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MONETARY POLICY AND ASSET PRICES:
A LOOK BACK AT PAST U.S. STOCK MARKET BOOMS

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ABSTRACT

This paper examines the economic environments in which past U.S. stock market booms occurred as a first step toward understanding how asset price booms come about and whether monetary policy should be used to defuse booms. We identify several episodes of sustained rapid rise in equity prices in the 19th and 20th Centuries, and then assess the growth of real output, productivity, the price level, money and credit stocks during each episode. Two booms stand out in terms of their length and rate of increase in market prices — the booms of 1923-29 and 1994-2000. In general, we find that booms occurred in periods of rapid real growth and productivity advance, suggesting that booms are driven at least partly by fundamentals. We find no consistent relationship between inflation and stock market booms, though booms have typically occurred when money and credit growth were above average.

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Monetary Policy and Asset Prices: A Look Back at Past U.S. Stock Market Booms

Large swings in asset prices and economic activity in the United States, Japan, and other countries over the past several years have brought renewed focus on the linkages between monetary policy and asset markets. Monetary policy has been cited as both a possible cause of asset price booms and a tool for defusing booms before they can cause macroeconomic instability. Economists and policymakers have focused on how monetary policy might cause an asset price boom, or turn a boom caused by real phenomena, such as an increase in aggregate productivity growth, into a bubble. They have also addressed how monetary policy authorities should respond to asset price booms.

This paper examines the economic environments in which past U.S. stock market booms occurred as a first step toward understanding how asset price booms come about. Have past booms reflected real economic growth and productivity advance, expansionary monetary policy, inflation, or simply “irrational exuberance” that defies explanation? We use a simple metric to identify several episodes of sustained rapid rises in equity prices in the 19th and 20th Centuries, and then assess both narrative and quantitative information about the growth of real output, productivity, the price level, money supply and credit during each episode. Across some two hundred years, we find that two U.S. stock market booms stand out in terms of their length and rate of increase in market prices – the booms of 1923-29 and 1994-2000. In general, we find that booms occurred in periods of rapid real growth and productivity advance. We find, however, no consistent relationship between inflation and stock market booms, though booms have typically occurred when money and credit growth were above average. Finally, contrary to conventional wisdom, we find that wars have not always been good for the market.

This paper begins by reviewing relevant issues concerning the links between monetary policy and asset prices. The following section presents a monthly time series index of U.S. equity prices spanning two hundred years, and identifies boom episodes. Subsequent sections present a

descriptive history of U.S. stock market booms since 1834, summarize our findings, and offer conclusions.

MONETARY POLICY ISSUES

The literature on the linkages between monetary policy and asset markets is vast. Here, we focus on two issues – the role of asset prices in the transmission of monetary policy to the economy as a whole, and the appropriate response of monetary policy to asset price booms. The first concerns the extent to which monetary policy might cause an asset price boom. The second concerns the circumstances in which monetary policymakers should attempt to defuse asset price booms.

Asset Prices and the Transmission Mechanism

There are many views about how monetary policy might cause an asset price boom. For example, a traditional view focuses on the response of asset prices to a change in money supply, arguing that added liquidity causes asset prices to rise as a link in the transmission of monetary policy actions to the economy as a whole. A second view, voiced by Austrian economists in the 1920s and more recently by economists of the Bank for International Settlements (BIS), argues that asset price booms are more likely to arise in an environment of low, stable inflation. In this view, monetary policy can encourage asset price booms simply by credibly stabilizing the price level. Still another view, coming from the dynamic general equilibrium macroeconomics literature, argues that asset price bubbles can result from *failure* of monetary policy to credibly stabilize the price level.

The liquidity view has a long history. Some early Keynesian IS-LM models, such as that of Metzler (1951), had central bank operations affecting stock prices directly. A next generation of models, variants of which are presented in Friedman and Schwartz (1963b), Tobin (1969), and Brunner and Meltzer (1973), introduce a broader range of assets into the traditional Keynesian liquidity mechanism. In these models, central bank operations that increase liquidity will cause the prices of assets that comprise the private sector's portfolio, including equities and real estate,

to rise and thereby lower their returns. Substitution from more to less liquid assets occurs as the returns on the former decline relative to the latter. The impact of expansionary monetary policy will be apparent first in the price of short-term government securities, then longer-term securities, then other assets such as stocks, real estate, old masters and commodities such as gold, and finally in the overall price level. Thus, this view sees rising asset prices as a possible harbinger of future inflation.

The Austrian – BIS view argues that an asset price boom, whatever its fundamental cause, can degenerate into a bubble if monetary policy passively allows bank credit to expand to fuel the boom. This view holds that unless policymakers act to defuse a boom, a crash will inevitably follow that in turn may cause a downturn in economic activity. The Austrians tended to equate rising asset prices with general price inflation. For example, although the level of U.S. consumer prices was virtually unchanged between 1923 and 1929, the Austrians viewed the period as one of rapid inflation fueled by loose Federal Reserve policy and excessive growth of bank credit (e.g., Rothbard, 1983).¹

This view has carried forward into the modern discussion of asset price booms. Two issues are relevant. The first is whether the price index targeted by the central bank should include asset prices. Alchian and Klein (1973) contend that a theoretically correct measure of inflation is the change in the price of a given level of utility, which includes the present value of future consumption. An accurate estimate of inflation, they argue, requires a broader price index than one consisting only of the prices of current consumption goods and services. To capture the price of future consumption, Alchian and Klein (1973) contend that monetary authorities should target a price index that includes asset prices. Bryan, et al. (2002) concur, arguing that because it

¹ See Laidler (2003) and the references therein for more on the Austrian view.

omits asset prices (especially housing prices), the Consumer Price Index (CPI) seriously understated inflation during the 1990s.²

A second connection of the Austrian view to the recent experience concerns the issue of “financial imbalances,” which Borio and Lowe (2002) define as rapid growth of credit in conjunction with rapid increases in asset prices and, possibly, investment.³ Borio and Lowe (2002) argue that a build up of such imbalances can increase the risk of a financial crisis and macroeconomic instability. They construct an index of imbalances based on a credit gap (deviations of credit growth from trend), an equity price gap, and an output gap, to identify incipient asset price declines that lead to significant real output losses, and advocate its use as a guide for proactive action. Eichengreen and Mitchener (2003) find that a similar index for the 1920s helps explain the severity of the Great Depression.

Borio and Lowe (2002) argue that low inflation can promote financial imbalances, regardless of the underlying cause of an asset price boom. For example, by generating optimism about the macroeconomic environment, low inflation might cause asset prices to rise more in response to an increase in productivity growth than they otherwise would. Similarly, an increase in demand is more likely to cause asset prices to rise if the central bank is viewed as credibly committed to price stability. A commitment to price stability that is viewed as credible, Borio and Lowe (2002) argue, will make product prices less sensitive and output and profits more sensitive in the short run to an increase in demand. At the same time, the absence of inflation may cause monetary policymakers to delay tightening policy as demand pressures build. Thus, Borio and Lowe (2002, pp. 30-31) contend, “these endogenous responses to credible monetary policy [can] increase the probability that the latent inflation pressures manifest themselves in the

² See also Goodhart and Hofmann (2000). Filardo (2000), by contrast, concludes that including housing prices in an index of inflation would not substantially improve U.S. economic performance.

³ See also Borio, et al. (2002) and Borio and White (2003). See Laidler (2003) and Eichengreen and Michener (2003) for discussion of the similarities and differences between the modern “imbalance” view and the Austrian emphasis on bank credit induced “forced saving” as the cause of “overinvestment” in the 1920s that led to the stock market crash and the Great Depression.

development of imbalances in the financial system, rather than immediate upward pressure in higher goods and services price inflation.”

The possibility that monetary policy can produce asset price bubbles has also been studied extensively in equilibrium rational expectations models. In such models, poorly designed monetary policies, such as the use of interest rate rules without commitment to a steady long run inflation rate, can lead to self-fulfilling prophecies and asset price bubbles. Such outcomes are less likely, Woodford (2003) argues, if monetary policymakers follow a clear rule in which the interest rate target is adjusted sufficiently to stabilize inflation. The theoretical literature thus suggests that consideration of the monetary policy environment may be crucial to understanding why asset booms come about.

Proactive Policy in Response to Asset Price Booms?

The appropriate response, if any, of monetary policy to an asset price boom was the subject of extensive debate during the U.S. stock market boom of 1994-2000 and the recession that followed. Since periods of explosive growth in asset prices have often preceded financial crises and contractions in economic activity, some economists argue that by defusing asset price booms, monetary policy can limit the adverse impact of financial instability on economic activity. The likelihood of a price collapse and subsequent macroeconomic decline might, however, depend on why asset prices are rising in the first place. Many analysts believe that asset booms do not pose a threat to economic activity or the outlook for inflation so long as they can be justified by realistic prospects of future earnings growth. On the other hand, if rising stock prices reflect “irrational exuberance,” they may pose a threat to economic stability and, in the minds of many, justify a monetary policy response to encourage market participants to revalue equities more realistically.

The traditional view holds that monetary policy should react to asset price movements only to the extent that they provide information about future inflation. This view holds that monetary policy will contribute to financial stability by maintaining stability of the price level

(Bordo et al., 2002, 2003; Schwartz, 1995), and that financial imbalances or crises should be dealt with separately by regulatory or lender of last resort policies (Schwartz, 2002).⁴

Many economists do not accept the traditional view, at least not entirely. Smets (1997), for example, argues that monetary policy tightening is optimal in response to “irrational exuberance” in financial markets (see also Detken and Smets, 2003). Similarly, Cecchetti, et al. (2000), contend that monetary policy should react when asset prices become misaligned with fundamentals. Bernanke and Gertler (2001) express doubt that policymakers can judge reliably whether asset prices are being driven by “irrational exuberance,” or that an asset price collapse is imminent. Cecchetti (2003) replies, however, that asset price misalignments are no more difficult to identify than other components of the Taylor rule, such as potential output.

Bordo and Jeanne (2002a, 2002b) offer a novel argument in support of a monetary policy response to asset price booms. They argue that preemptive actions to defuse an asset price boom can be regarded as insurance against the high cost of lost output should a bust occur. Bordo and Jeanne contend that policymakers should attempt to contain asset price misalignments when the risk of a bust (or the consequences of a bust) is large, or when the cost of defusing a boom is low in terms of foregone output. Bordo and Jeanne show that a tension exists between these two conditions. As investors become more exuberant, the risks associated with a reversal in market sentiment increases, but leaning against the wind of investor optimism requires more costly monetary actions. Thus, the monetary authorities must evaluate both the probability of a costly crisis and the extent to which they can reduce this probability.

FOMC Deliberations about the Stock Market

The debate about the appropriate response of monetary policy to asset price booms has not taken place solely in professional journals and working papers. The implications of rising asset prices became an increasingly important component of Federal Reserve policy discussions

⁴ Bernanke and Gertler (1999, 2001) present the traditional view in the context of a Taylor Rule. Bernanke (2002), Bullard and Schaling (2002), Schinasi and Hargraves (1993), and White (2004) are among other

during the U.S. stock market boom of 1994-2000. Cecchetti (2003) presents evidence suggesting that movements in equity prices help explain adjustments in the Federal Open Market Committee's (FOMC's) federal funds rate target during this period.⁵

Transcripts of FOMC meetings in 1996 and 1997 reveal that Fed officials focused on a potential "wealth effect" of rising stock prices on consumer confidence and spending, and worried that a sudden reversal of equity prices could cause real economic activity to decline sharply. For example, at a meeting on March 26, 1996, Chairman Greenspan stated that "It's hard to believe that if any series of adverse developments were to occur, the market would not come down rather substantially and reverse the wealth effect. That probably would dampen economic activity quite substantially." (FOMC transcript, March 26, 1996, p. 29)

Policymakers grew increasingly concerned as equity prices continued to rise, and the FOMC discussed how to respond. At a Committee meeting on February 4-5, 1997, Chairman Greenspan stated that the prevailing level of equity prices, along with unusually narrow interest rate credit spreads, "suggest that product prices alone should not be the sole criterion [for conducting monetary policy] if we are going to maintain a stable, viable financial system whose fundamental goal ... is the attainment of maximum sustainable economic growth." (FOMC transcript, February 4-5, 1997, p. 103)

Greenspan saw a conundrum in the use of monetary policy to defuse an asset price boom, however, and expressed the view that stock market booms are more likely to occur when inflation is low: "We have very great difficulty in monetary policy when we confront stock market bubbles. That is because, to the extent that we are successful in keeping product price inflation down, history tells us that price-earnings ratios under those conditions go through the roof. What is really needed to keep stock market bubbles from occurring is a lot of product price inflation, which historically has tended to undercut stock markets almost everywhere. There is a clear

studies supporting the traditional view.

tradeoff. If monetary policy succeeds in one, it fails in the other. Now, unless we have the capability of playing in between and managing to know exactly when to push a little here and to pull a little there, it is not obvious to me that there is a simple set of monetary policy solutions that deflate the bubble.” (FOMC transcript, September 24, 1996, pp. 30-31)

We next turn to the history of past U.S. stock market booms to try to identify the macroeconomic environments in which booms have occurred as a first step toward identifying lessons for the conduct of monetary policy in response to asset price booms.

HISTORICAL DATA ON THE U.S. STOCK MARKET

We focus on the stock market because long-term data on the prices of other assets, e.g., real estate, are not available and, moreover, because stock prices are often the focus of policy concerns about the causes and effects of booms and busts (e.g., during the late 1990s and the 1920s).⁶ Our interest is with the performance of broad stock market averages, not in the performance of individual stocks or groups of stocks. Booms, of course, are typically centered in particular sectors – usually the “high-tech” sectors of the day – but the booms that capture the attention of macroeconomists and policymakers are broadly based. In the 1990s, computer, telecommunications, and internet stocks were at the epicenter of the stock market boom. The stock prices of a wide range of companies also rose sharply, however, and the broader market averages, such as the S&P 500 and the Wilshire 5000, all increased substantially, though not as much as the NASDAQ, which quintupled (see Figure 1 for comparison of the S&P500 and NASDAQ from 1990-2003).

Schwert (1990) constructed a continuous monthly stock market index for the United States from 1802-1870, linking indexes created by Smith and Cole (1935) for 1802-62 and Macaulay (1938) for 1863-70. Banks were the first large corporate enterprises in the United

⁵ Additional evidence of a monetary policy response to the stock market is presented by Rigobon and Sack (2003). Hayford and Malliaris (2004), by contrast, find that the Fed did not respond to the market.

⁶ Helbling and Terrones (2004) examine both housing and stock market booms for several countries since 1970.

States, and for 1802-34, the stock market index consists only of bank stocks. Railroads, the largest corporate sector throughout much of the 19th Century, got their start in the 1830s. For 1835-45, the stock market index is comprised of both bank and railroad stock prices, and for 1846-70 of just railroad stocks.

The U.S. industrial sector grew to include large publicly traded manufacturers of steel, petroleum products, chemicals, and other goods after the Civil War, and available indexes of stock prices reflect the increasing breadth of the market. We link Schwert's (1990) index for 1802-70 to the Cowles (1939) index of New York Stock Exchange prices covering 1871-1920, and then to the Standard and Poors (S&P) Composite index. A consistent S&P series is available from 1921 to the present modern form, the S&P 500 index.⁷ Figure 2 plots the entire index, from 1802 to 2002.⁸

Identifying Booms

Our objective is to describe the macroeconomic environments in which sustained, rapid rises in stock prices have occurred. Over our entire sample, two boom episodes stand out, both in terms of their length and rate of advance in the market index: the bull markets of 1923-29 and of 1994-2000. The rate of advance in the market has been faster at other times, but only for short periods. Similarly, there have been other long bull markets, but none with such a rapid average rate of increase in the index. Since the bull market of the 1920s stands out, we examine both the macroeconomic environment in which that boom occurred and the debate it generated among monetary policymakers. We also examine other episodes of rapid, sustained increases in the stock market index, however, in our attempt to identify environmental characteristics of stock market booms in general.

⁷ Data for 1871-1920 are from the NBER macrohistory database (series m11025a), and those for 1921-2002 are from Haver Analytics. Alternative indexes are available, e.g., the Dow Jones Industrial Average, which began in 1895, but the episodes of "boom" and "bust" that appear in one index are common to all of the alternative broad indexes.

⁸ The New York Stock Exchange was closed during August-November 1914 and, hence, there are no index values for those months.

There is, of course, no precise empirical definition of an asset price boom, and researchers have imposed a number of filters to identify specific episodes that they then define as booms. We begin by using the methodology of Pagan and Sossounov (2003) to identify sustained periods of rising stock prices. Beginning in 1834, we identify the months in which the market reached a peak and a trough within a rolling, 25-month window.⁹ We require that peaks and troughs alternate, and so we eliminate all but the highest (lowest) of peaks (troughs) that occur before a subsequent trough (peak). Finally, we identify booms as periods lasting at least three years from trough to peak. Table 1 lists all such booms in our data, plus a few shorter episodes of exceptional increase in the market index, such as February 1834 – May 1835. The table also lists a few periods that include two or more consecutive booms that were interrupted by short market declines, and that might be better thought of as a single episode. For each period, the table also lists the average, annualized increase in the index during the boom period, i.e., from the month following the trough to the peak month.

One might question whether stock market booms should be defined to include recoveries from prior stock market declines. Indeed, some of the booms listed in Table 1 include long periods in which the market average remained below a prior peak. Hence, for each boom, we also indicate the month in which the previous (local) peak was reached, as well as the month in which the previous all-time market (global) peak was reached.¹⁰ For each episode, we report the average, annualized increase in the index from the month following the attainment of both the prior local and global peaks to the new peak month. Clearly, a few sustained booms, such as that of July 1861 – March 1864, involved several months in which the market was merely recovering to a prior peak (or to the prior all-time high). Indeed, a few booms ended without reaching a prior global peak. In general, the average increase in the market index was larger during the recovery

⁹ We begin with 1834 because the stock market index before that year was comprised of only a small number of bank stocks and, as shown in Figure 2, there appear to have been no large movements in the index before then.

phase of booms than during the phase in which the market index exceeded its prior high.

Interestingly, two exceptions are the booms of the 1920s and of the late 1990s, suggesting again that these two booms were unique in character as well as magnitude.

Some studies define booms as sustained periods of increase in an asset price index above a trend growth rate (e.g., Bordo and Jeanne, 2002a; Detken and Smets, 2003). Figures 3 and 4 plot values of our stock price index alongside a nine-year trailing moving average of the index.¹¹ From these charts, episodes when the market average increased (or fell) rapidly relative to its recent trend are evident. Booms are evident in the mid-1830s, during the Civil War, from about 1879 to 1881, and, with interruptions, from about 1896 to 1906. The bull market of the 1920s is clearly evident, as is the rise from 1994 to 2000. In addition, the market advanced well above trend in the early 1950s and again from about 1984 to 1987.

Figure 5 plots the “real”, i.e., inflation-adjusted, stock market index and nine-year trailing moving average for 1924-2002. In theory, stock prices should not be affected by inflation that is anticipated.¹² Nevertheless, this plot illustrates more clearly that the bull markets of the 1920s and 1994-2000 stand out as exceptional periods of sustained, large increases in real as well as nominal stock prices. The real stock market index also rose substantially during the mid-1950s and between 1984 and 1987. Thus, regardless of how one looks at the data, the same boom episodes stand out.

¹⁰ Helbling and Terrones (2004) use a similar approach in their cross-country study of stock market and real estate booms since 1970.

¹¹ We do not plot data for 1914-21 because the New York Stock Exchange was closed during August-November 1914, thereby complicating the calculation of the nine-year moving average. As is evident from Figure 2, there was no boom during 1914-21.

¹² The traditional capital asset pricing model posits that the current market price of a stock will equal the present discounted value of the expected dividend stream to the stockholder. Expected inflation should not affect the current price of the stock because even though expected inflation may increase the nominal dividend stream, the relevant interest rate for discounting those earnings also will reflect the expected inflation. Unanticipated inflation can, of course, wreak havoc with an investor's ex post real return on asset holdings, as occurred during the 1970s.

THE ECONOMIC ENVIRONMENT OF BOOMS

Table 2 reports information about the growth rates of labor productivity, real GDP, industrial production, money, credit, and the price level during the boom episodes identified in Table 1. Here we define the start of a boom as the month following a market trough. For comparison, we also report growth rates of these variables over longer periods. Unfortunately, few macroeconomic data exist for early boom periods, and what data there are usually consist of annual observations. It appears, however, that market booms generally occurred during periods of relatively rapid growth of output and productivity. Pre-World War II booms also tended to occur during periods of above average growth in the money stock, bank credit, and, sometimes, the price level. The growth rates of money, credit, and the price level were not above average during the boom of 1923-29, however, nor during most post-World War II booms.

We proceed next to examine specific historical episodes in more detail. Obviously, not every episode identified in Table 1 deserves attention. From looking closely at a few episodes, however, we identify certain characteristics about the environments in which booms have occurred.

Antebellum Stock Market Booms

The stock market booms of the 19th Century were closely associated with the development of the nation's infrastructure, first canals and steamships, then railroads.

1834-35. Schwert's (1990) stock market index for this period combines indexes of bank and railroad stocks from Smith and Cole (1935), with more weight put on the railroad stock index. Smith and Cole (1935) document a close relationship between public land sales and railroad stock prices in 1834-35, though stock prices peaked and began to fall before land sales started to decline in 1836 (p. 82). The close correlation between land sales and railroad stock prices throughout the antebellum period led Smith and Cole to conclude that "both series ... may be regarded as reflecting a common element – that of the well-known speculative spirit of the country" (p. 82).

Federal Government land sales rose from under \$2 million a year in the 1820s to \$5 million in 1834, \$15 million in 1835, and \$25 million in 1836. The land-sales and stock market booms occurred during a period of commodity price inflation. Temin (1967, p. 92) argues that the land boom was sparked by a sharp increase in the price of cotton, which rose some 50 percent during 1834 alone. The money stock increased sharply in 1835-36, spurred by large inflows of Mexican silver which increased the growth rate of the monetary base (Temin, 1967, pp. 68-69).¹³ It appears from limited data that the boom also occurred during a period of fairly strong growth of real economic activity. Smith and Cole's (1935, p. 73) index of the volume of trade shows a 14 percent rise in domestic trade from 1834 to 1835, and even larger percentage gains in exports in 1835-36. Davis' (2002) index of industrial production shows an increase of about 12 percent between 1834 and 1835 (Table 2). Hence, the boom episode coincided with both a general price inflation and rapid real economic growth.

The boom was short-lived. Stock prices peaked in May 1835, and land sales peaked in the first six months of 1836. Monetary policy actions appear to explain the end of the boom and a subsequent banking panic in 1837. Acting under the Deposit Act of June, 1836, the Secretary of the Treasury ordered a redistribution of public balances from New York City banks to banks in other states. Subsequently, President Andrew Jackson issued an executive order known as the Specie Circular mandating the use of specie (gold and silver) rather than bank notes in the purchase of Federal land. In the absence of a well-functioning interregional reserves market, the ensuing outflow of reserves left the New York money market vulnerable to shocks and, according to Rousseau (2002), precipitated the Panic of 1837.¹⁴

Limited data make it impossible to determine whether the stock market and land booms of the 1830s were justified by reasonable expectations of profit growth. The success of New

¹³ At the time, the United States was on a bimetallic – gold and silver – standard. An increase in British investment in U.S. securities, coupled with a decline in silver exports to China, caused the inflow of Mexican silver to increase the monetary base.

York's Erie Canal, which was completed in 1825, brought heavy investment in other canal projects. Railroad building took off about the same time. The prospect of greatly reduced transportation costs, combined with rising export prices (chiefly cotton), were real phenomena that could cause equity prices and public land sales to increase. Nevertheless, monetary shocks, and perhaps a dose of irrational exuberance, may have also contributed to the boom, and the end of the boom was caused by monetary policy actions.

The 1840s. The stock market recovered quickly from a trough in 1843. Much of the 1843-45 boom was a recovery to a prior (local) peak (see Table 1). Smith and Cole (1935, p. 136) attribute the recovery to "cheap money" and rapid expansion of economic activity, with capital inflows from abroad sustaining the boom (p. 111). As in the 1830s, the stock market boom coincided with a sharp increase in public land sales. The period also was marked by rapid growth of the money stock, price level, and industrial production (see Table 2).

After a pause in the mid-1840s, stock prices increased sharply in 1847 but fell back quickly during the Panic of 1847. Stock prices began to rise again in 1848 and rose at about a 10 percent annual rate through 1852. As during the prior boom, the period 1848-52 was characterized by above average growth of the money stock, price level, and industrial production. Thus, all three of the antebellum stock market booms we identify occurred during periods of rapid growth of the money stock and price level as well as strong economic activity.

The Civil War Boom

Equity prices rose sharply from July 1861 to March 1864, though the real, inflation-adjusted returns to investors were more modest. The stock price index rose at an average annual rate of 40.2 percent during the boom, whereas the price level rose at an average annual rate of 25.8 percent (Table 2). Adjusted for inflation, the market peak occurred in October 1863, and the real stock price index declined precipitously until early 1865, as shown in Figure 6.

¹⁴ Temin (1967), by contrast, argues that the U.S. money market tightened when the Bank of England raised its discount rate (i.e., Bank Rate) to discourage capital outflows from the United Kingdom.

It was once thought that the Civil War had encouraged the development of manufacturing and thereby increased the subsequent growth rate of the U.S. economy. Industrial production rose fairly rapidly during the war (see Table 2). Estimates of the economic cost of the Civil War and its impact on growth indicate, however, that although specific firms and industries experienced high profits during the war, the economy as a whole suffered and the war did not increase growth (Goldin and Lewis, 1975). Recent studies have related break points in various asset price time series to war news, with major Union victories producing increases in asset prices (e.g., McCandless, 1996).

From the Civil War to World War I

The United States experienced a great industrial expansion during the late 19th and early 20th Centuries, with many new corporations formed and listed on the stock exchanges. Our stock market index shows a sustained, though not especially rapid, rise from April 1867 to April 1872, a more rapid rise from June 1877 to June 1881, and a long rise with two significant interruptions from August 1896 to September 1906.

The U.S. price level declined almost continuously from 1866 to 1896, with the cost of living falling at an average annual rate of 2 percent (David and Solar, 1977). Figure 7 plots our stock market index alongside a commodity price index for 1866-1913. Like the cost of living, commodity prices fell almost continuously until 1896, except from mid-1879 to mid-1882, when commodity prices rose at an average annual rate of 9 percent. At the ends of the stock market booms of 1867-72 and 1877-81, the level of commodity prices was below where it had been at the start of each boom.

By contrast, the price level rose during the booms of 1896-1906. Commodity prices rose at a fairly rapid 4.58 percent annual rate during the 1896-99 boom, and again rose during the subsequent booms of 1900-02 and 1903-06 (see Table 2). Hence, the evidence from the post-Civil War era indicates that stock market booms can occur during periods of inflation, deflation, and a fairly stable price level.

Figure 8 plots end-of-quarter values of the stock market index alongside Balke-Gordon's (1986) quarterly estimates of real GNP from 1875 to 1913. Real output growth accelerated in 1879, after several years of modest growth following a cycle peak in October 1873, and achieved an astounding 8.4 percent average rate during the boom of 1877-81 (see Table 2). The growth rates of the stock price index and of both real GNP and industrial production were closely correlated during 1890-1913 (see Table 2). Hence, as in the antebellum era, our evidence indicates that late 19th Century stock market booms occurred during periods of unusually rapid growth in real economic activity.

Linking stock market booms to productivity growth during this era is more difficult because productivity data are limited. Figure 9 plots annual estimates of labor productivity growth from 1875 to 1913 alongside June values of our stock price index. Productivity growth appears to have increased before the stock market in 1896, and the ups and downs in the market that follow are correlated positively with changes in productivity growth.¹⁵

Next we examine growth of the money and credit stocks. We plot end of quarter values of our stock market index and a broad money stock measure ("M2") for 1875-1913 in Figure 10 (M2 data are from Balke and Gordon, 1986). Like real output and commodity prices, M2 grew rapidly during the course of the 1877-81 stock market boom. M2 also grew at double-digit rates during the stock market booms of 1896-99, 1900-02, and 1903-06.

The relationship between the stock market and bank credit is more difficult to ascertain because the only comprehensive credit data for this period are annual. Figure 11 plots total bank credit against June values of the stock market index for 1866-1913, and Figure 12 plots annual data on the stock market loans of New York City national bank against the stock market index for 1880-1913. Whereas the correlation between the growth of total bank credit and the stock market

¹⁵ The pattern of growth in total factor productivity is similar to that of labor productivity in this period.

index is low, Figure 12 indicates that stock market loan growth increased during the booms of 1896-99, 1900-02, and 1903-06, as well as during the recovery of 1908-09.¹⁶

Railroads were the most visible industry in the economic expansion and stock market between 1867 and 1873. Railroad investment hit a peak in 1871-72, as did stock prices (Fels, 1959, p. 98). The collapse of Jay Cooke and Company, the principal financier of the Northern Pacific Railroad, triggered the financial crisis of 1873. Railroad building was stagnant until 1876, but began to expand rapidly in 1877, and the stock market revived. Although the railroads grew faster than any other industry, the 1870s and early 1880s also witnessed rapid growth in manufacturing, as well as agricultural output and productivity (Friedman and Schwartz, 1963a, pp. 35).

On the monetary side, the United States returned to the gold standard, which had been suspended during the Civil War, in 1879. Hence, the stock market boom occurred in an environment of strong growth of real economic activity and successful resumption of the international monetary standard. While there were reasons to be optimistic about the growth of corporate earnings in this environment, contemporary accounts, cited by Fels (1959, pp. 120-25), suggest that risk premiums fell unjustifiably and investors were swept up in a “bubble of overoptimism.”

Similar contemporary and historical accounts cite “speculative activity” as one reason for rapid increases in equity prices during subsequent booms. For example, Friedman and Schwartz (1963a, p. 153) write that “The years from 1902 to 1907 were characterized by industrial growth ... by speculative activity in the stock market, and by a wave of immigration.”

In summary, we find that the 19th and early 20th Century booms occurred when growth of real output and the money stock were high, but we observe no consistent pattern with respect to

¹⁶ Data on stock market loans are as of call report dates (usually September) from Bordo, Rappaport and Schwartz (1992). Although stock market loans appear to rise and peak before the stock market, because the data on loans and the stock market index are not for the same month in each year, we are hesitant to draw any conclusions about timing.

the price level, i.e., booms occurred during periods of deflation, inflation, and more or less stable prices. Anecdotes suggest that speculation also characterized most booms, but a quantitative assessment of the extent to which the rise in stock prices during booms exceeded rational pricing based on fundamentals is beyond the scope of this article.

20th Century Booms

The period between the Panic of 1907 and the beginning of the bull market of the 1920s was characterized by a choppy market. A significant panic occurred at the start of World War I in 1914, and the U.S. stock market was closed for four months. There were no sustained movements in the market between 1914 and 1923.

1923-29. In terms of duration and amplitude, the U.S. stock market boom of 1994-2000 has but one historical rival – the boom of 1923-29. The market index rose at an annual average rate of about 20 percent during both six year booms. Both periods were also characterized by low and stable inflation, and high average growth of real GDP and industrial production. Productivity growth also increased during both the 1920s and 1990s. In the 1920s, however, the increase in productivity growth occurred in the three years preceding the stock market boom, and productivity growth slowed during the boom period. By contrast, in the 1990s, productivity began to accelerate around 1995, and rapid productivity growth coincided with the stock market boom.

Figure 13 plots our stock market index alongside the Consumer Price Index for 1915-40. A rapid increase in the price level during World War I was followed by deflation in 1920-21. The consumer price level was virtually unchanged over the remainder of the 1920s. As illustrated in Figure 14, real GNP exhibited positive growth during 1923-29, interrupted by brief recessions in 1923-24 and 1927. GNP growth during the boom averaged above the historical norm, but not above the growth rates experienced during prior booms (see Table 2). Industrial production also grew rapidly during the 1923-29 boom, shown in Figure 15, and reached a peak a few months

before the stock market peak in September 1929. Average growth of industrial production during the boom was similar to that experienced in late 19th Century booms (Table 2).

Figure 16 plots annual estimates of nonfarm labor and total factor productivity for the U.S. economy, from Kendrick (1961), alongside June values of our stock market index for 1889-1940. Both labor and total factor productivity grew relatively rapidly in the early 1920s. Economists have attributed this growth to the diffusion of technological breakthroughs that had occurred in the late 19th and early 20th Centuries, including the internal combustion engine and inventions that made the industrial use of electric power practical. Although the stock market boom of the 1920s did not coincide precisely with the productivity acceleration, as it did during 1995-2000, both booms have been associated with technological breakthroughs that revolutionized production in numerous existing industries as well as created entirely new industries. The high-flying stocks of the 1920s, such as RCA, Aluminum Company of America, United Aircraft and Transportation Corporation, and General Motors were direct beneficiaries of the new general purpose technologies and were expected to have high profit potential, not unlike the “dot-com” stocks that led the boom of the 1990s.¹⁷

Whereas technological progress and accelerating productivity would be expected to generate an increase in the growth of corporate profits, and thereby justify an increase in stock prices, the question remains whether such “fundamentals” can explain the entire increase in the market. Contemporary observers disagreed about the whether the stock market boom of 1923-29

¹⁷ The internal combustion engine and electric motors are often referred to as general purpose technologies because of their wide applicability and potential to increase productivity in many industries. The microprocessor is also regarded as a general purpose technology, and the increase in productivity growth that occurred around 1995 is commonly attributed to the widespread application of computer technology. Greenspan (2000), for example, contends that “When historians look back at the latter half of the 1990s a decade or two hence, I suspect that they will conclude we are now living through a pivotal period in American economic history. New technologies that evolved from the cumulative innovations of the past half-century have now begun to bring about dramatic changes in the way goods and services are produced and in the way they are distributed to final users. Those innovations, exemplified most recently by the multiplying uses of the Internet, have brought on a flood of startup firms, many of which claim to offer the chance to revolutionize and dominate large shares of the nation’s production and distribution system.” See also David (1990), David and Wright (1999), Gordon (2000a), and Jovanovic and Rousseau (2004).

was justified by realistic expectations of future earnings, as do economists who look back at the episode. Yale economist Irving Fisher famously defended the level of the stock market. For example, he argued that the increase in corporate profits during the first nine months of 1929 “is eloquent justification of a heightened level of common stock prices” (quoted in White, 2004, p. 10). There were naysayers, however, including Paul M. Warburg, a leading banker and former member of the Federal Reserve Board. Warburg argued in March 1929 that the market reflected “unrestrained speculation” that, if continued, would result in a collapse and a “general depression involving the entire country.”¹⁸

In addition to rapid earnings growth, Fisher (1930) cited improved management methods, a decline in labor disputes, and high levels of investment in research and development as reasons why stocks were not overvalued in 1929. McGrattan and Prescott (2003) argue that Fisher was correct. Although the total market value of U.S. corporations in 1929 exceeded the value of their tangible capital stock by 30 percent, McGrattan and Prescott (2003) estimate that the value of intangible corporate assets, e.g., the value of R&D investment, fully justified the level of equity prices.

Other researchers have examined the growth of corporate earnings and dividends during the 1920s, and most conclude that equity prices rose far higher than could be justified by reasonable expectations of future dividends. White (2004), who surveys and extends this literature, concludes that the increase in stock prices during 1928-29 exceeded what could be explained by earnings growth, the earnings payout rate, the level of interest rates, or by changes in the equity premium, all of which are components of a standard equity pricing model.

Several Federal Reserve officials, Secretary of Commerce Herbert Hoover, as well as a number of other prominent public officials attributed the stock market boom to loose monetary policy and rapid growth of credit. Neither the money stock nor total bank credit grew at an unusually fast pace during 1923-29 (see Table 2). Brokers’ loans rose rapidly and in line with

¹⁸ Quoted in Galbraith (1961, p. 77).

stock prices, however, as Figure 17 illustrates. Federal Reserve officials viewed the growth in loans to stock brokers and dealers with alarm. Many adhered to the so-called Real Bills Doctrine, which focuses on the composition, rather than total quantity, of bank credit. According to this view, banks should make only short-term commercial and agricultural loans to finance the production of real goods and services. Loans to finance purchases of financial assets tend to promote speculation, misallocation of economic resources, and inflation.¹⁹ Moreover, asset price bubbles inevitably lead to crashes and depressions, which are required to “purge the rottenness out of the system,” as U.S. Treasury Secretary Andrew Mellon famously once said (Hoover, 1952, p. 30).

Federal Reserve officials debated whether their actions had contributed to the growth of brokers’ loans and financial speculation. Some officials complained that the Fed was fueling the stock market boom by making discount window loans to banks that in turn lent to stock brokers and dealers. Although only short-term commercial and agricultural loans could be used as collateral for discount window loans, some Federal Reserve Board members argued that banks should be forced to liquidate their loans to stock brokers and dealers before being allowed to borrow at the discount window with eligible collateral. In February 1929, the Federal Reserve Board directed the Reserve Banks to ensure that Federal Reserve credit was not used to finance speculative activity: “The Board ... has a grave responsibility whenever there is evidence that member banks are maintaining speculative security loans with the aid of Federal Reserve credit. When such is the case the Federal Reserve Bank becomes either a contributing or a sustaining factor in the current volume of speculative security credit. This is not in harmony with the intent

¹⁹ Contemporaries argued that banks “pushed” loans to purchase stocks on an unsophisticated public. Rappoport and White (1994) show, however, that the risk premium on brokers loans increased sharply in the late 1920s, indicating that the growth of brokers loan volume reflected growing demand rather than increasing loan supply.

of the Federal Reserve Act nor is it conducive to the wholesome operation of the banking and credit system of the country.”²⁰

Open market operations constituted a second channel by which Federal Reserve credit contributed to the stock market boom, according to critics. Open market purchases made during economic recessions in 1924 and 1927 came when “business could not use, and was not asking for increased money,” Federal Reserve Board member Adolph Miller alleged.²¹ In the absence of increased demand for Fed credit for “legitimate” business needs, according to this view, open market purchases increased the supply of funds available to purchase stocks, and thereby inflated the bubble.

Fed officials were not unanimous in their views. In general, Federal Reserve Bank officials disagreed with the idea that it was desirable, or even possible, to control commercial banks’ use of funds obtained from the discount window. Reserve Bank officials tended to argue for discount rate increases, rather than any form of “direct pressure,” to curtail discount window borrowing.

Fed officials also disagreed about the relationship between open market operations and the stock market. Disagreement centered on whether the large open market purchases of 1924 and 1927 had been desirable or harmful. Benjamin Strong, the Governor of the Federal Reserve Bank of New York from its inception in 1914, was the Fed’s dominant figure and head of the System’s Open Market Investment Committee until his death in 1928. Although other System officials acquiesced, the open market purchases of 1924 and 1927 were largely Strong’s idea.²² When asked by the Senate Banking Committee in 1931 whether those purchases had been

²⁰ Quoted in Chandler (1971, pp. 56-57).

²¹ Testifying before the Senate Banking Committee in 1931 (quoted in Wheelock, 1991, pp. 98-99).

²² Strong’s motives for engaging in open market purchases in 1924 and 1927 have been debated. Meltzer (2003, pp. 197-221) finds that the actions were undertaken both to encourage domestic economic recovery from recessions and to assist the Bank of England in attracting and maintaining gold reserves by lowering U.S. interest rates relative to those in the United Kingdom. Meltzer concludes, however, that international cooperation was relatively more important than domestic recovery in 1927. Wheelock (1991) reports empirical evidence that both domestic and international goals were important throughout 1924-29.

appropriate, some Reserve Bank officials argued that they had been useful but perhaps too large, while other Fed officials contended that no open market purchases should have been made in those years. For example, officials of the Federal Reserve Bank of Chicago argued that the purchases in 1924 had been too large and “in 1927 the danger of putting money into the market was greater than in 1924 as speculation was well under way.” Officials of the Federal Reserve Bank of Richmond went further, arguing that “we think ... securities should not have been purchased in these periods, and the aim should have been to decrease rather than augment the total supply of Federal Reserve Credit.”²³ Although not reflected in growth of the money stock or total bank credit, critics charged that the Fed had pursued a dangerously loose monetary policy as reflected in the growth of brokers’ loans and rise in the stock market.

The 1930s. At its nadir in June 1932, the S&P stock market index stood at just 15 percent of its September 1929 peak. The market staged a brief recovery in 1933, then surged from March 1935 to February 1937. The boom of 1935-37 coincided with a period of rapid growth in real output and the money stock, and came in the middle of a decade of unusually rapid growth in total factor productivity (Field, 2003). Inflation, however, remained low (see Table 2). The adoption of highly restrictive monetary and fiscal policies in 1936-37 snuffed out the economic recovery and brought a halt to the stock market boom in early 1937.

World War II. The next stock market boom occurred during World War II. U.S. equity prices declined when the war began in Europe, hitting a low point in March 1942. The stock market then rose as the U.S. economy was being mobilized for war. Similar to the view that the Civil War had a positive effect on postwar economic growth by hastening the development of manufacturing industries, World War II has also been viewed as an important source of technological progress and postwar economic growth. Field (2004) shows, however, that most of the seeds of postwar growth were sown during the 1930s, and that productivity growth was slow during the war outside the munitions industries. Thus, the stock market boom probably reflected

²³ These quotes are from Wheelock (1991, p. 100).

more the rapid increases in output and liquidity during the war as the economy finally reached full employment than productivity-driven expectations of a long-run increase in the growth of corporate profits.

The Post-World War II Era

The nearly 60 years since the end of World War II can be divided into three distinct eras. The first, from the end of the war to the early 1970s, was characterized by a rising stock market, strong real economic growth, a high average rate of productivity growth and, toward the end of the period, rising inflation. The second era, covering the 1970s and early 1980s, was characterized by stagflation – high inflation coupled with both highly variable and low average output and productivity growth. Nominal stock returns were flat, and *ex post* real returns were negative. In the third era, from the mid-1980s to the present, real output growth has been more stable and, on average, higher than it was before 1980. Inflation has fallen markedly, and since the mid-1990s, productivity growth has returned to the high average rates observed in the 1950s and early 1960s. Stock returns have been high, both in nominal and real terms, especially during the booms of 1984-1987 and 1994-2000. Figures 18-22 illustrate these patterns.

Technological breakthroughs in chemicals, electronics, and other industries during the 1930s and 1940s enabled rapid growth in labor productivity and living standards during the 1950s and 1960s (Field, 2003; Gordon, 2000a). These decades also witnessed high levels of investment in public infrastructure and education. Our metric identifies three specific stock market booms in these decades, though one might characterize the entire period as a boom.

The first boom began as the economy pulled out of a mild recession in 1949. The market rose at an average annual rate of 18 percent between June 1949 and January 1953. Following a pause during another recession in 1953-54, the market rose at an average annual rate of nearly 27 percent from September 1953 to July 1956. Although the growth rates of output and productivity were somewhat slower during the latter boom, the return to more stable monetary and fiscal policies after the Korean War may explain why the stock market increased at a faster pace. The

third distinct boom lasted from June 1962 to January 1966, and coincided with a long period of economic expansion, characterized by high average growth of GDP, industrial production, and productivity, as well as low inflation.

The stock market performed poorly during the 1970s, with the market peak of January 1973 not reached again until July 1980. No stock market booms occurred during this decade of adverse supply shocks, low productivity growth, highly variable output growth and high inflation. The next market boom occurred during the three year period from July 1984 to August 1987. This period of economic recovery was characterized by moderately strong real economic growth and falling inflation, but productivity growth that was below its post-World War II average.

The macroeconomic environment of the April 1994–August 2000 boom period is well known. This period was characterized by somewhat above average growth of real output and industrial production, and low and stable inflation. An increase in the trend growth rate of productivity to approximately the rate that had prevailed during the 1950s and 1960s was the most remarked about feature of this boom period, and has often been cited as the main fundamental cause of the stock market boom.

CONCLUSION

Our survey finds that U.S. stock market booms have occurred in a variety of macroeconomic environments. Nevertheless, some common patterns are evident:

1. Most booms occurred during periods of relatively rapid economic growth and, to the extent it can be measured, productivity advance. This suggests that booms were driven at least to some extent by fundamentals.
2. Many booms also occurred during periods of relatively rapid growth of the money stock and bank credit, reflecting either passive accommodation of booms by the banking system or expansion of the monetary base via gold inflows or monetary policy actions.
3. Stock market booms have occurred in periods of deflation, e.g., the late 1870s and early 1880s, in periods of inflation, e.g., the 1830s, 1840s, and late 1890s and early

1900s, and in periods of price stability, e.g., the 1920s and 1990s. In general, booms appear to have been driven by increases in the growth of real output and productivity, and can persist despite either inflation or deflation so long as the growth of output and productivity remain strong.²⁴ The tendency for the money stock, but not the price level, to grow rapidly during booms suggests that money growth accommodated increases in productivity that fueled booms. In the absence of an increase in money growth, the quantity theory predicts that an increase in productivity and potential output growth would lead to deflation. In future work, we intend to examine formally whether accelerations in money stock growth during booms were quantitatively consistent with increases in long-run productivity growth.

4. Wartime experience seems to have been different from peacetime but no consistent wartime pattern emerges. The old adage that “war is good for the market” does not seem to always hold up. Stock market booms occurred during World War II and to a lesser extent the Civil War, but market performance was relatively poor during World War I and the Vietnam War.

The stock market booms of 1923-29 and 1994-2000 stand alone in terms of their length and the extent to which market averages increased. Both bull markets have been attributed to increased productivity growth associated with the widespread application of new general purpose technologies that promised new eras of rapid economic growth. The macroeconomic environments in which these two booms occurred were strikingly similar. Both decades saw above average though not exceptional growth of real output and industrial production, while

²⁴ Periods of depressed stock market returns occurred during periods of declining productivity growth or other adverse supply shocks. Some such periods were characterized by deflation, e.g., 1929-32, while others were characterized by inflation, e.g., the 1970s. In deflationary periods when aggregate supply growth outpaced aggregate demand, such as in the late 1870s and early 1880s, the market did as well as it did in the inflationary 1830s, 1840s, and late 1890s and early 1900s when rapid aggregate supply growth was surpassed by demand growth (Bordo and Redish, 2002; Bordo, Lane and Redish, 2004). This contrasts sharply with the experiences of the Great Depression, when collapsing aggregate demand coincided with a

consumer price inflation was quite low and stable during both boom periods. Productivity growth did increase in both the 1920s and 1990s, though in the 1920s productivity growth appears to have occurred prior to the stock market boom, whereas the increase in productivity growth during the 1990s coincided with the boom.

Policymakers paid a great deal of attention to the stock market during each of the great booms. In the 1920s, debate centered on whether the Fed had fostered the boom by oversupplying Federal Reserve credit through open market purchases and inadequate administration of the discount window. Many Fed officials adhered to the Real Bills Doctrine, which held that an increase in credit beyond that required to finance short-term production and distribution of real goods would end up fostering speculation and inflation. Despite the absence of consumer price inflation, officials interpreted the stock market boom as evidence of inflation. Accordingly, the Fed tightened policy in 1928 and 1929, which may have hastened the collapse of both stock prices and the economy (Schwartz, 1991; Hamilton, 1987). Lingering doubts about the efficacy of using monetary policy to foster economic recovery then contributed to the Fed's failure to ease aggressively to fight the Great Depression (Wheelock, 1991; Meltzer, 2002).

The Fed's understanding of the role of monetary policy was quite different in the 1990s and 2000s. Transcripts of FOMC meetings indicate that during the 1990s, the Fed was mainly concerned about the potential consequences of a sharp decline in stock prices, fearing that falling stock prices would reduce consumption by reducing wealth. Although the Fed did tighten policy in the later stages of the boom by raising its target for the fed funds rate in 1999-2000, it eased aggressively when stock prices declined and the economy entered recession. In sharp contrast to its policy in the early 1930s, the Fed maintained an aggressively accommodative monetary policy well after the stock market decline had ended with the objectives of preventing deflation and encouraging economic recovery.

decline in aggregate supply, and the Stagflation of the 1970s, which was characterized by excessive growth of aggregate demand in the face of low or negative aggregate supply growth.

Our survey of U.S. stock market booms finds that booms do not occur in the absence of increases in real economic growth and perhaps productivity growth. We find little indication that booms were caused by excessive growth of money or credit, though 19th Century booms tended to occur during periods of monetary expansion. The view that monetary policy can cause asset market speculation by failing to control the use of credit has been largely discarded. Nevertheless, anecdotal evidence suggests that the stock market sometimes rises more than can be justified by fundamentals, though economists continue to debate whether even the market peak of 1929 was too high. Not surprisingly, these questions leave the issue of how monetary policy should respond to an asset price boom unsettled. Although one can offer plausible theoretical arguments for responding proactively to an asset price boom, our survey suggests that policymakers should be cautious about attempting to deflate asset prices without strong evidence that a collapse of asset prices would have severe macroeconomic costs.

References

- Alchian, Armen A. and Klein, Benjamin. "On a Correct Measure of Inflation." *Journal of Money, Credit and Banking*, February 1973, 5(1), Part 1, pp. 173-191.
- Balke, Nathan S. and Gordon, Robert J. "Appendix B, Historical Data," in Robert J. Gordon, ed. *The American Business Cycle: Continuity and Change*. Chicago: University of Chicago Press, 1986, pp. 781-850.
- Bernanke, Ben S. and Gertler, Mark. "Should Central Banks Respond to Movements in Asset Prices?" *American Economic Review*, 2001, 91(2), pp. 253-57.
- ____ and _____. "Monetary Policy and Asset Volatility." *Economic Review*, Federal Reserve Bank of Kansas City, 1999, 84(4), pp. 17-52.
- Bordo, Michael D.; Dueker, Michael J. and Wheelock, David C. "Aggregate Price Shocks and Financial Stability: The United Kingdom 1796-1999." *Explorations in Economic History*, April 2003, 40(4), pp. 143-69.
- Bordo, Michael D.; Dueker, Michael J. and Wheelock, David C. "Aggregate Price Shocks and Financial Stability: A Historical Analysis." *Economic Inquiry*, October 2002, 40(4), pp. 521-38.
- Bordo, Michael D. and Jeanne, Olivier. "Boom-Bust in Asset Prices, Economic Instability, and Monetary Policy." NBER working paper no. 8966, June 2002a.
- Bordo, Michael D. and Jeanne, Olivier. "Monetary Policy and Asset Prices: Does 'Benign Neglect' Make Sense?" *International Finance*, 5(2), pp. 139-64.
- Bordo, Michael D.; Rappoport, Peter and Schwartz, Anna J. "Money versus Credit Rationing: Evidence for the National Banking Era, 1880-1914," in Claudia Goldin and Hugh Rockhoff, eds., *Strategic Factors in Nineteenth Century American Economic History, A Volume to Honor Robert W. Fogel*. Chicago: University of Chicago Press, 1992, pp. 189-224.
- Borio, Claudio; English, William and Filardo, Andrew. "A Tale of Two Perspectives: Old or New Challenges for Monetary Policy?" BIS working paper no. 127, 2003.
- Borio, Claudio and Lowe, Philip. "Asset Prices, Financial and Monetary Stability: Exploring the Nexus," BIS working paper no. 114, 2002.
- Borio, Claudio and White, William. "Whither Monetary and Financial Stability? The Implications of Evolving Policy Regimes." Presented at Federal Reserve Bank of Kansas City Symposium on *Monetary Policy and Uncertainty: Adapting to a Changing Economy*. August 2003.
- Brunner, Karl and Meltzer, Allan H. "Mr. Hicks and the 'Monetarists'." *Economica*, February 1973, 40(157), pp. 44-59.

- Bryan, Michael F.; Cecchetti, Stephen G. and O'Sullivan, Roisin. "Asset Prices in the Measurement of Inflation." National Bureau of Economic Research Working Paper no. 8700, January 2000.
- Bullard, James B. and Schaling, Eric. "Why the Fed Should Ignore the Stock Market." Federal Reserve Bank of St. Louis *Review*, March/April 2002, 84, pp. 35-42.
- Cecchetti, Stephen G., "What the FOMC Says and Does When the Stock Market Booms." Paper prepared for the Conference on Asset Prices and Monetary Policy at the Reserve Bank of Australia, Sydney, August 2003.
- Cecchetti, Stephen G.; Genberg, Hans; Lipsky, John and Wadhwani, Sushil. "Asset Prices and Central Bank Policy." *Geneva Reports on the World Economy* 2, International Center for Monetary and Banking Studies and Centre for Economic Policy Research, July 2000.
- Chandler, Lester V. *American Monetary Policy 1928-1941*. New York: Harper and Row, 1971.
- Cole, Arthur H. *Wholesale Commodity Prices in the United States 1700-1861*. Cambridge: Harvard University Press, 1938
- David, Paul A. "The Dynamo and the Computer: An Historical Perspective on the Modern Productivity Paradox," *American Economic Review*, May 1990, 80(2), pp. 355-61.
- David, Paul A. and Solar, Peter. "A Bicentenary Contribution to the History of the Cost of Living in America." *Research in Economic History*, 1977, 2, pp. 1-80.
- David, Paul A. and Wright, Gavin. "General Purpose Technologies and Surges in Productivity: Historical Reflections on the Future of the ICT Revolution." Presented to the International Symposium on *Economic Challenges of the 21st Century in Historical Perspective*, July 1999.
- Davis, Joseph H. "An Annual Index of U.S. Industrial Production, 1790-1915. Working paper, October 2002.
- DeLong, J. Bradford and Schleifer, Andrei. "The Stock Market Bubble of 1929: Evidence from Closed-end Mutual Funds. *Journal of Economic History*, September 1991, 52, pp. 675- .
- Detken, Carsten and Smets, Frank. "Asset Price Booms and Monetary Policy." Kiel Institute of World Economics conference presentation, June 2003 (revised, December 2003).
- Dupor, B. "Comment on 'Monetary Policy and Asset Prices'." *Journal of Monetary Economics*, 2002, 49, pp. 99-108.
- Eichengreen, Barry and Mitchener, Kris. "The Great Depression as a Credit Boom Gone Wrong." Working paper, March 2003.
- Fels, Rendig. *American Business Cycles 1865-1897*. Chapel Hill: University of North Carolina Press, 1959.
- Field, Alexander J. "The Most Technologically Progressive Decade of the Century." *American Economic Review*, 2003, 93(4), pp. 1399-1413.

- Filardo, Andrew J. "Monetary Policy and Asset Prices." Federal Reserve Bank of Kansas City *Economic Review*, third quarter 2000, pp. 11-37.
- Fisher, Irving. *The Stock Market Crash – And After*. New York: Macmillan, 1930.
- Friedman, Milton and Schwartz, Anna J. *Monetary Statistics of the United States: Estimates, Sources, and Methods*. New York: Columbia University Press, 1970.
- Friedman, Milton and Schwartz, Anna J. *A Monetary History of the United States, 1867-1960*. Princeton: Princeton University Press, 1963a.
- Friedman, Milton and Schwartz, Anna J. "Money and Business Cycles." *Review of Economics and Statistics*, February 1963b, 45(), pp. 32-64.
- Galbraith, John Kenneth. *The Great Crash, 1929*. Boston: Houghton Mifflin, 1961.
- Gilchrist, Simon and Leahey, John V. "Monetary Policy and Asset Prices." *Journal of Monetary Economics*, January 2002, 49(), pp. 75-97.
- Goodhart, Charles A. and Hofmann, Boris. "Do Asset Prices Help Predict Consumer Price Inflation?" *Manchester School Journal*, September 2000, pp. .
- Gordon, Robert J. "Does the 'New Economy' Measure Up to the Great Inventions of the Past?" *Journal of Economic Perspectives*, Fall 2000a, 14(4), pp. 49-74.
- Gordon, Robert J. *Macroeconomics*. Reading, MA: Addison-Wesley, 2000b.
- Greenspan, Alan. "Economic Volatility." Remarks at a Symposium sponsored by the Federal Reserve Bank of Kansas City, August 2003.
- Greenspan, Alan. "Technology Innovation and its Economic Impact." Remarks, April 7, 2000.
- Greenspan, Alan. "The Federal Reserve: Semiannual Report on Monetary Policy." Testimony before the Committee on Banking and Financial Services, U.S. House of Representatives, July 1999.
- Greenspan, Alan. "The Challenge of Central Banking in a Democratic Society." Remarks at the American Enterprise Institute, December 5, 1996.
- Hamilton, James D. "Monetary Factors in the Great Depression," *Journal of Monetary Economics*, 1987, 19, pp. 145-69.
- Hayford, Marc D. and Malliaris, A. G. "Monetary Policy and the U.S. Stock Market," *Economic Inquiry*, July 2004, 42(3), pp. 387-401.
- Helbling, Thomas and Terrones, Marco. "Asset Price Booms and Busts – Stylized Facts from the Last Three Decades of the 20th Century." International Monetary Fund working paper, March 2004.
- Hoover, Herbert C. *The Memoirs of Herbert Hoover: The Great Depression, 1929-1941*. New York: Macmillan, 1952.

- Jovanovic, Boyan and Rousseau, Peter L., "Measuring General Purpose Technologies," presented at a conference sponsored by Duke University and the University of North Carolina, *Understanding the 1990s: The Economy in Long-Run Perspective*, March 26-27, 2004.
- Kendrick, John. *Productivity Trends in the United States*. Princeton: Princeton University Press, 1961.
- Laidler, David. "The Price Level, Relative Prices, and Economic Stability: Aspects of the Interwar Debate." Prepared for conference on "Monetary stability, financial stability and the business cycle," Bank for International Settlements. Basel, Switzerland, 2003.
- Meltzer, Allan H. *A History of the Federal Reserve, Volume 1*. Chicago: University of Chicago Press, 2002.
- Metzler, Lloyd A., "Wealth, Saving, and the Rate of Interest," *Journal of Political Economy*, April 1951, 59(2), pp. 93-116.
- McCandless, George T., "Money, Expectations, and the U.S. Civil War," *American Economic Review*, June 1996, 86(3), pp. 661-71.
- McGrattan, Ellen R. and Prescott, Edward C. "The 1929 Stock Market: Irving Fisher Was Right." Federal Reserve Bank of Minneapolis Research Department Staff Report 294, May 2003.
- Miron, Jeffrey A. and Romer, Christina D. "A New Monthly Index of Industrial Production, 1884-1940." NBER working paper 3172, November 1989.
- Mishkin, Frederic S. and White, Eugene N. "U.S. Stock Market Crashes and Their Aftermath: Implications for Monetary Policy." Prepared for a conference sponsored by the Federal Reserve Bank of Chicago, April 23, 2002.
- Pagan, Adrian R. and Sossounov, Kirill A. "A Simple Framework for Analysing Bull and Bear Markets." *Journal of Applied Econometrics*, 2004, 18(), pp. 23-46.
- Posen, Adam. "It Takes More than a Bubble to Become Japan." Presented at Reserve Bank of Australia conference on *Asset Prices and Monetary Policy*, August 2003.
- Rappoport, Peter and White, Eugene N. "Was the Crash of 1929 Expected? *American Economic Review*, March 1994, 84(1), pp. 271-81.
- Rigobon, R. and Sack, Brian. "Measuring the Reaction of Monetary Policy to the Stock Market," *Quarterly Journal of Economics*, 2003, 118(2), pp. 639-69.
- Rothbard, Murray. *America's Great Depression*. Fourth edition. New York: Richardson and Snyder, 1983.
- Rousseau, Peter L. "Jacksonian Monetary Policy, Specie Flows, and the Panic of 1837." *Journal of Economic History*, June 2002, 62(2), pp. 457-88.

- Schinasi, Garry and Hargraves, Monica. "Boom and Bust in Asset Markets in the 1930s: Causes and Consequences." Staff Studies for the *World Economic Outlook*, International Monetary Fund, 1993.
- Schwartz, Anna J. "Asset Price Inflation and Monetary Policy." NBER working paper no. 9321, 2002.
- Schwartz, Anna J. "Why Financial Stability Depends on Price Stability." *Economic Affairs*, 1995, pp. 21-25.
- Schwartz, Anna J. "Understanding 1929-1933," in Karl Brunner, ed., *The Great Depression Revisited*. Boston: Kluwer-Nihoff, pp. 5-48.
- Schwert, G. William. "Indexes of U.S. Stock Prices from 1802 to 1987." *Journal of Business*, 1990, 63(3), pp. 399-426.
- Smets, Frank. "Financial Asset Prices and Monetary Policy: Theory and Evidence." BIS working paper no. 47, September 1997.
- Smith, Walter B. and Cole, Arthur H. *Fluctuations in American Business, 1790-1860*. Cambridge, MA: Harvard University Press, 1935.
- Temin, Peter. *The Jacksonian Economy*. New York: Norton, 1969.
- Tobin, James. "A General Equilibrium Approach to Monetary Theory." *Journal of Money, Credit, and Banking*, February 1969, 1(1), pp. 15-29.
- Wheelock, David C. *The Strategy and Consistency of Federal Reserve Monetary Policy, 1924-1933*. Cambridge: Cambridge University Press, 1991.
- White, Eugene N. "Bubbles and Busts: The 1990s in the Mirror of the 1920s." Paper presented at a conference sponsored by Duke University and the University of North Carolina, *Understanding the 1990s: The Long-Run Perspective*, March 26-27, 2004.
- White, Eugene N. "The Stock Market Boom and Crash of 1929 Revisited. *Journal of Economic Perspectives*, Spring 1990, 4(2), pp. 67-83.
- Woodford, Michael. *Interest and Prices: Foundations of a Theory of Monetary Policy*. Princeton: Princeton University Press, 2003.

Table 1: U.S. Stock Market Booms – Alternative Starting Dates

Boom Beginning In Trough	Avg. %Δ in Index During Boom (Months Duration)	Beginning When Local Peak Surpassed	Avg. %Δ in Index During Boom (Months Duration)	Beginning When Global Peak Surpassed	Avg. %Δ in Index During Boom (Months Duration)	Boom Ending Month
Feb. 1834	35.06 (16)	April 1834	26.45 (14)	April 1834	26.45 (14)	May 1835
Jan. 1843	23.35 (36)	Dec. 1843	12.31 (25)	Dec. 1852	n/a	Dec. 1845
Nov. 1848	9.80 (50)	May 1852	20.05 (7)	Dec. 1852	n/a	Dec. 1852
July 1861	40.20 (33)	Oct. 1862	37.28 (20)	May 1863	27.24 (10)	Mar. 1864
April 1867	8.83 (61)	Jan. 1868	7.05 (52)	Jan. 1868	7.05 (52)	April 1872
June 1877	22.58 (49)	Oct. 1879	21.13 (21)	Apr. 1880	21.22 (15)	June 1881
Aug. 1896	20.74 (33)	Sept. 1896	19.47 (32)	Dec. 1900	n/a	April 1899
Sept. 1900	22.02 (25)	Nov. 1900	17.76 (23)	Dec. 1900	15.34 (22)	Sept. 1902
Oct. 1903	16.74 (36)	Mar. 1905	12.82 (19)	Mar. 1905	12.82 (19)	Sept. 1906
Aug. 1896	10.33 (122)	Sept. 1896	9.92 (121)	Dec. 1900	7.32 (70)	Sept. 1906
Oct. 1923	23.70 (72)	Nov. 1924	25.12 (59)	Jan. 1925	23.97 (45)	Sept. 1929
Mar. 1935	41.32 (24)	Aug. 1935	30.28 (19)	Sep. 1954	n/a	Feb. 1937
April 1942	21.92 (50)	Dec. 1944	25.78 (18)	Sep. 1954	n/a	May 1946
June 1949	18.08 (44)	Jan. 1950	15.17 (37)	Sep. 1954	n/a	Jan. 1953
Sept. 1953	26.87 (35)	Mar. 1954	26.88 (29)	Sep. 1954	24.85 (23)	July 1956
June 1949	18.27 (86)	Jan. 1950	16.95 (79)	Sep. 1954	24.85 (23)	July 1956
June 1962	14.79 (44)	Sep. 1963	10.84 (29)	Sep. 1963	10.84 (29)	Jan. 1966
July 1984	26.04 (38)	Jan. 1985	25.96 (32)	Jan. 1985	25.96 (32)	Aug. 1987
Dec. 1987	11.57 (74)	July 1989	8.34 (55)	July 1989	8.34 (55)	Jan. 1994
April 1994	19.64 (77)	Feb. 1995	21.23 (67)	Feb. 1995	21.23 (67)	Aug. 2000

Table 2: The Macroeconomic Environment of U.S. Stock Market Booms

Trough Month	Peak Month	Avg. % Δ Stock Index	Avg. % Δ Productivity	Avg. % Δ Money Stock	Avg. % Δ Bank Credit	Avg. % Δ Price Level	Avg. % Δ Ind. Prod.	Avg. % Δ Real GDP	Crashes and Wars ^a
Feb. 1834	May 1835	35.06	n/a	6.58	13.33	13.26	11.91	n/a	Crash, May 1835
Jan. 1843	Dec. 1845	23.35	n/a	16.57	7.29	7.83	11.13	n/a	
Nov. 1848	Dec. 1852	9.80	n/a	11.65	5.25	6.75	7.45	n/a	
July 1861	March 1864	40.20	n/a	n/a	-2.24	25.80	9.68	n/a	Civil War
April 1867	April 1872	8.83	n/a	4.00	5.26	-3.54	5.93	n/a	
June 1877	June 1881	22.58	1.20	11.93	3.20	-1.22	12.76	8.40	Crash, 1880
Aug. 1896	April 1899	20.74	3.44	12.38	10.29	4.58	11.48	6.76	Crash, summer 1896
Sept. 1900	Sept. 1902	22.02	2.30	12.10	11.64	2.33	10.04	6.58	Crash, 1900
Oct. 1903	Sept. 1906	16.74	3.16	8.47	7.82	1.79	12.68	7.03	Crash, July-Oct. 1903; 1907
Aug. 1896	Sept. 1906	10.33	2.57	9.88	9.41	3.27	8.98	5.90	
Oct. 1923	Sept. 1929	23.70	2.08	3.93	5.02	0.02	10.95	4.33	Crash, Oct. 1929
Mar. 1935	Feb. 1937	41.32	2.49	10.93	5.78	1.51	19.49	10.63	Crash, Oct. 1937-March 1938
April 1942	May 1946	21.92	1.90	17.91	21.42	3.42	-1.01	1.67	World War II; crash, Sept. 1946
June 1949	Jan. 1953	18.08	3.86	3.75	5.17	3.01	10.08	6.60	
Sept. 1953	July 1956	26.87	1.69	2.85	3.51	0.53	2.09	2.84	
June 1949	July 1956	18.27	2.71	3.30	4.63	1.89	6.00	4.70	
June 1962	Jan. 1966	14.79	3.68	7.83	8.47	1.53	7.77	5.61	Crash, April-June 1962
July 1984	Aug. 1987	26.04	1.54	7.37	9.29	3.04	2.41	3.38	Crash, Oct. 1987
Dec. 1987	Jan. 1994	11.57	1.62	3.43	5.50	3.88	1.71	2.34	Crash, Aug.-Oct. 1990
April 1994	Aug. 2000	19.64	1.98	5.13	7.43	2.53	5.06	3.76	Crash, Aug. 2000-2001

Comparison Periods

Jan. 1834	Dec. 1859	-0.62	n/a	5.93	4.00	0.51	6.93	n/a
Jan. 1866	Dec. 1913	2.31	1.30 ^b	5.71 ^c	6.64	-1.06	5.41	4.02 ^b
Jan. 1919	Dec. 1940	3.99	2.05	3.29	1.81	-0.67	12.73	2.29
Jan. 1946	Dec. 2002	7.67	2.21 ^d	6.09	7.24	4.05	3.62	3.37 ^e

Notes:

^a Crashes and wars that occurred immediately prior to, during, or immediately after a boom. 20th Century crashes are documented by Mishkin and White (2002).

^b Average for 1875-1913.

^c Average for 1867-1913.

^d Average for 1949-2002.

^e Average for 1947-2002.

Table 2, continued: Definitions and Sources

Percentage changes (% Δ) are computed as annualized percentage changes in monthly data, i.e., $\% \Delta_t = 1200[(x_t/x_{t-1}) - 1]$ (similar formulae are used for quarterly or annual data). The figures reported in the table are averages of these percentage changes from the month (quarter or year) following the trough month to the peak month, except as noted below.

Productivity: For 1879-1946, labor productivity from Gordon (2000b). The data are annual – we report the average annual percentage change in productivity from the year after that in which the trough occurs to the year in which the peak occurs. For 1947-2000, non-farm business sector labor productivity (output/hour, seasonally adjusted, 1992=100) from the Commerce Department. The data are quarterly – we report average annualized growth rates from the quarter following the trough to the quarter of the peak, unless the peak occurred in the first month of a quarter, in which case our averages are based on data through the previous quarter).

Money: For 1834-1906, data are annual, and we report the average annual percent change in the money stock from the trough year to the peak year. For 1907-2000, data are monthly, and we report the average annualized percent change from the month following the trough to the peak month. The data for 1834-59 are the broad money stock series in Friedman and Schwartz (1970). For 1860-62, we use estimates provided by Hugh Rockhoff. Data for 1863-66 are not available. The data for 1867-1946 are the broad money stock series in Friedman and Schwartz (1963a). The data for 1947-58 are a broad money stock series from the NBER Macro-History Database (series 14195). For 1960-2002, we use the M2 money stock (seasonally adjusted) from the Board of Governors of the Federal Reserve System.

Bank Credit: For 1834-1946, data are annual (June figures), and we report the average annual percent change in total bank credit from the trough year to the peak year. Source: Historical Statistics of the United States (1976, Series X580). Data prior to 1896 are incomplete. For 1947-2002, data are monthly from the Board of Governors of the Federal Reserve System.

Price level: For 1834-1912, monthly wholesale price index (Warren-Pearson and BLS) from Cole (1938) and NBER Macro-History database (series M04048a/b). For 1913-2000, CPI-U (all items, seasonally adjusted).

Industrial Production: For 1834-95, Davis (2002). Davis' data are annual – we report the average annual growth rate from the year following the trough (except that for the boom beginning in January 1843 we include 1843) through the peak year. For 1896-1940, Miron and Romer (1989), monthly data. For 1941-2000, Federal Reserve monthly Index of Industrial Production (seasonally adjusted).

GDP: For 1879-1946 (quarterly data), Balke and Gordon (1986). For 1949-2000, real GDP (chained \$1996) (quarterly data). We report the average annual growth rate from the quarter following the trough to the peak quarter.

Figure 1: S&P 500 and NASDAQ Composite Indexes, Jan. 1990-Oct. 2003

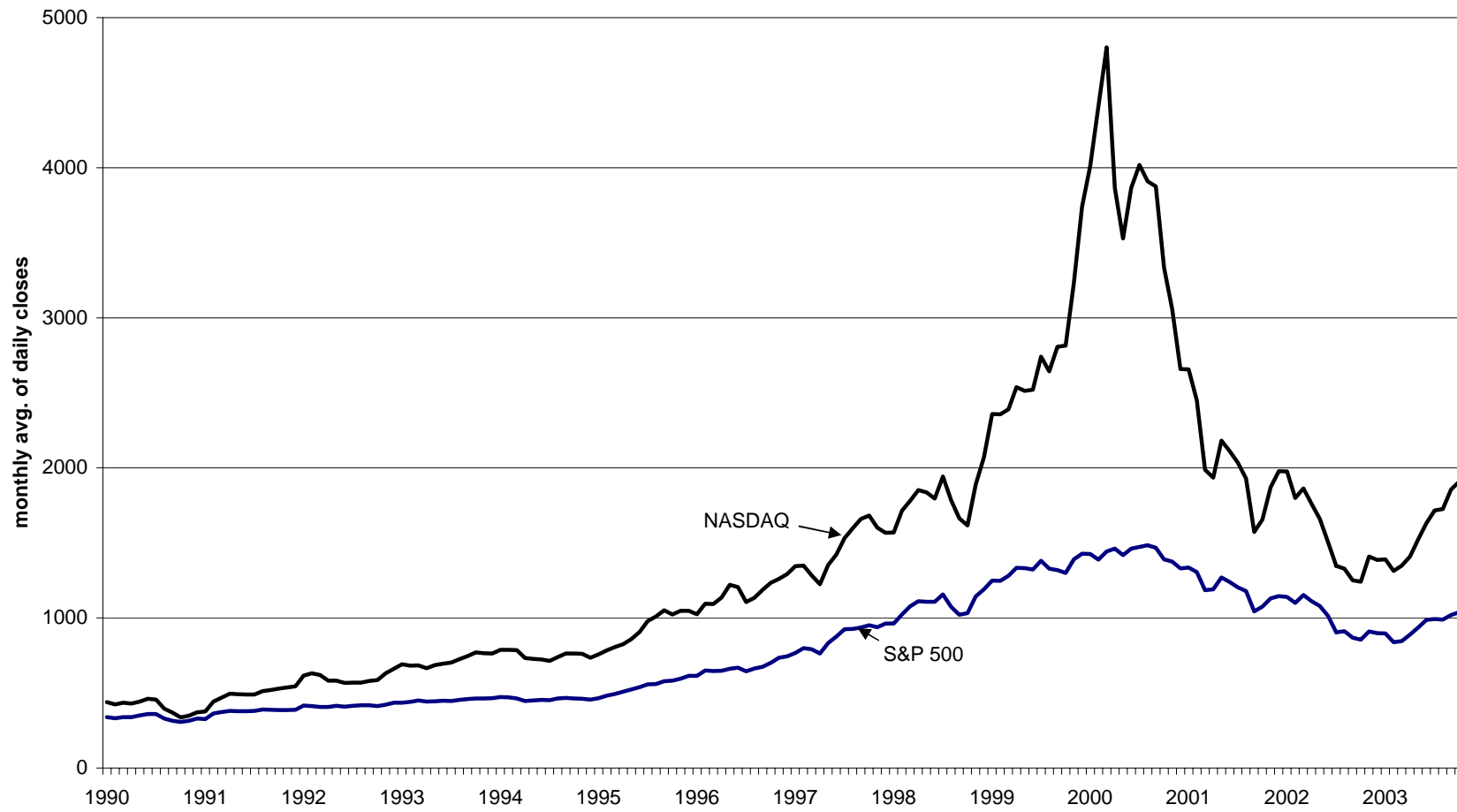


Figure 2: Schwert-S&P Stock Price Index, 1802-2002

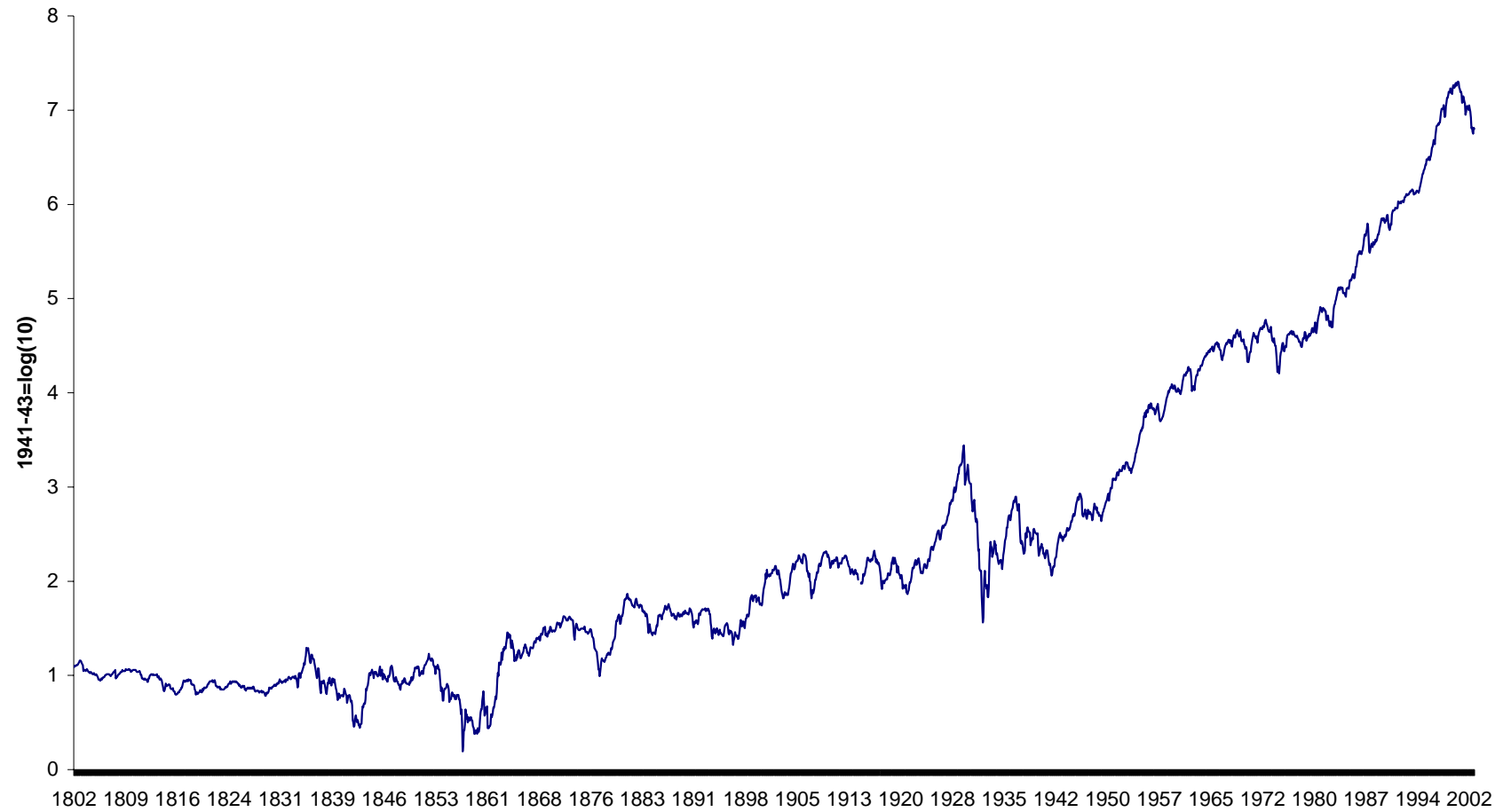


Figure 3: Stock Price Index, 1830-1913
Actual vs. 9-Year Trailing Moving Average

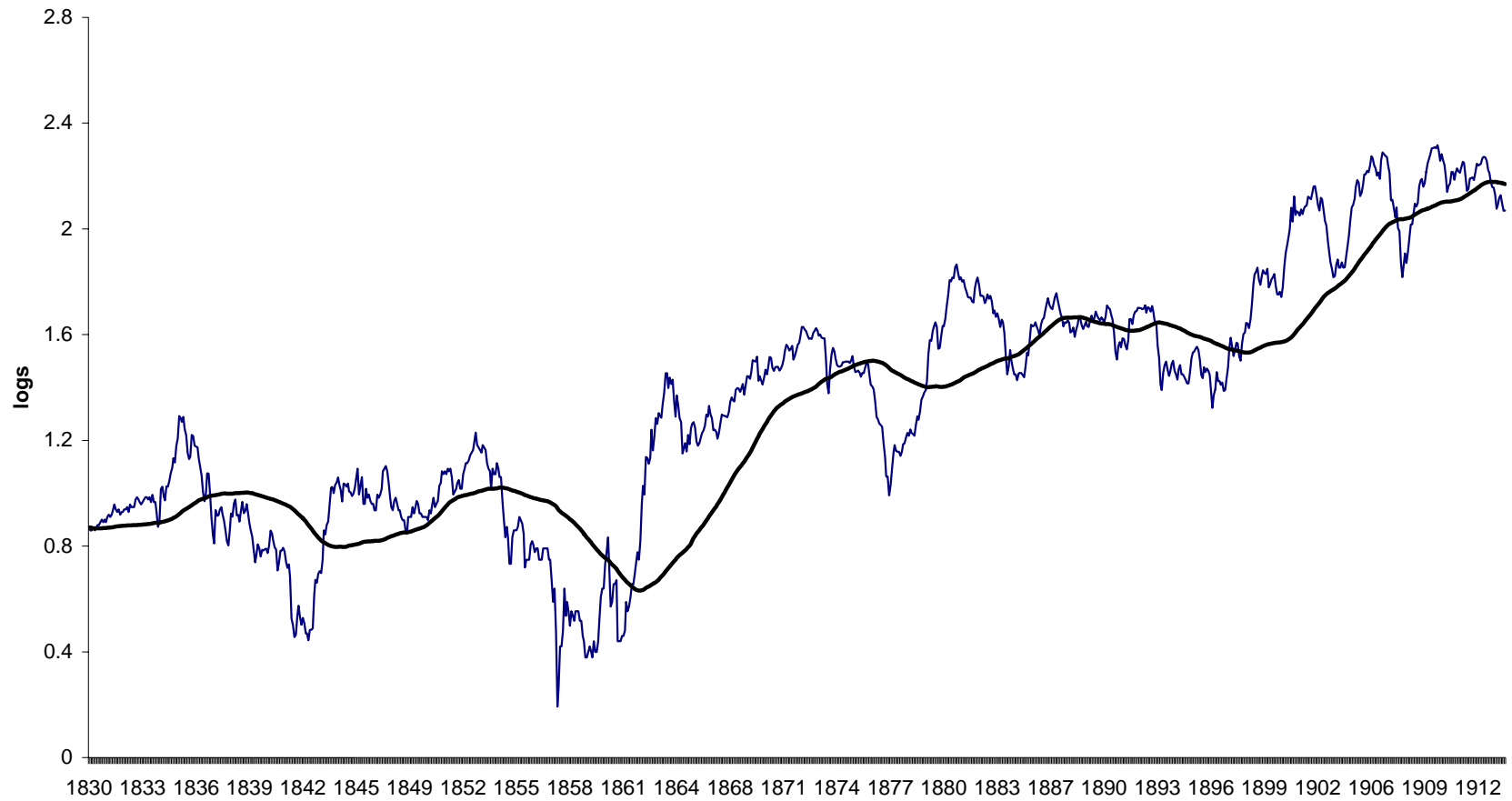


Figure 4: S&P Stock Price Index, 1922-2002
Actual vs. 9-Year Trailing Moving Average

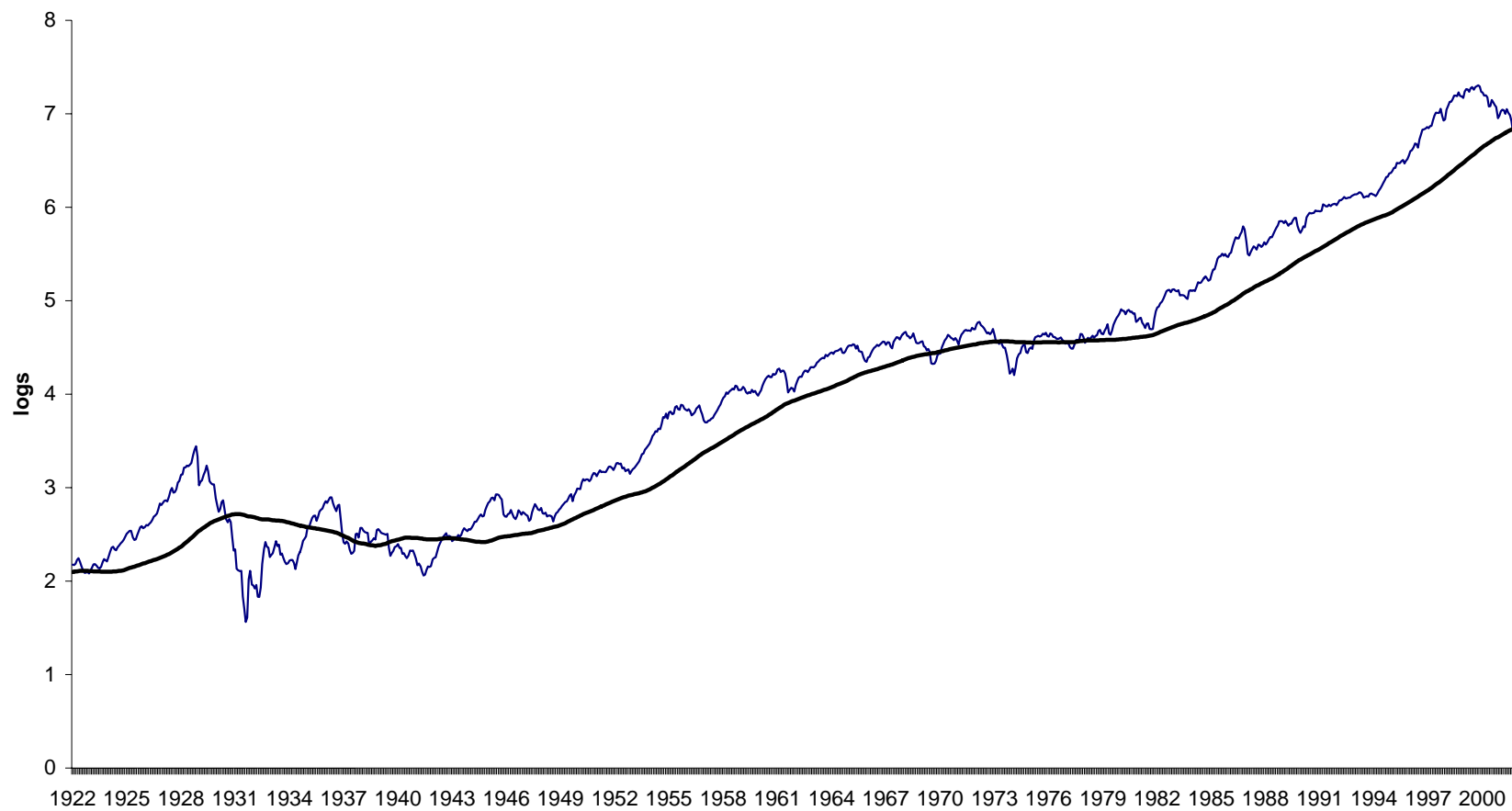


Figure 5: Real Stock Price and 9-Year Trailing Moving Average, 1924-2002

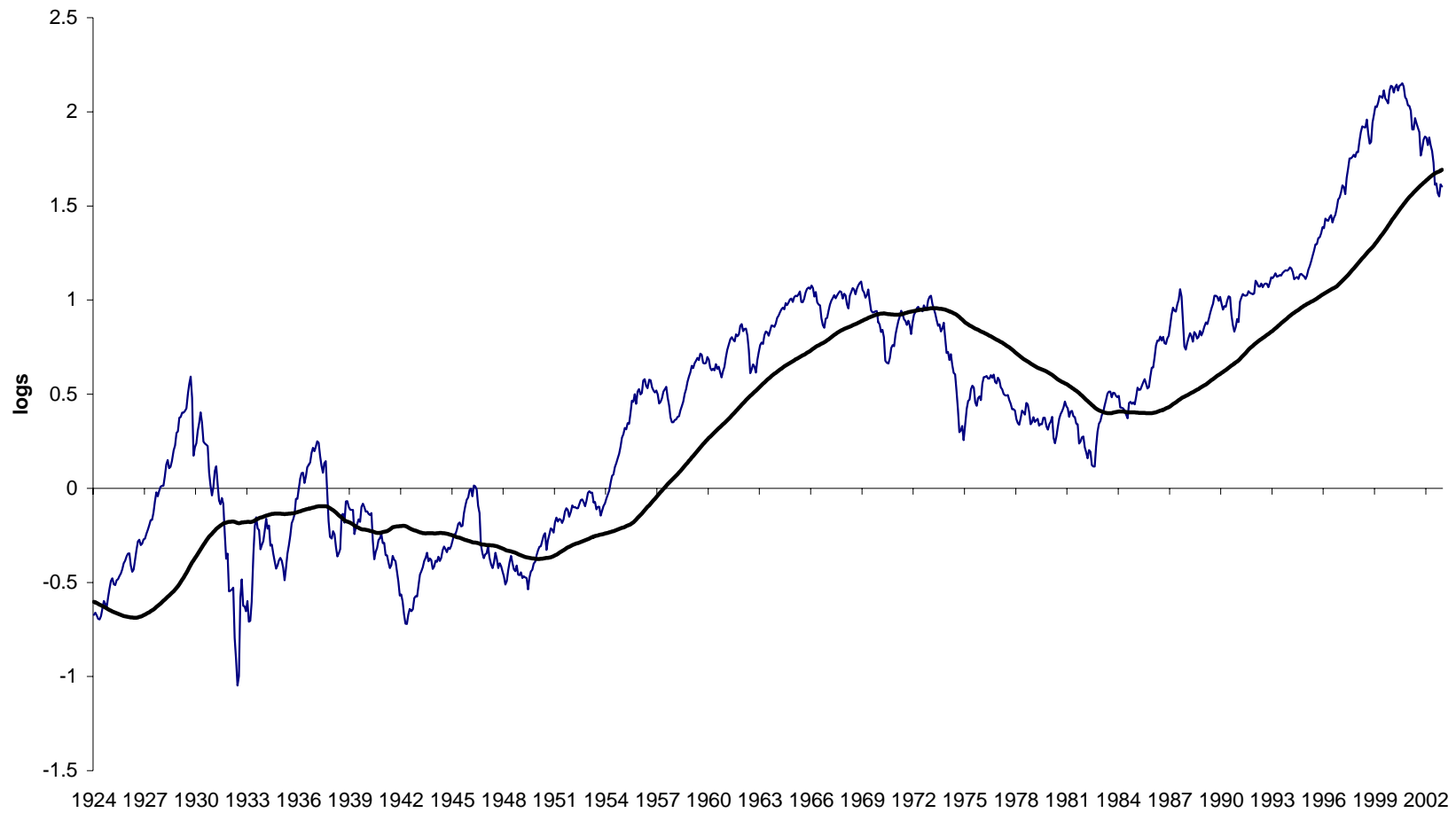


Figure 6: Real and Nominal Stock Price Index, 1860-66

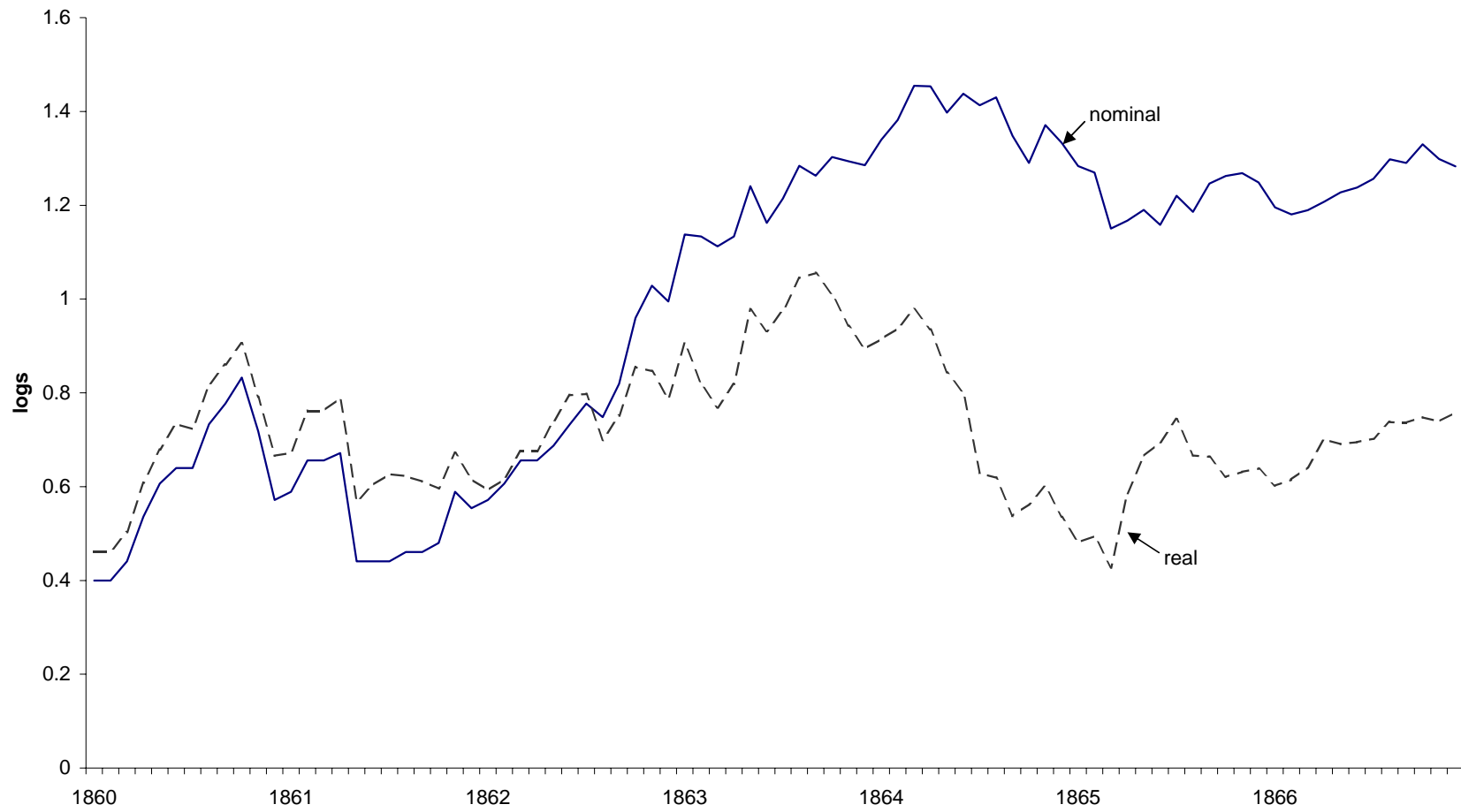


Figure 7: Stock Market and Commodity Price Indexes, 1866-1913

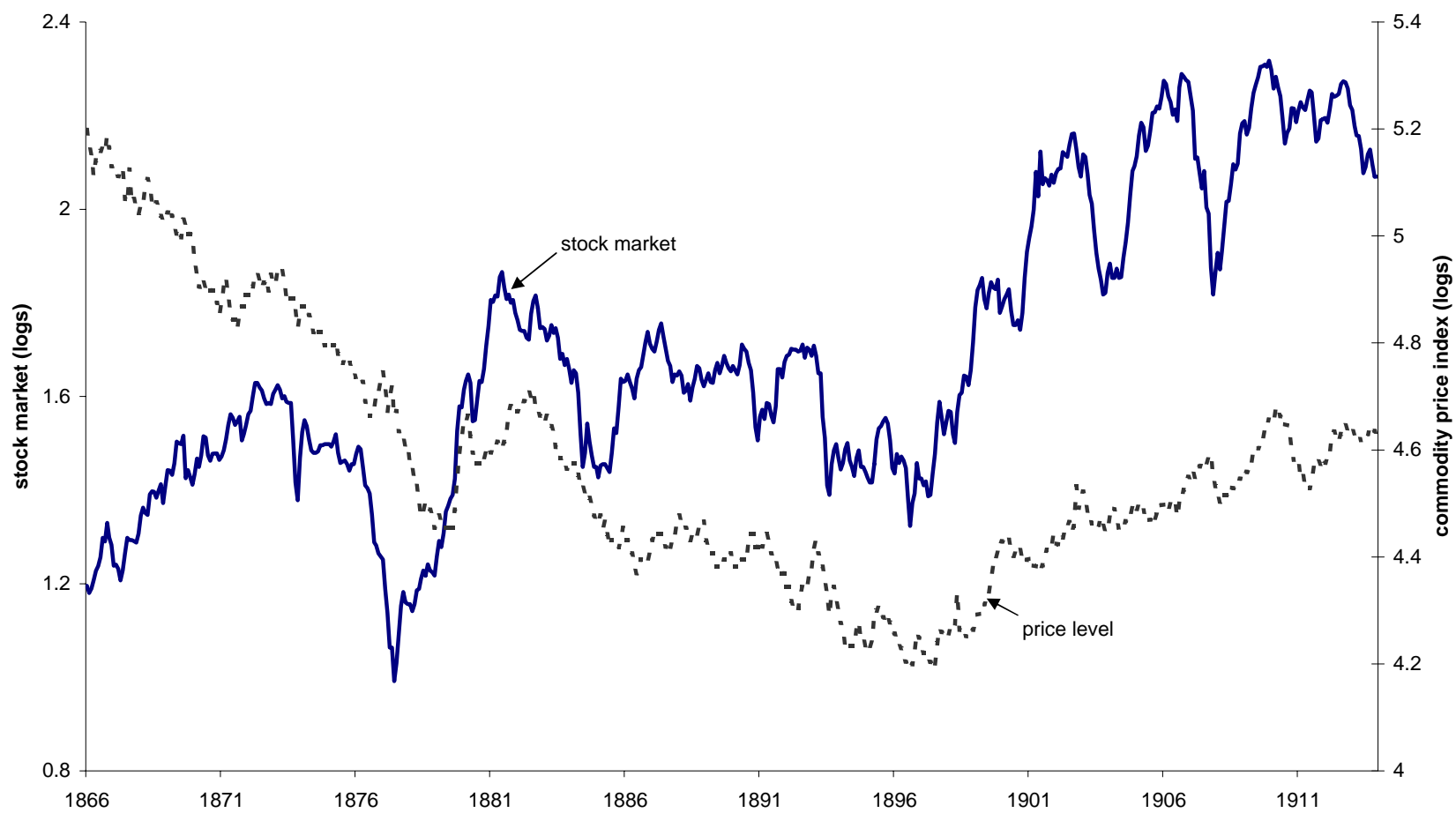


Figure 8: Stock Market Index and Real GNP, 1875-1913

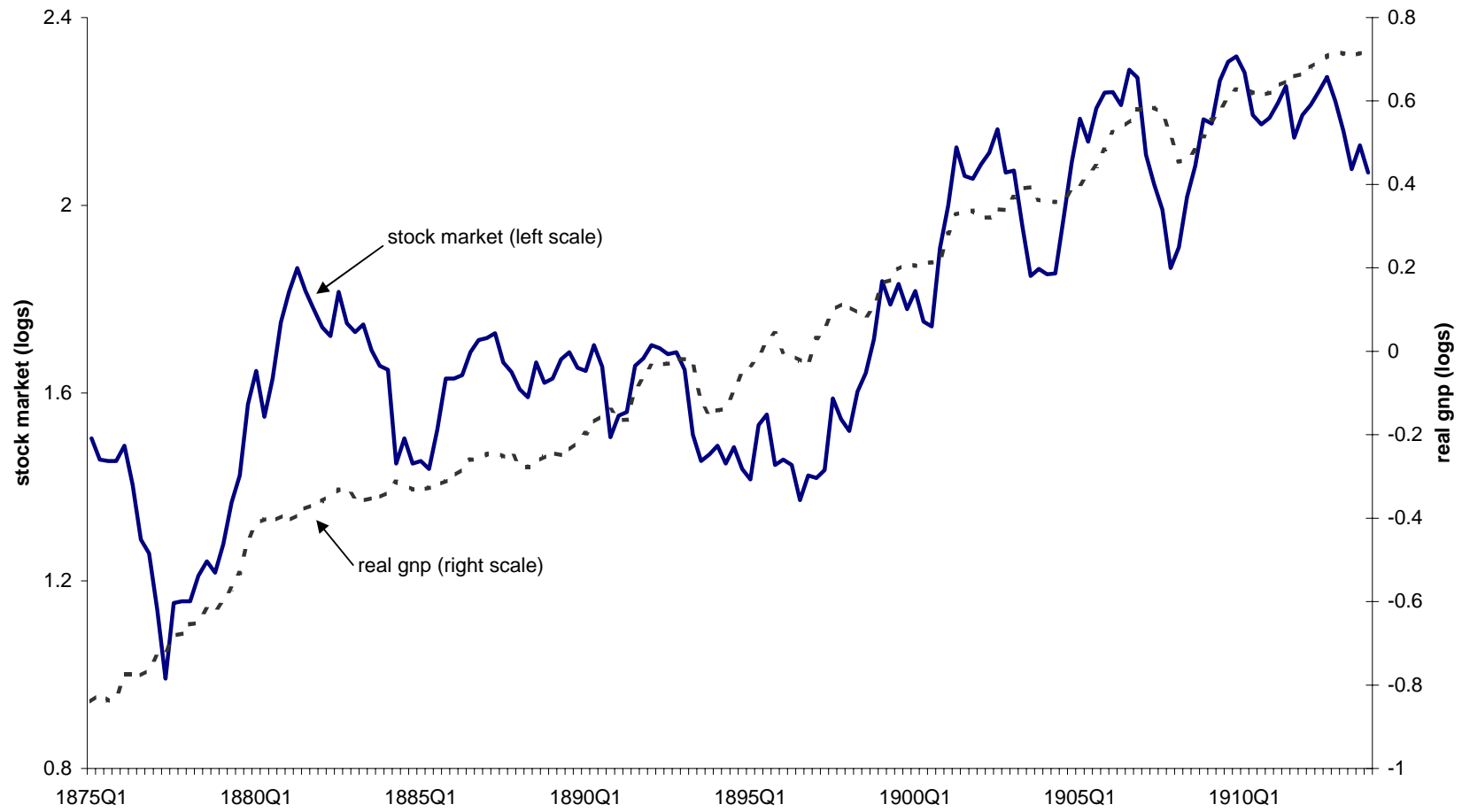


Figure 9: Stock Market Index and Labor Productivity, 1866-1913

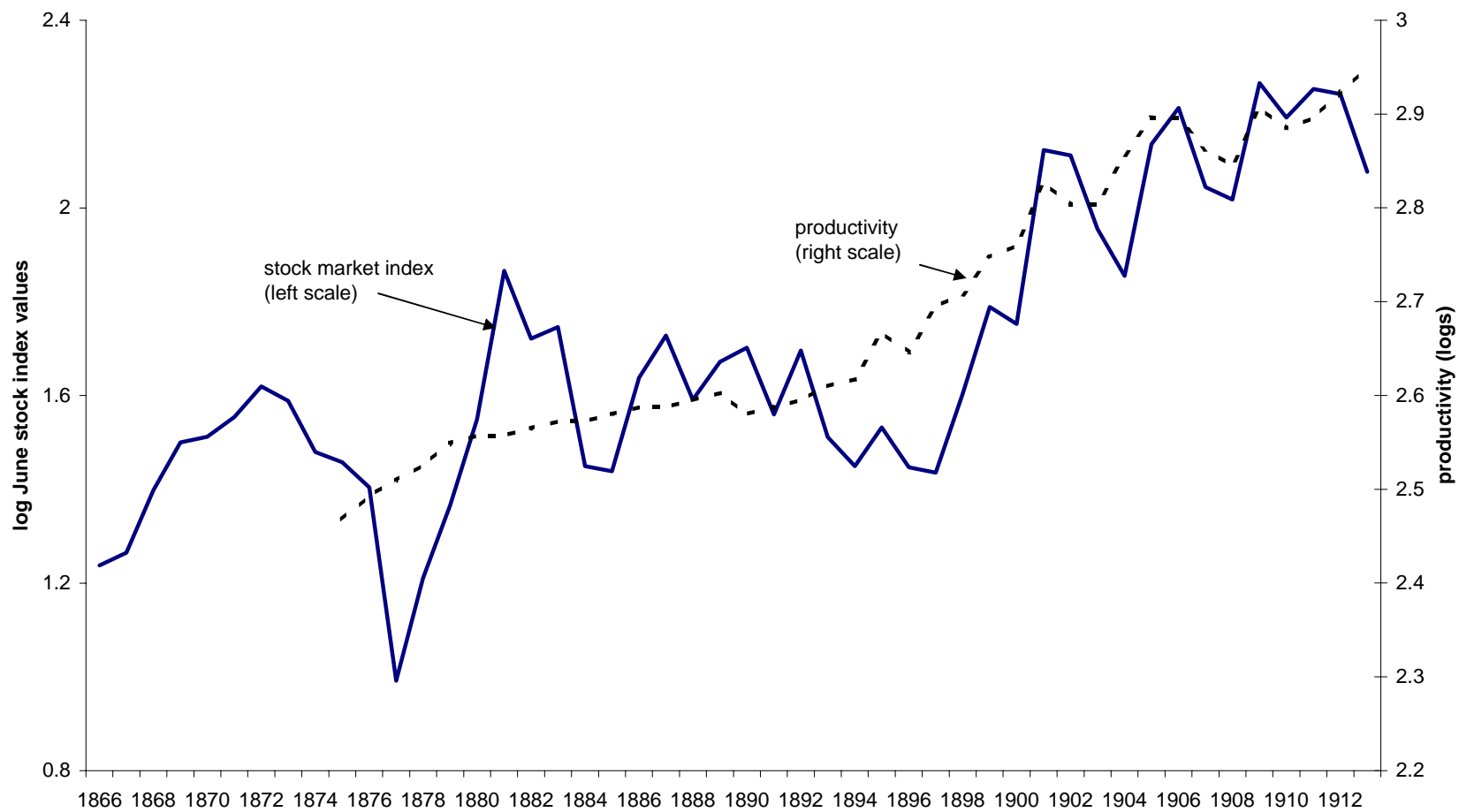


Figure 10: Stock Market Index and Money Stock, 1875-1913

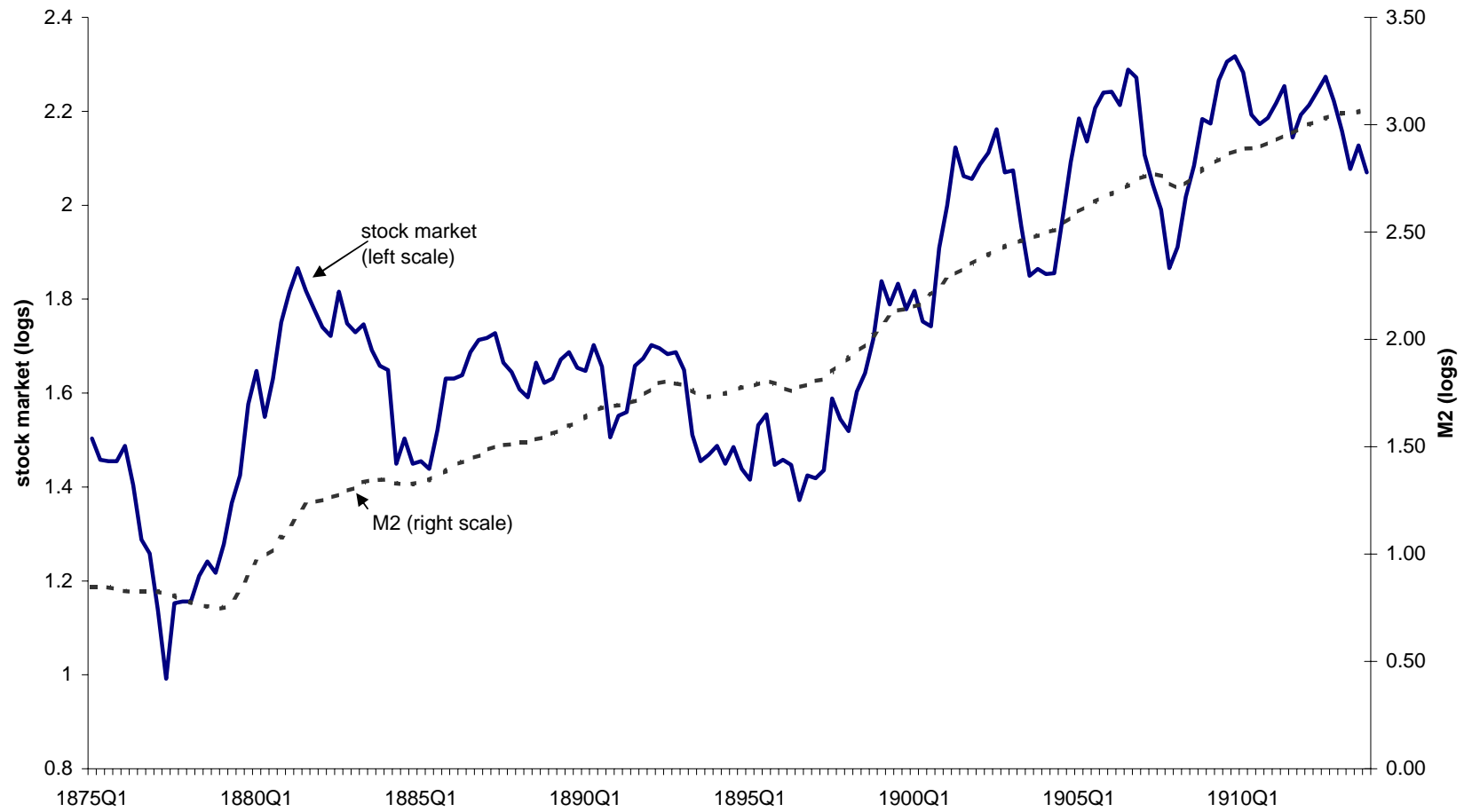


Figure 11: Stock Market Index and Bank Credit, 1866-1913

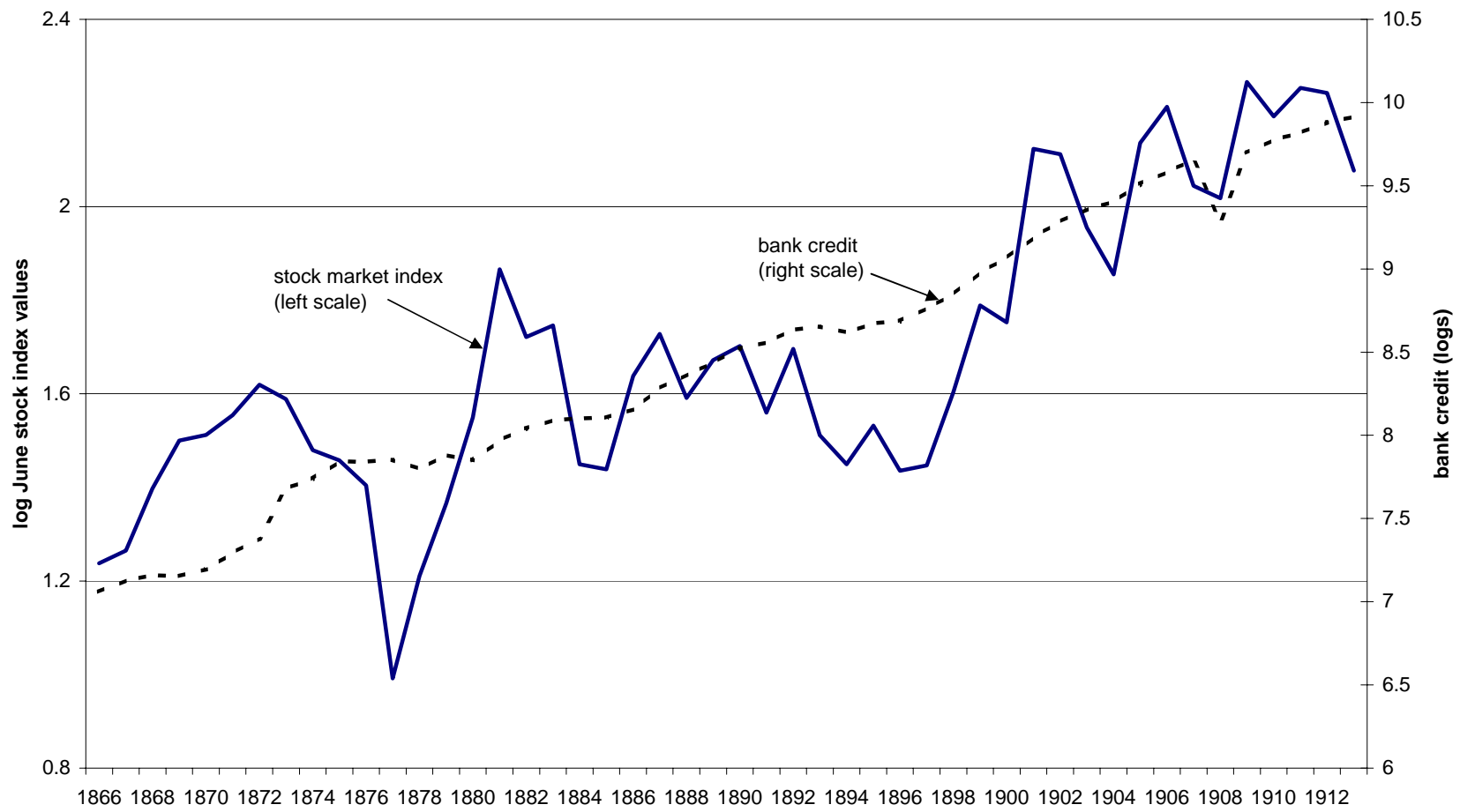


Figure 12: Stock Market Index and New York Stock Market Loans, 1880-1913

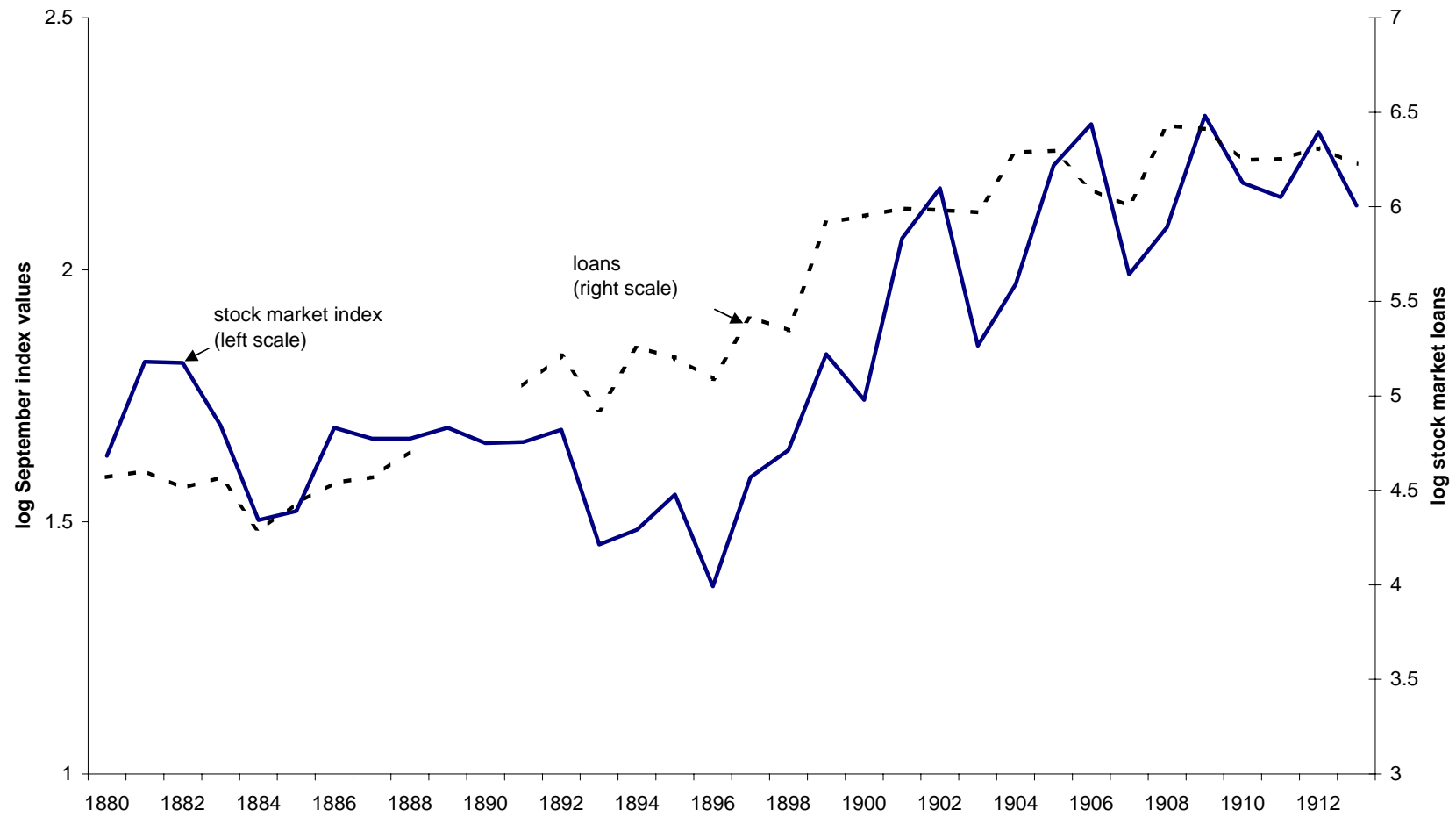


Figure 13: Consumer Price Index and Stock Price Index, 1915-40

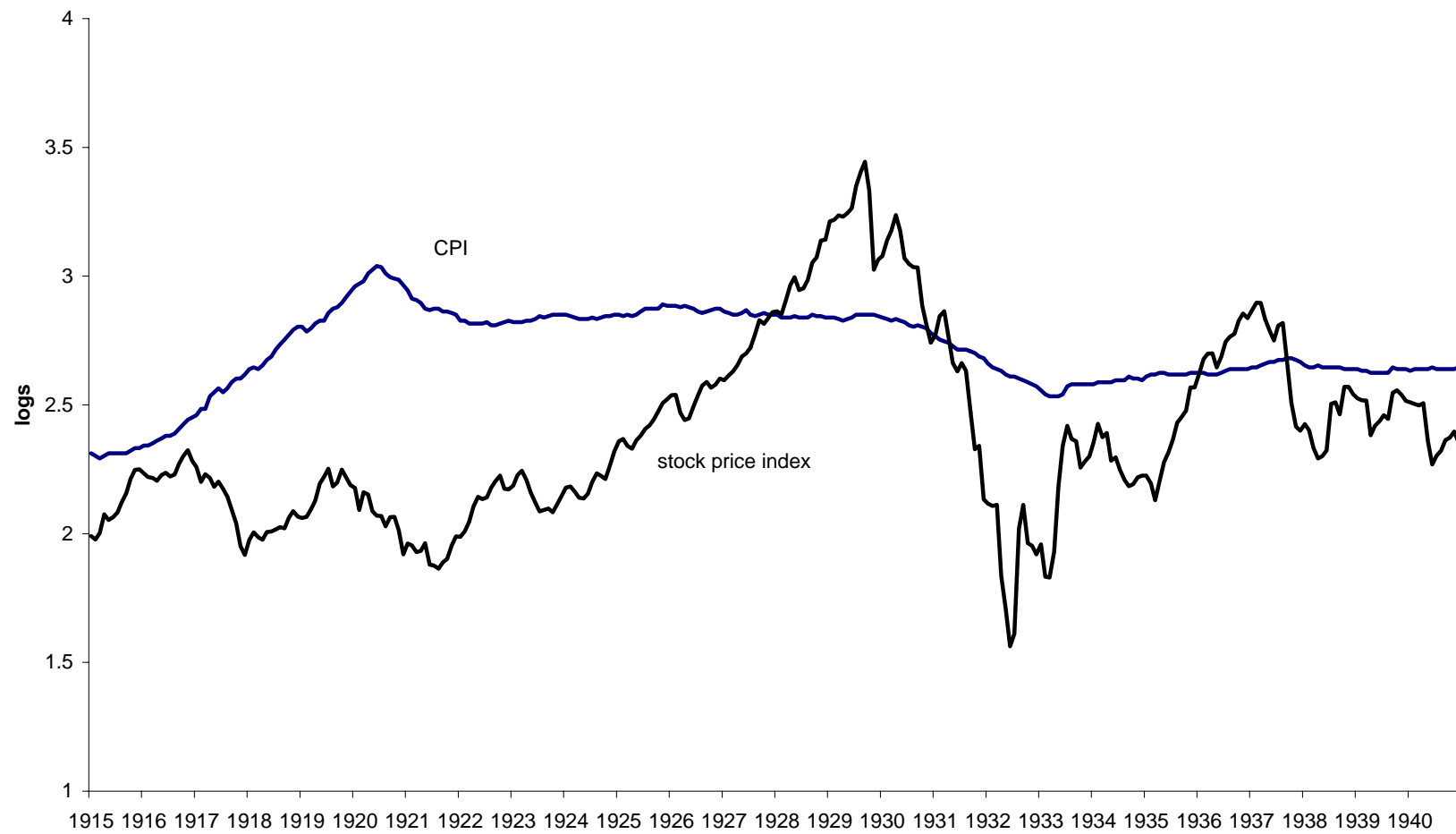


Figure 14: Stock Market and Real GNP, 1915-40

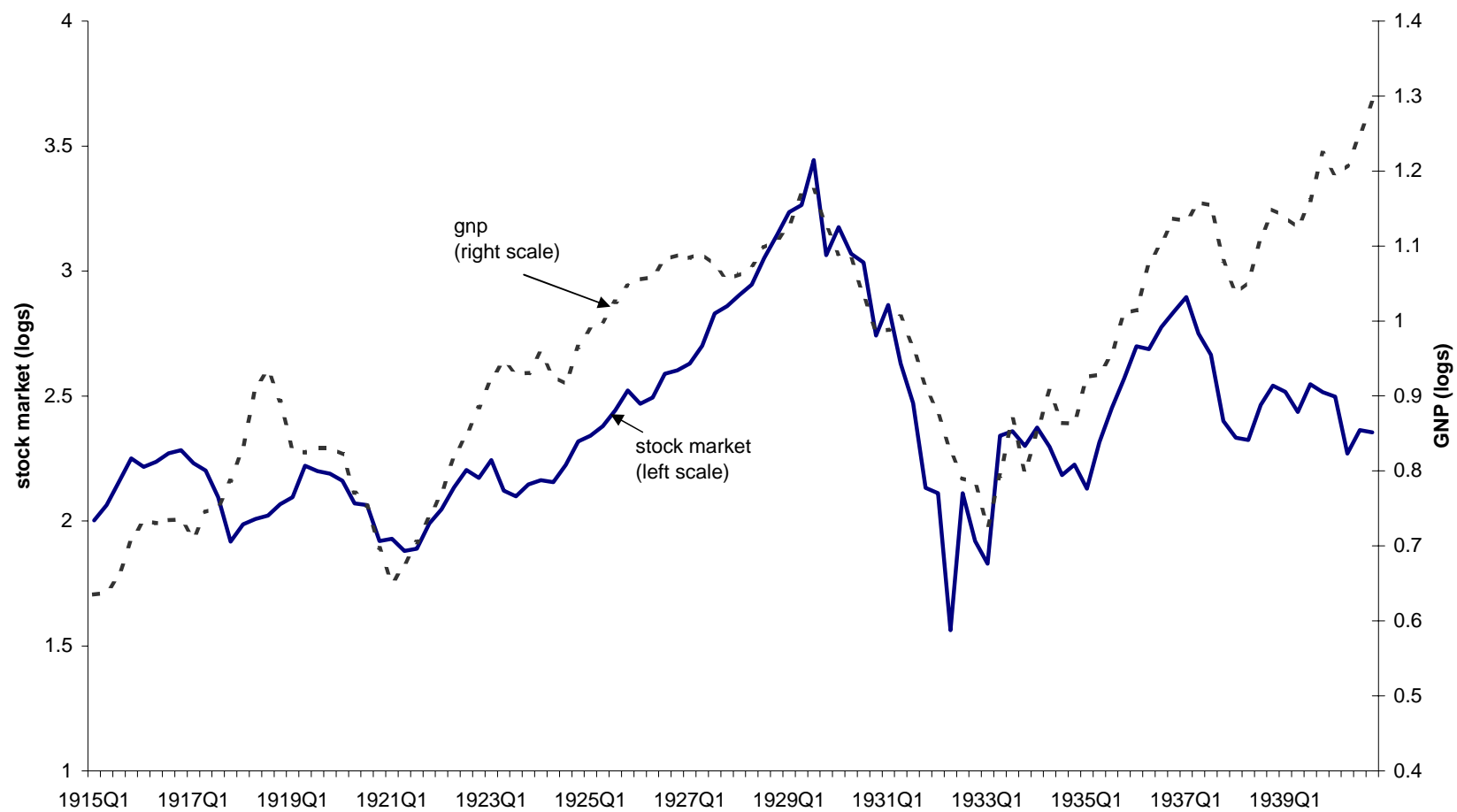


Figure 15: Industrial Production and Stock Price Index, 1915-39

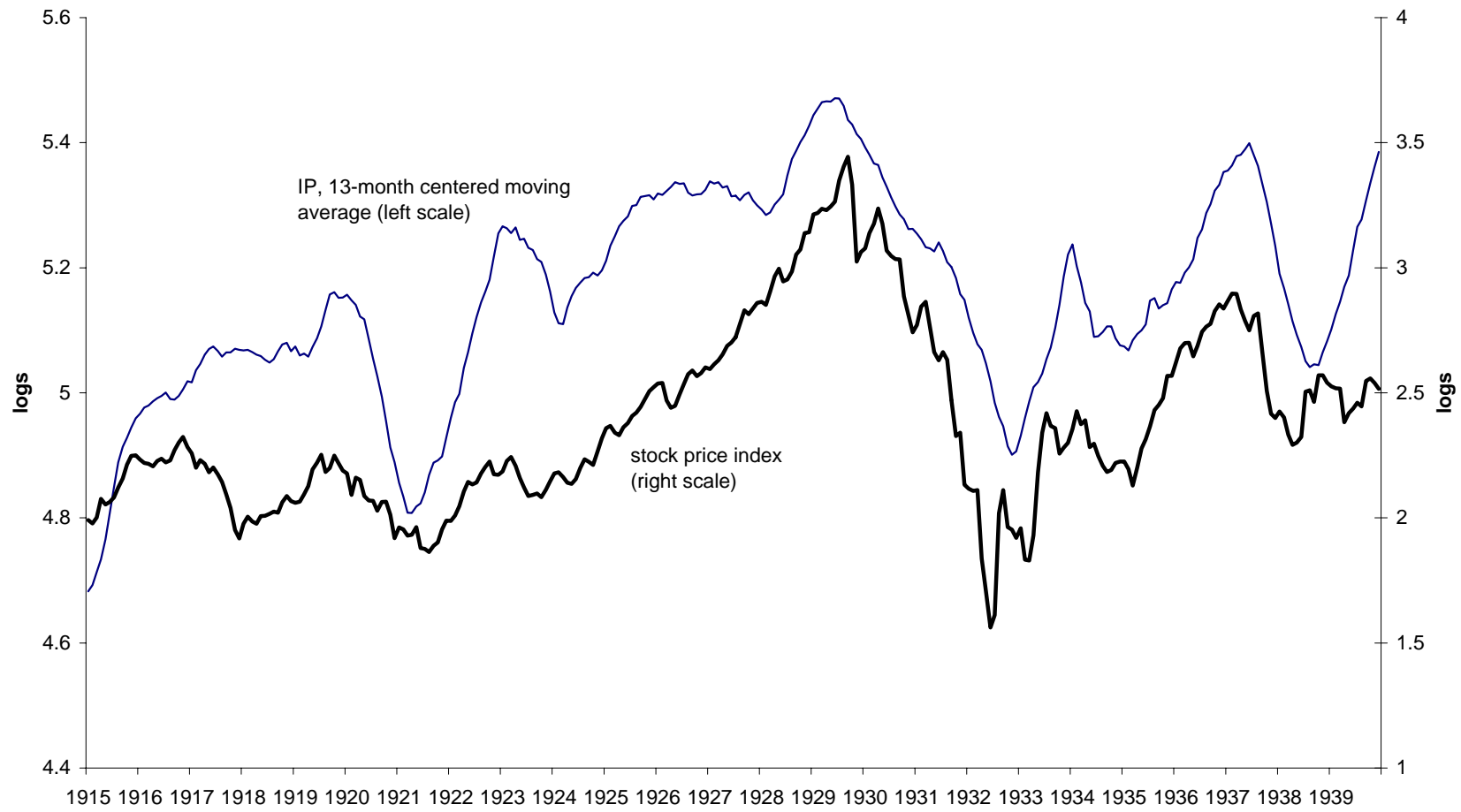


Figure 16: Productivity and Stock Price Index, 1889-1940

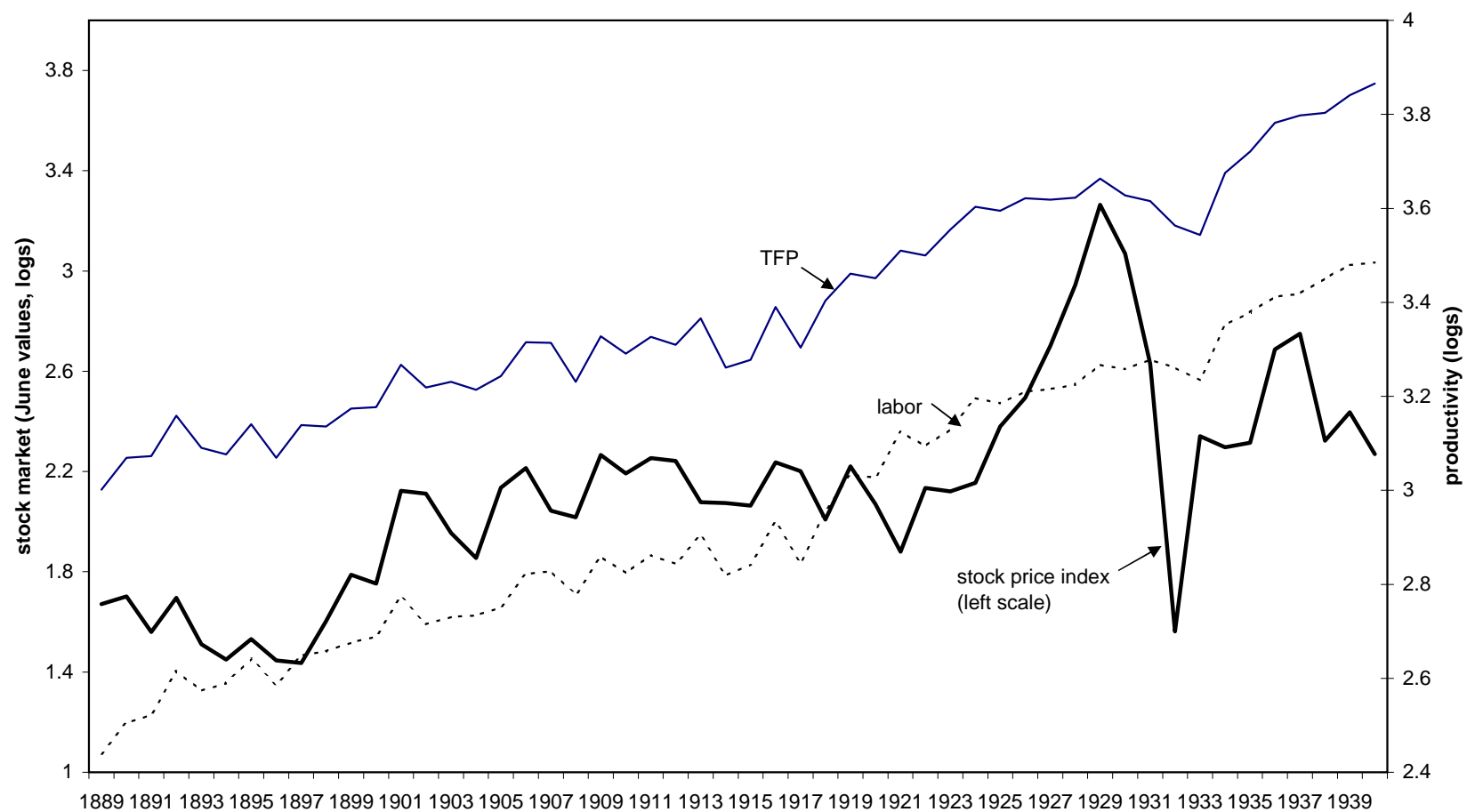


Figure 17: Stock Price Index and Brokers' Loans

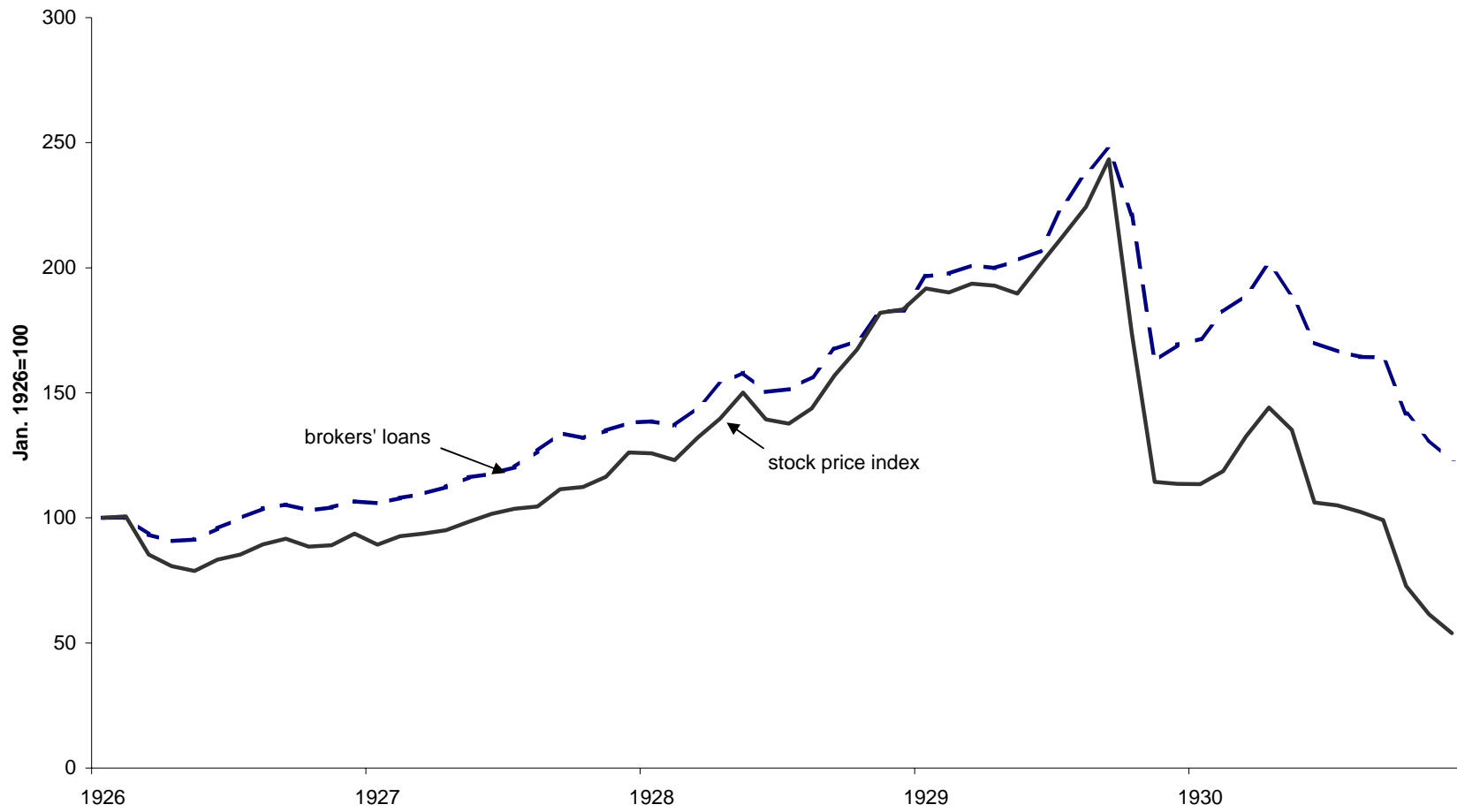


Figure 18: Stock Price Index and Real GDP, 1947-2002

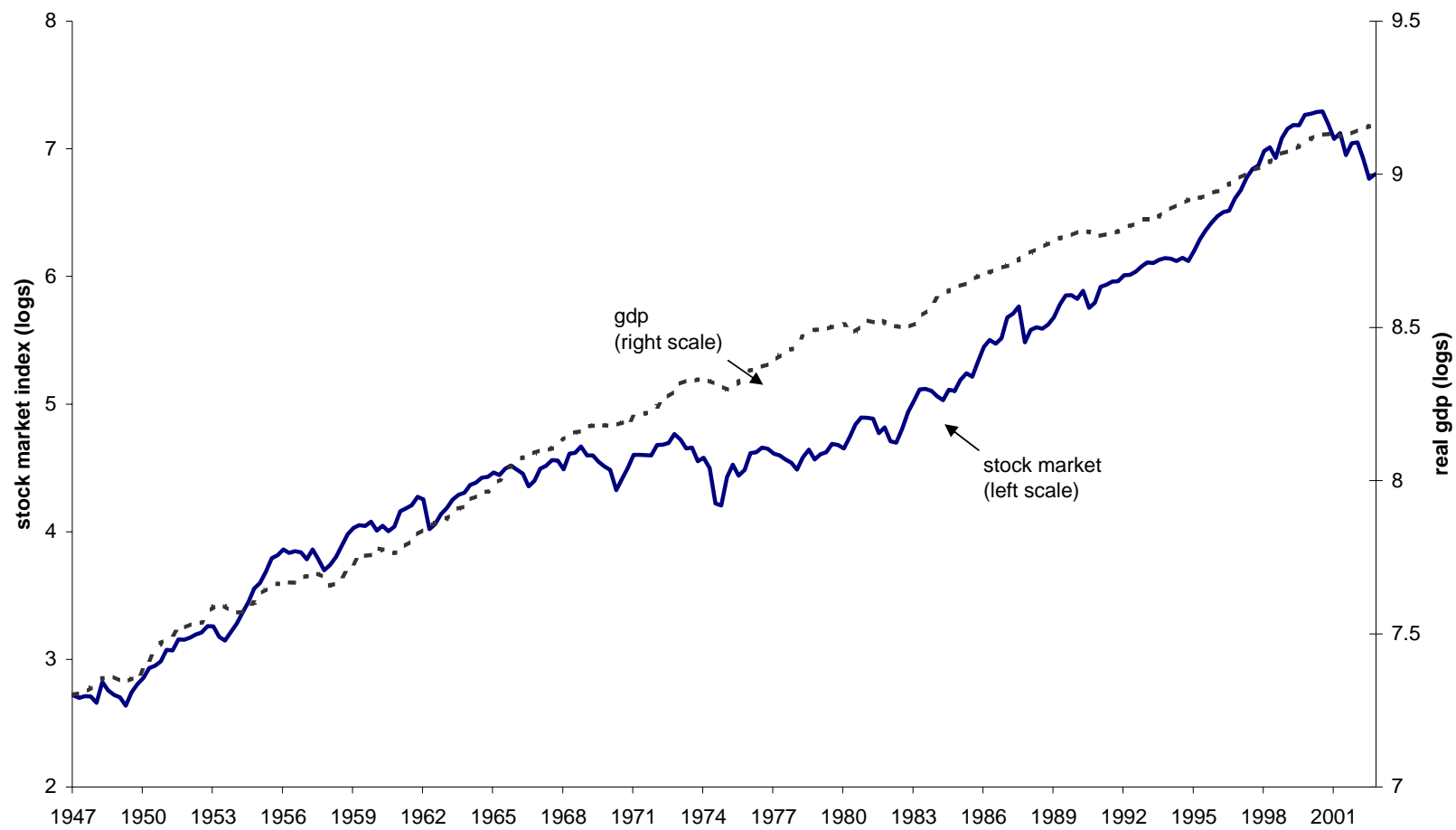


Figure 19: Stock Market Index and Index of Industrial Production, 1949-2002

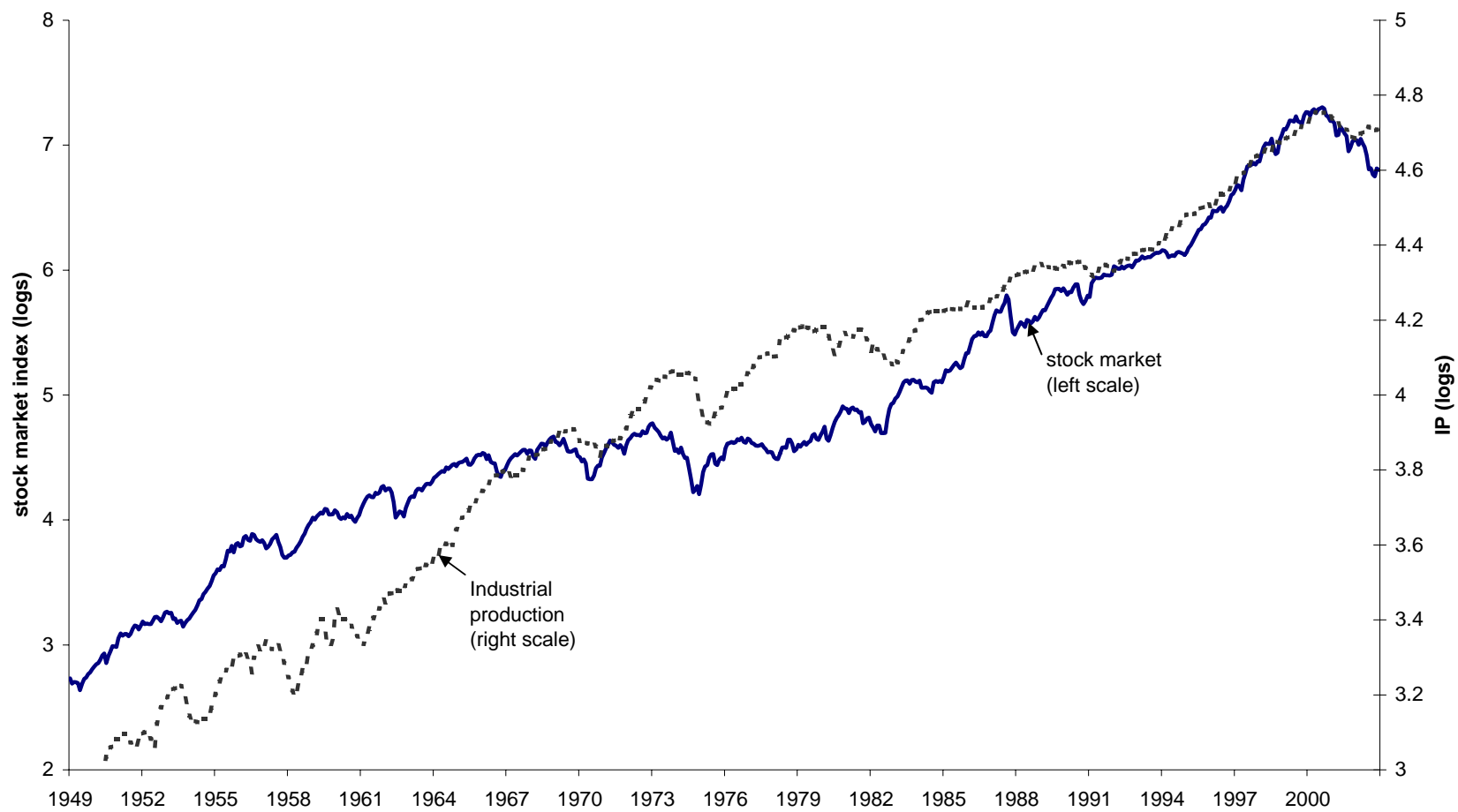


Figure 20: Stock Market Index and Labor Productivity, 1949-2002

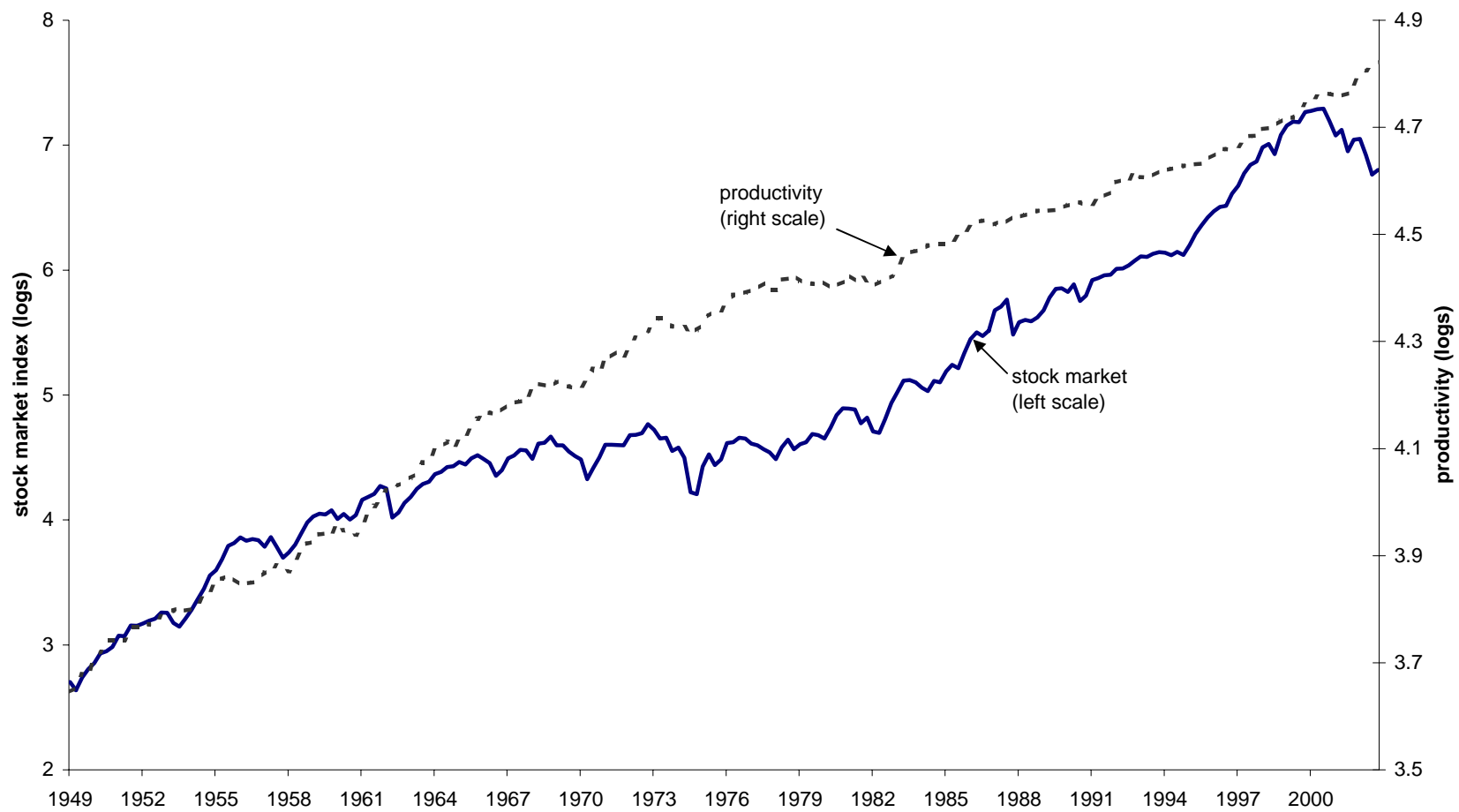


Figure 21: Stock Market Index and Consumer Price Index, 1949-2002

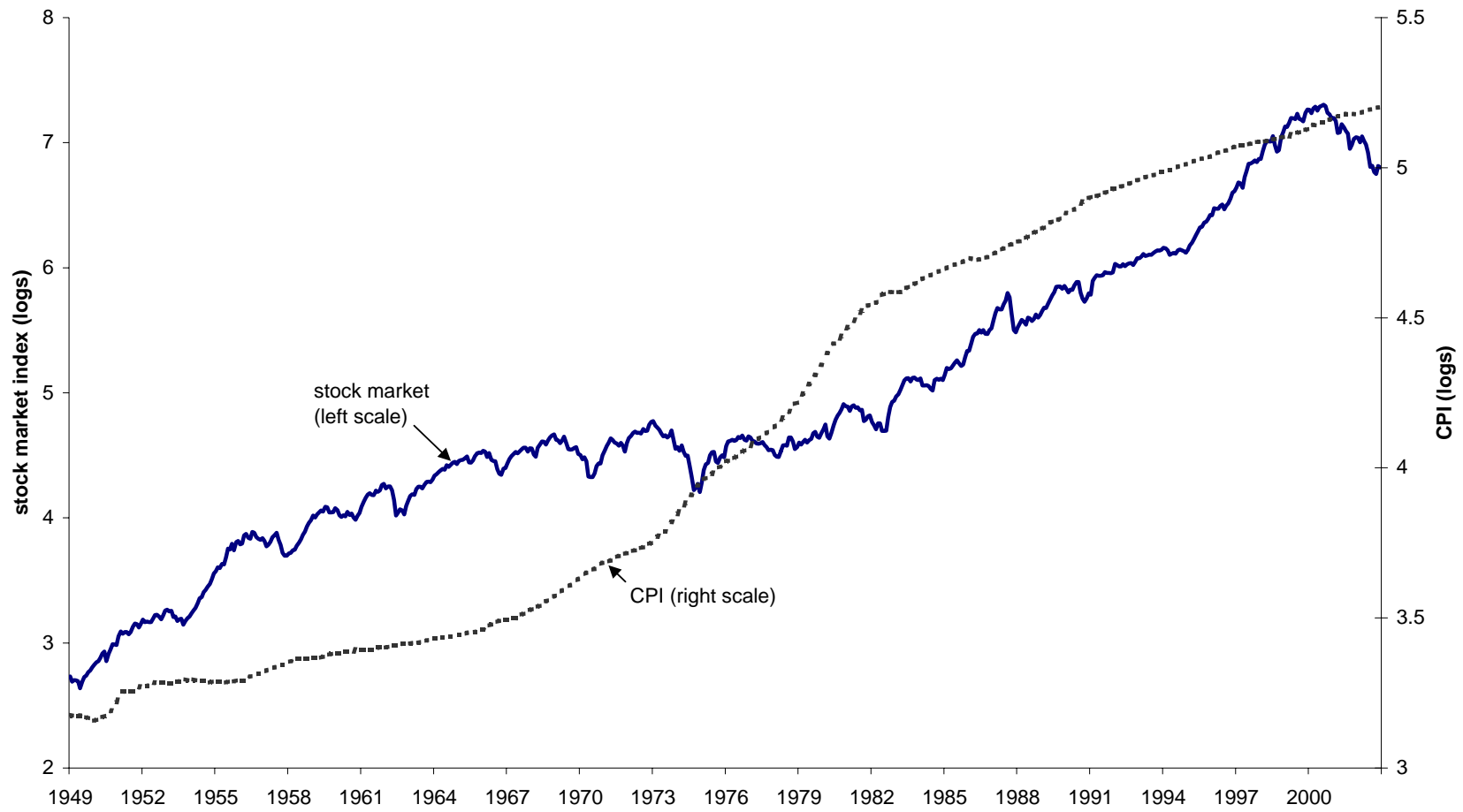


Figure 22: Stock Market Index and Money Stock, 1949-2002

