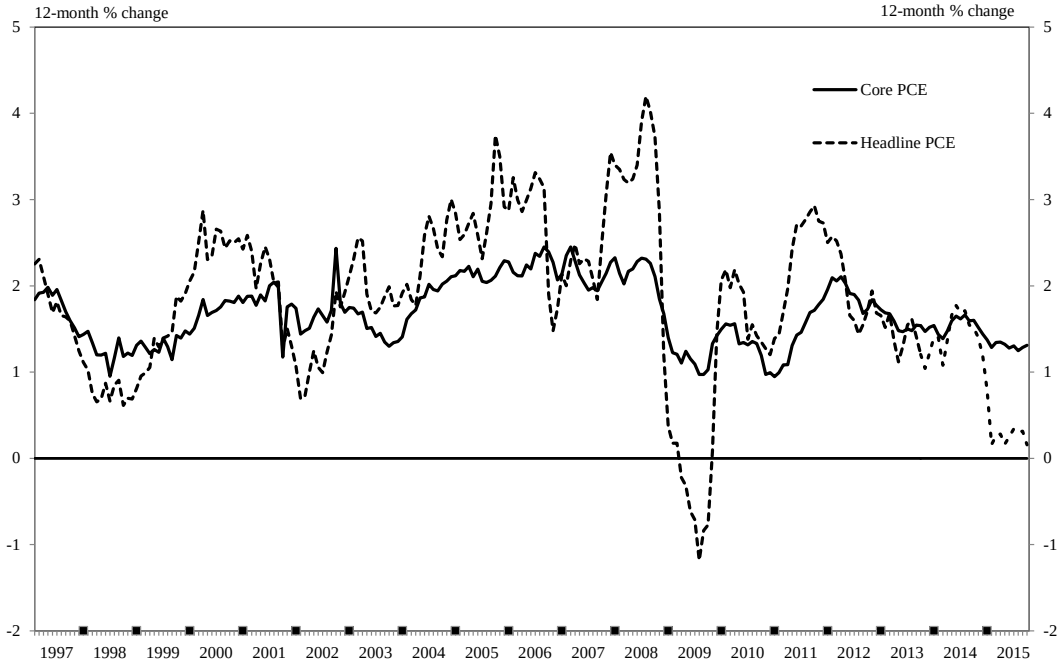
Notes: Deviation of Real PCE from Cycle Trend is the difference between the actual values and trend lines shown in Figure 6. Inflation is twelve-month percentage changes in the personal consumption expenditures deflator. The Real Interest Rate is the commercial paper rate minus the inflation forecasts made by the staff of the Board of Governors shown in Figure 8. Shaded areas indicate NBER recessions. Heavy tick marks indicate December. Source: Inflation data from Haver Analytics.

Figure 12
Real Price of Oil



Notes: Monthly observations of the West Texas intermediate crude oil spot price per barrel deflated by the PCE price index. Shaded areas are NBER recessions. Tick marks indicate December. Source: Haver Analytics.

Figure 13
Headline and Core PCE

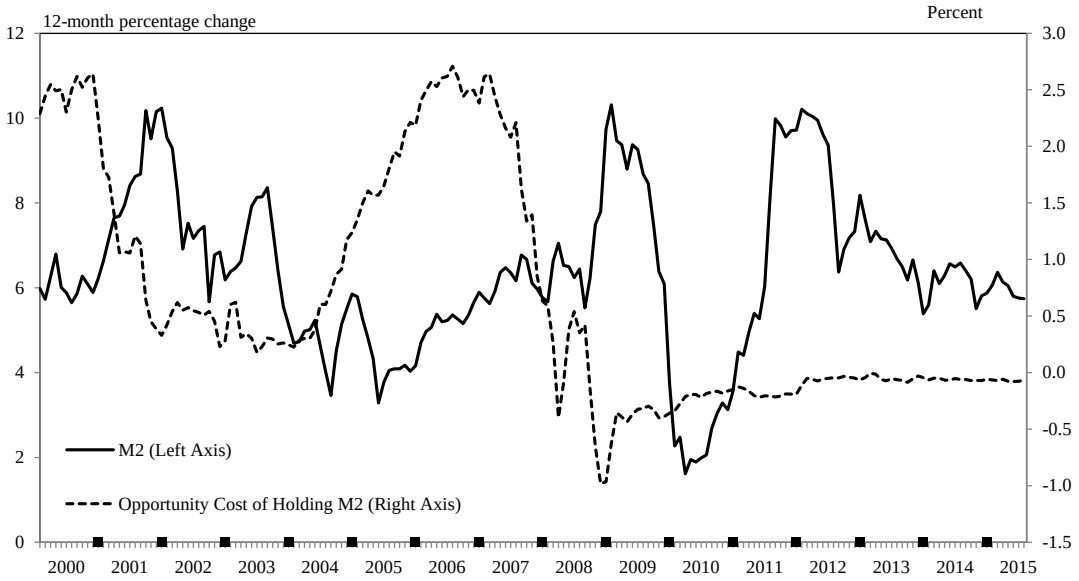


Notes: Monthly observations of 12-month percentage changes in the personal consumption expenditures deflator. Heavy tick marks indicate December. Source: Haver Analytics.

Figure 14
Growth of Real Personal Consumption Expenditures and Real Personal Disposable Income

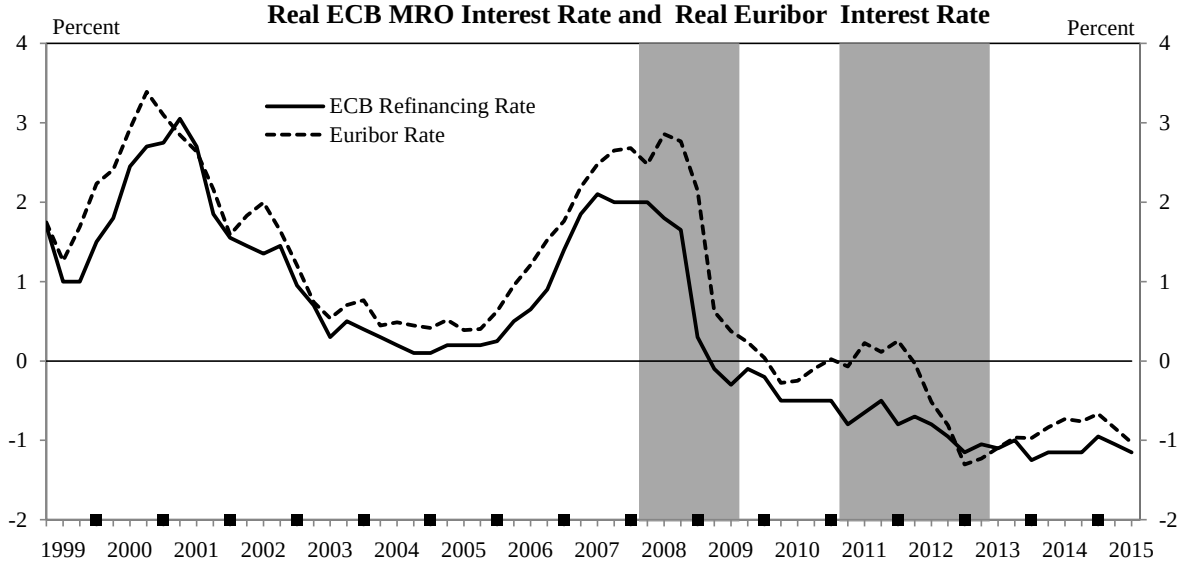
Notes: Real personal consumption expenditures (RPCE) and real personal disposable income (RPDI) are 12-month percentage changes. Upward and downward spikes in December 2004 and December 2005 reflect microsoft dividend in December 2004. Upward spike in May 2008 reflects Bush tax cut. Upward and downward spikes in December 2012 and December 2013 reflect shifting of capital gains income into 2012. Heavy tick marks indicate December. Source: Haver Analytics.

Figure 15
M2 Growth and the Opportunity Cost of Holding M2



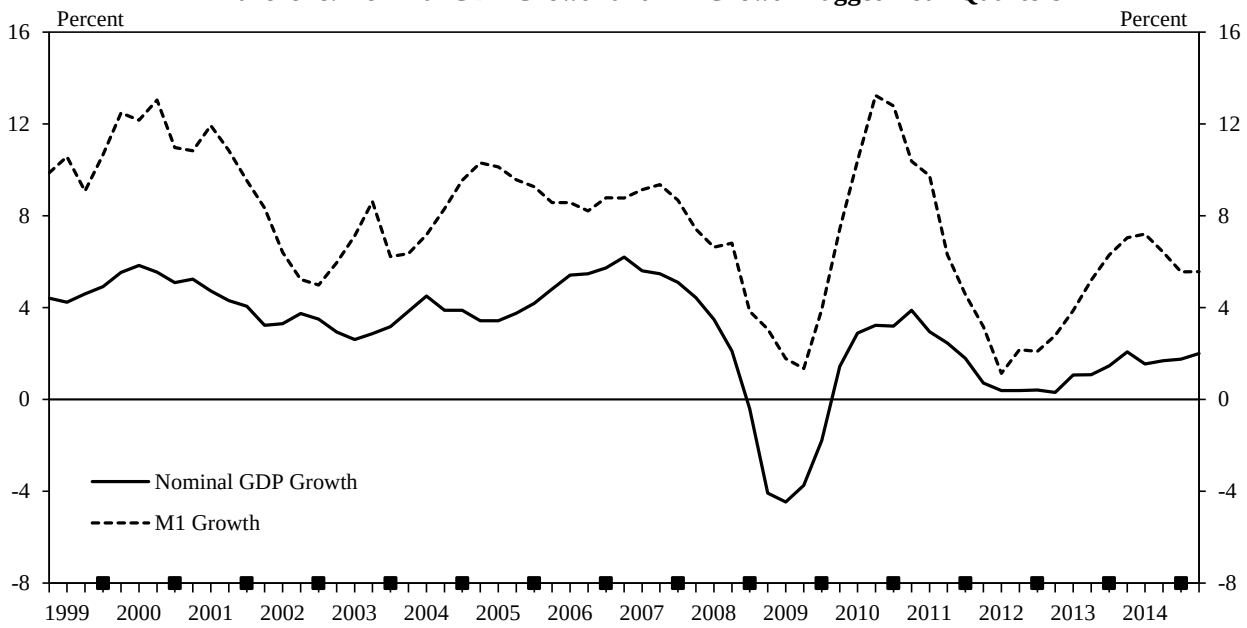
Notes: Monthly observations of 12-month percentage changes in M2.The opportunity cost of holding M2 is the 3-month Treasury bill rate minus the own rate of interest on M2. Heavy tick marks indicate December. Source: FRED and Haver Analytics.

Figure 16
Real ECB MRO Interest Rate and Real Euribor Interest Rate



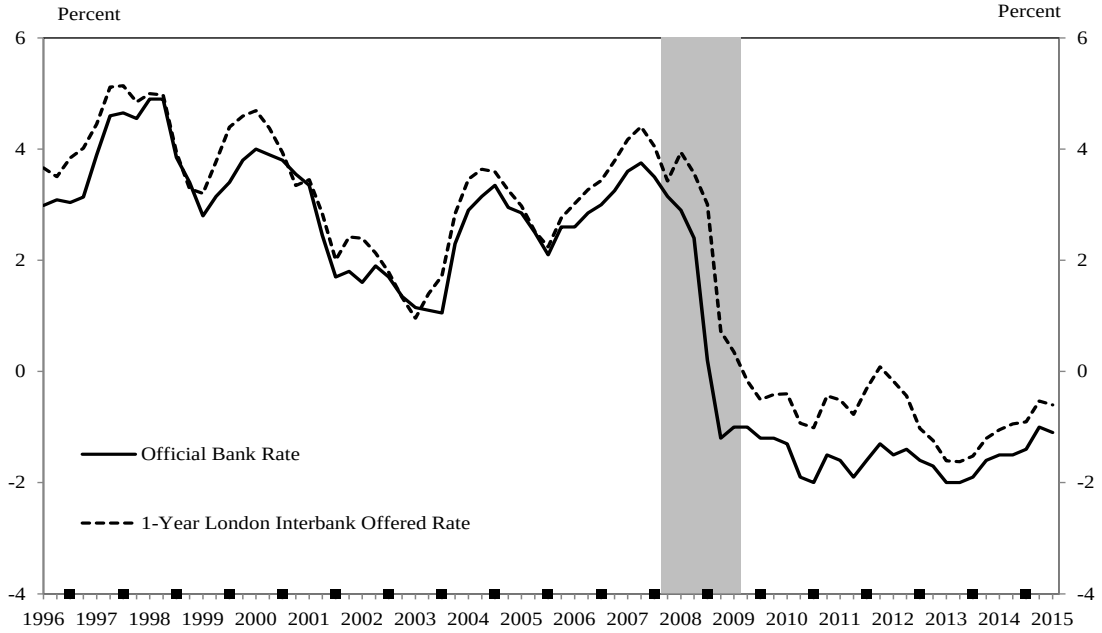
Notes: Quarterly observations of real ECB MRO (main refinancing operations) and real one-year Euribor interest rates are constructed by subtracting one-year ahead inflation forecasts from ECB Survey of Professional Forecasters mean point estimates. Shaded areas mark recessions with cycle peaks 2008Q1 and 2011Q1. Heavy tick marks indicate fourth quarter. Source: ECB and Haver Analytics.

Figure 17
Eurozone: Nominal GDP Growth and M1 Growth Lagged Four Quarters



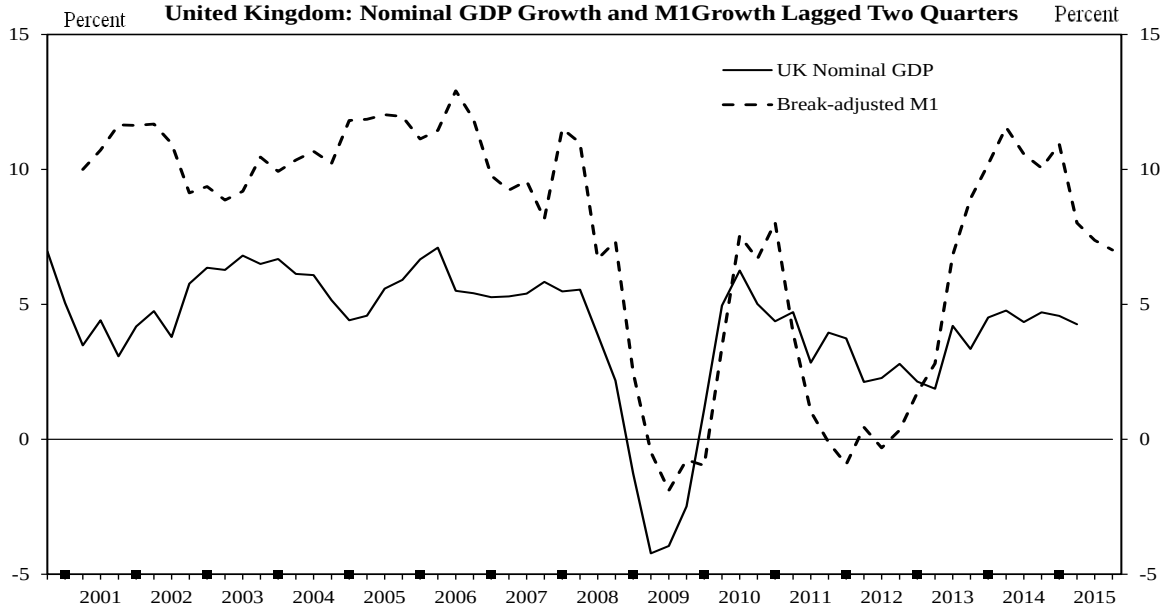
Notes: Quarterly observations of four-quarter percentage changes. M1 is lagged 4 quarters. M1 adjusted tor a reclassification in June 2005 that produced a one-time discontinuity. Heavy tick marks indicate fourth quarter Source: Eurostat and Haver Analytics.

Figure 18
United Kingdom: Real Rate of Interest



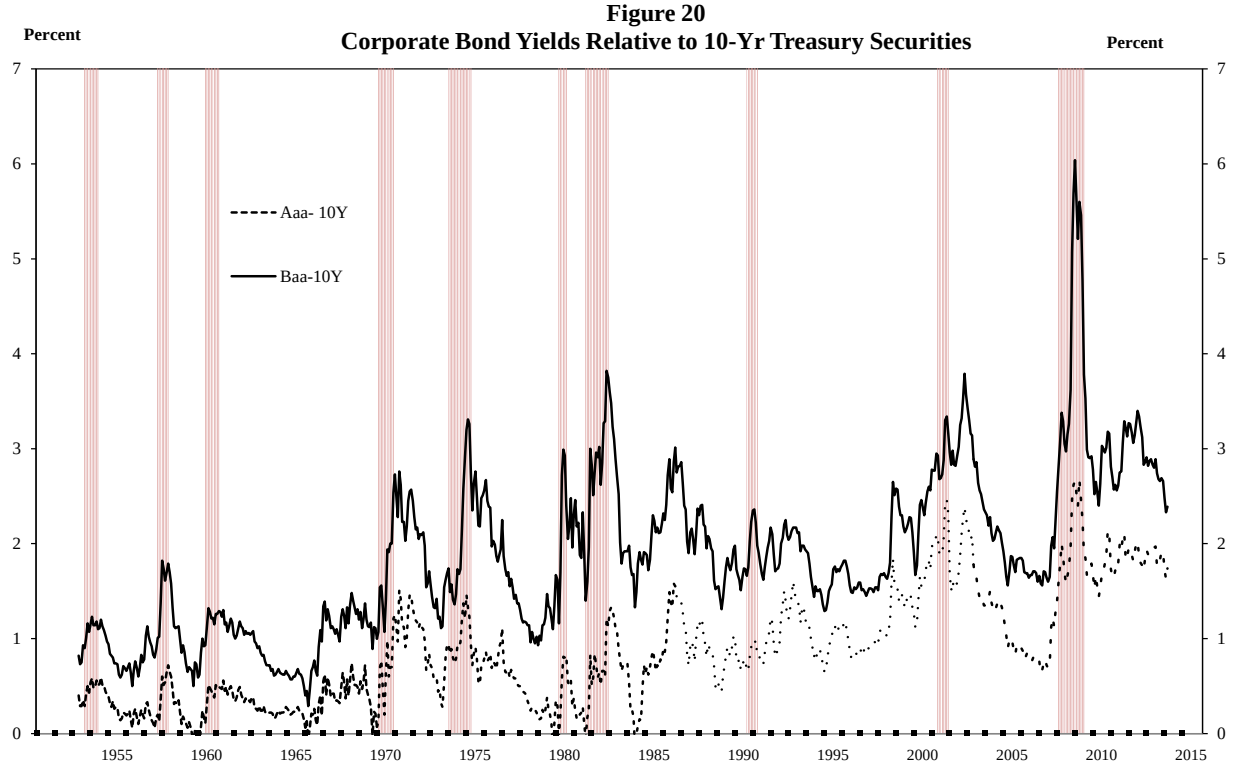
Notes: Quarterly observations of the real rate of interest using as the nominal interest rate the official bank rate set by the Bank of England and the 1-year London Interbank Offered Rate. The real rate is the nominal rate minus forecasted inflation. The latter is from the Bank of England Survey of Professional Forecasters. It is corrected for a discontinuity in 2004 due to the change from the RPIX to the CPI. Source: Bank of England and Haver Analytics.

Figure 19
United Kingdom: Nominal GDP Growth and M1Growth Lagged Two Quarters



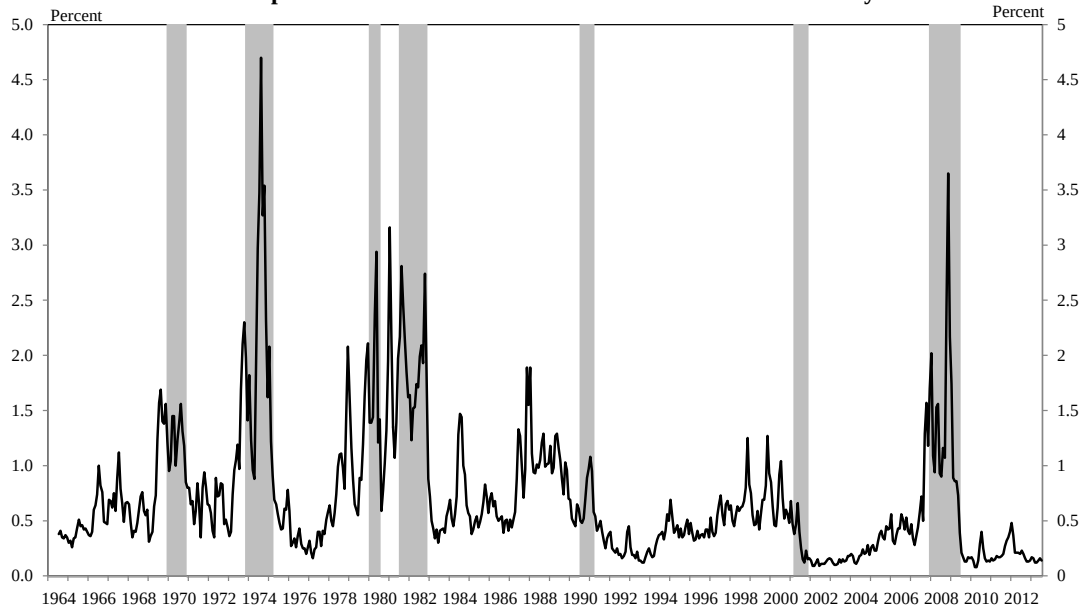
Notes: Quarterly observation of four quarter percentage changes in UK Nominal GDP and Break-adjusted M1 lagged two quarters. Heavy tick marks represent fourth quarters. Source: Bank of England and Haver Analytics.

Figure 20
Corporate Bond Yields Relative to 10-Yr Treasury Securities



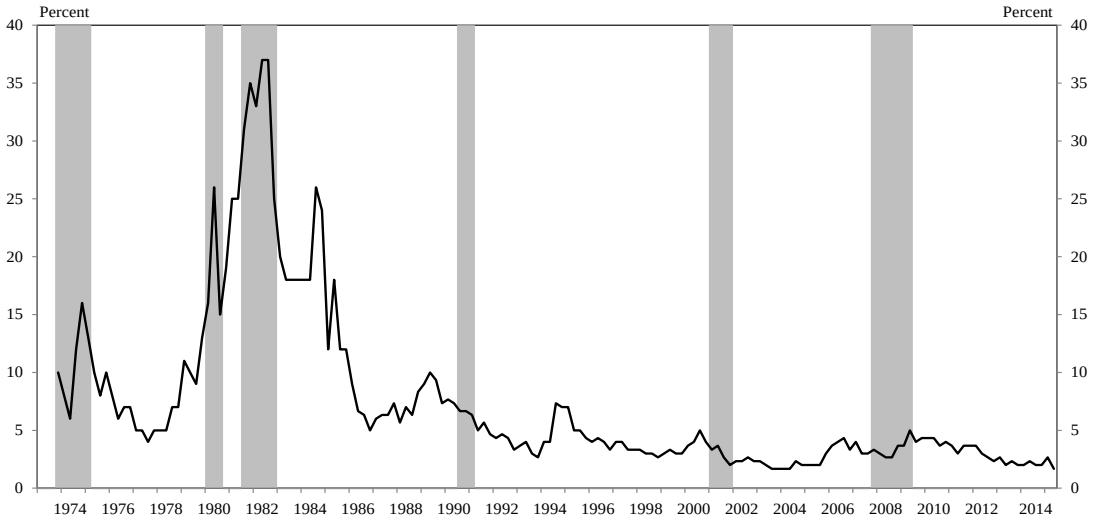
Notes: Monthly observations of the difference in the Aaa corporate bond yield and the Baa corporate bond yield relative to the 10-year Treasury yield.. Shaded areas indicate NBER recessions. Tick marks indicate December. Source: Haver Analytics.

Figure 21
Yield Spread: The 3-month CD Rate Minus the 3-month Treasury Bill Rate



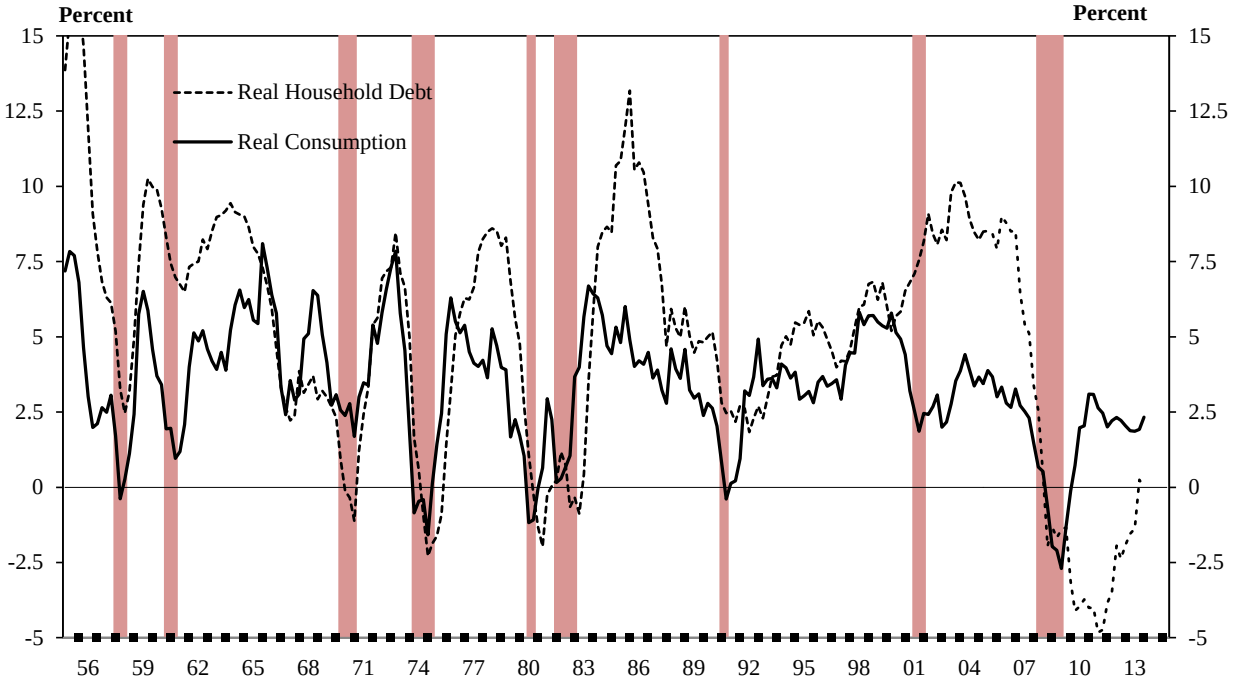
Notes: Average rate on 3-month negotiable certificates of deposit (secondary market). Discontinued after June 2013. Shaded areas indicate NBER recessions. Source: Federal Reserve Board, Selected Interest Rates H.15.

Figure 22
Single Most Important Problem: Percent Reporting Financial and Interest Rates



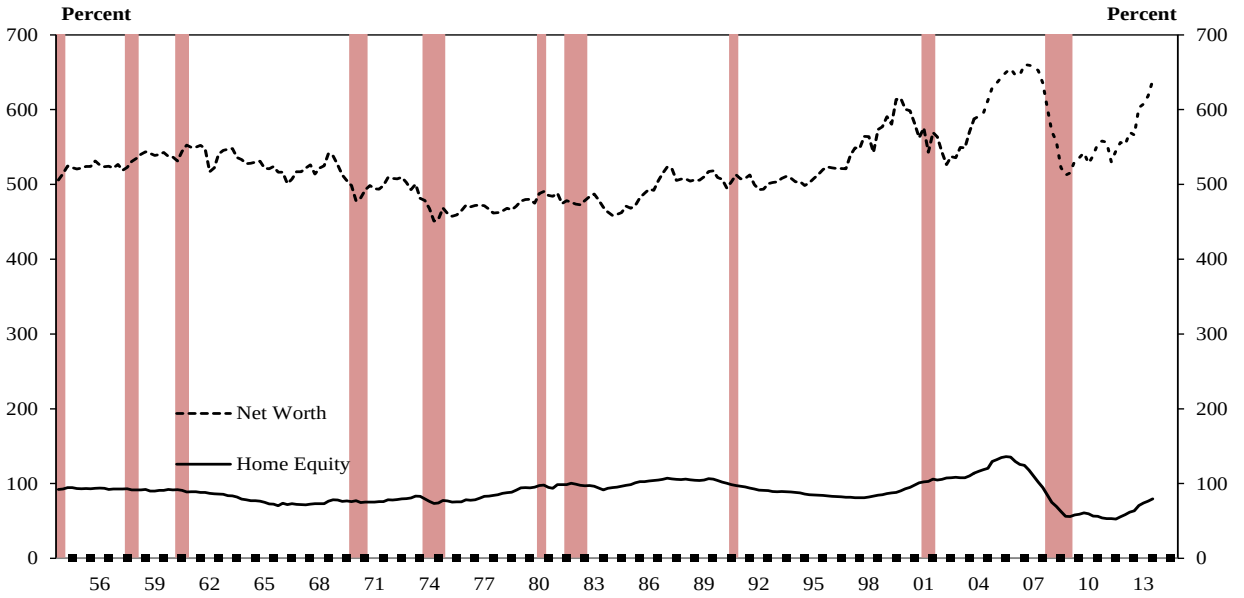
Notes: Percent of small businesses reporting "financial and interest rates" in response to the question, "What is the single most important problem facing your business today?" Survey conducted by the National Federation of Independent Businesses, Small Business Economic Trends. Shaded areas indicate NBER recessions. Heavy tick marks indicate December. Source: Haver Analytics.

Figure 23
Growth in Real Consumption and in Real Houshold Debt



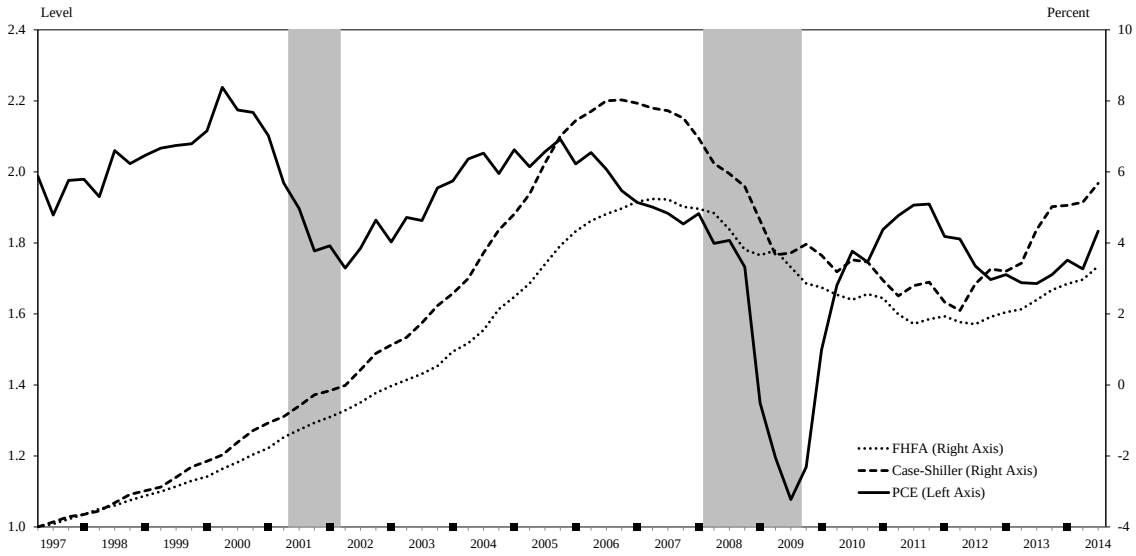
Notes: Quarterly observations of four-quarter percentage changes. Real Consumption is real personal consumption expenditures. Real Household Debt is household credit market liabilities deflated by the personal consumption expenditures deflator. Shaded areas are NBER recessions. Heavy tick marks indicate fourth quarter. Source: Board of Governors Financial Accounts of the United States and Haver Analytics.

Figure 24
Household Net Wealth and Home Equity Wealth as Percent of Income



Notes: Series are represented as a fraction of disposable personal income. Shaded areas are NBER recessions. Heavy tick marks indicate fourth quarter. Source: Board of Governors Financial Accounts of the United States and Haver Analytics.

Figure 25
House Price Indices and the Growth Rate of Personal Consumption Expenditures



Notes: Quarterly observations of FHFA (Federal Housing Finance Agency) House Price Index and S&P/Case-Shiller Home Price Index normalized using 1997 as the base year. Personal consumption expenditures (PCE) are 4-quarter percentage changes. Shaded areas indicate NBER recessions. Heavy tick marks indicate fourth quarter of year. Source: Haver Analytics.

Appendix: Real Rate of Interest

The short-term real interest rate is the difference between the commercial paper rate and Greenbook inflation forecasts made by the staff of the Board of Governors before FOMC meetings. The commercial paper rate is for prime nonfinancial paper placed through dealers (A1/P1). The dates for the interest rates match the publication dates of the Greenbooks. Because observations correspond to FOMC meetings, they occur irregularly within the year and starting in 1979 the frequency is less than twelve times per year. The Board staff forecasts for "core" inflation become available only in January 1980. From 1966 through 1970, the inflation forecasts are for the implicit GNP deflator. From 1971 through March 1976, they are for the GNP fixed-weight index. Thereafter, until January 1980, the forecast series used is the gross business product fixed-weight index. From January 1980 until February 1986, the gross domestic business product fixed-weight index excluding food and energy is used. Thereafter, until January 2000, the CPI excluding food and energy is used. From January 2000 onward, the personal consumption expenditures chain-weighted index excluding food and energy is used. For additional details, see Hetzel (2008b, Ch. 4, Appendix: Series on the Real Interest Rate, Real Rate of Interest, Greenbook Forecasts).