America's First Great Moderation

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Abstract

We identify America's First Great Moderation—a recession-free, 16-year period from 1841 until 1856 that represents the longest economic expansion in U.S. history. This period was characterized not only by high rates of economic growth and private capital formation, but also by relatively low financial and macroeconomic volatility. America's First Great Moderation occurred despite a low level of government spending and the absence of a central bank. We argue that America's First Great Moderation was led by a surge in durable goods production. We attribute the economic expansion to several factors: 1) adoption of general purpose technologies (ships, railroad, and telegraph); 2) increased financial market integration; 3) immigration and western expansion; 4) absence of major international conflict; and 5) low and stable tariff rates and constitutional reform. The first Great Moderation ended with the recession of 1857 and the outbreak of the American Civil War. Our empirical analysis indicate that the low-volatility states derived for both industrial production and stock prices during the First Great Moderation are similar to those estimated for the Second Great Moderation (1984-2007).

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I. INTRODUCTION

The Great Moderation is a term frequently used to describe the period of low macroeconomic volatility observed in the United States from 1984 until the onset of the global financial crisis beginning in 2007. The significant reduction in the volatility of real output over this period is also associated with less frequent and less severe U.S. recessions. Indeed, according to the National Bureau of Economic Research's monthly business cycle chronology, three of the four longest U.S. expansions following World War II occurred during the Great Moderation, including the 120-month expansion of the 1990s, commonly viewed to-date as the longest expansion in U.S. history.

Economists have generally offered one of three types of explanations for the marked decline in macroeconomic volatility between the mid-1980s and the late 2000s. Some have argued that improved monetary policy is a primary reason for the large drop in macroeconomic volatility (Stock and Watson, 2002; Bernanke, 2004). Other research has pointed to structural change that has made the economy less sensitive to shocks, including the shift of economic production from goods to services, improved management of inventory investment through information technology, and innovations in financial markets that promote intertemporal smoothing of consumption and investment (Blanchard and Simon, 2001; McConnell and Perez-Quiros, 2000; Davis and Kahn, 2008). Several studies have also pointed to “good luck,” or the absence of large shocks (i.e. oil shocks or limited large technology shocks) as important factors that help explain this period of unusually low business cycle volatility. While the sources of the Great Moderation certainly remain open to debate and require future research, the conventional wisdom is that there has only been “one” Great Moderation in U.S. history.

We break new ground in this paper by identifying America's *First* Great Moderation. From 1841 until 1856, the United States experienced a 16-year economic expansion that was characterized by high economic growth rates (especially for durable goods and other private investment) similar in magnitude to that of modern-day China. During this period, economic and financial market volatility was significantly lower as well. Our results are based on an examination of both annual times series on industrial production, agriculture, as well as higher-frequency monthly data for commodity prices, stock prices, and interest rates. Our preliminary results suggest that America's First Great Moderation was the result of the introduction of general purpose technologies (i.e., clipper and steam ships, railroads, and telegraph), immigration and western expansion, increased financial market integration, the absence of global warfare, lower and stable tariffs, and state constitutional reforms that created incentives for better government and the private sector.

The paper begins with a brief history of pre-World War I business cycles, especially in the context of the pre-Civil War U.S. economy. We then compare the First Great Moderation in economic and financial performance with other periods in the pre-World War I period. We employ Markov-switching models to assess the statistical significance of the decline in macroeconomic and financial market volatility that we observe during the First Great Moderation period relative to the fuller pre-World War period.

We also compare the patterns and characteristics observed in our annual IP data and monthly stock market data during First Great Moderation with that of similar data for the Second Great Moderation that ran from the mid-1980s until the onset of the global financial crisis in 2007. Notably, our Markov-switching models reveal that the low-volatility, high-growth states derived for the First Great Moderation are of similar magnitude and statistical significance to those estim ated for the Second Great Moderation using comparable economic and stock-market data. Finally, we contemplate various factors—both structural and fortunate—that help explain the First Great Moderation.

II. EARLY U.S. BUSINESS CYCLES & THE FIRST GREAT MODERATION

A. CONVENTIONAL WISDOM

Our knowledge of early U.S. business cycles and nineteenth-century economic and financial market volatility has long been impaired by a lack of reliable and comprehensive data, especially prior to the Civil War. Today, the NBER does not officially record monthly business cycle peaks and troughs in U.S. economic activity prior to December 1854 for precisely this reason.[1]

Qualitatively, the mid nineteenth-century U.S. economy has long been characterized as having undergone tremendous structural change and periods of rapid growth. At the same time, however, the mid nineteenth-century U.S. economy is also believed to have spent nearly <u>every other year</u> in recession according to Thorp's *Business Annals* (1926) and Burns and Mitchell's *Measuring Business Cycles* (1946), two seminal NBER studies that laid the groundwork for the official monthly NBER business-cycle dates. Classic treatments of the nineteenth-century financial markets, such as Kindleberger (2000), refer to a number of financial panics during the late 1830s, 1840s, and 1850s that were believed to have led to significant recessions, deflation, and, at times, depressions. Indeed, we would argue that such characterizations are taken as facts in contemporary economic and history textbooks. At first glance, such descriptions would not seem consistent with a great moderation.

[1] See, for instance, Moore and Zarnowitz (1986).

Subsequent research, however, has questioned certain aspects of the conventional wisdom surrounding these perceived business-cycle properties, at least for the post-Civil War American economy. Romer (1994) demonstrates that, contrary to modern NBER practices, the monthly peaks and troughs between 1884 and 1927 were derived using detrended data that dated pre-WWII peaks earlier and troughs later vis-à-vis post-WWII turning points derived from data in levels. Watson (1994) shows that when post–WWII cycles are based solely upon nominal price data for commodities, crude materials, and financial instruments, subsequent differences in cyclical properties between the postbellum pre–World War I and post-WWII periods appear small.

Naturally, the results of Romer and Watson raise questions regarding the perceived high level of business-cycle volatility and high frequency of recessions during the pre-Civil War period, whose accounts were based on even scantier data.

B. GREAT MODERATION EMERGES FROM BETTER DATA

Our primary measure of the business cycle during America's First Great Moderation is the Davis (2004) quantity-based industrial production index, the most reliable broad measure of U.S. real output for the pre-Civil War period. The Davis index is comprised of 43 annual components in the manufacturing and mining industries that are consistently defined from 1790 until World War I. It is a comprehensive industrial output measure in so far as its components directly or indirectly represent close to 90 percent of the value added produced by the U.S. industrial sector during the nineteenth century. Changes in the Davis IP index reflect only fluctuations in real output.

Figure 1 charts logarithmic growth rates in the Davis IP index for the 1790-1915 period. In the figure we have highlighted the 1841-1856 period which we will call America's First Great Moderation. Table 1 compares the average growth rate in real output (as defined by the annual Davis IP index) during the First Great Moderation (1841-1856) with the sample periods before and after its occurrence.

Based on the annual Davis IP series, we find that economic growth averaged more than eight percent per annum during the First Great Moderation, compared to an average growth rate of approximately five percent for the rest of the pre-WWI period. Overall, the growth rate of IP was sixty percent higher on average during the First Great Moderation than in either of the preceding or subsequent sample periods.

The high rate of economic growth in industrial production was accompanied by low economic volatility. The standard deviation of economic growth was 5.4 percent between 1841 and 1856. For the antebellum period before the start of the First Great Moderation, the standard deviation of industrial production growth averaged 6.8 percent. The standard deviation of industrial production growth averaged 7.6 percent in the post-bellum period. The volatility of economic production was at least 20 percent lower during the First Great Moderation.

We also employ the coefficient of variation (standard deviation divided by the mean) to control for the fact that the average growth rate in industrial production was significantly higher during the First Great Moderation. Table 1 shows that the coefficient of variation for industrial production during the First Great Moderation was .668 compared to 1.366 for the antebellum period and 1.51 for the post-bellum period. This suggests that macroeconomic volatility was at least 50 percent lower during the First Great Moderation than other periods. The basic summary statistics suggest that economic growth was higher and macroeconomic volatility significantly lower during the First Great Moderation.

C. LONGEST EXPANSION IN U.S. HISTORY

We can also employ the Davis IP index to evaluate the reliability of Thorp's annual business cycle dates during the First Great Moderation. Specifically, we construct an alternative set of annual peaks and troughs between 1796 and 1914 as defined by absolute rises and declines in his annual IP index. A comparison of the NBER annual business-cycle chronology with this alternative set of peaks and troughs for the entire 1800s is reproduced from Davis (2006) in Table 2.

The resulting Davis chronology alters more than 40 percent of the peaks and troughs, and removes those cycles long considered the most questionable by various economists, including Friedman and Schwartz (1963), Temin (1969), and Zarnowitz (1992). As a result, the new annual peaks and troughs reduce the average frequency of nineteenth-century recessions from nearly every other year in the NBER set, to one out of five years. By removing dating inconsistencies from the conventional scale, the new peaks and troughs systematically double the mean duration of nineteenth-century expansions, while they truncate the average length of contractions by one-third. As a result, Davis (2006) finds that the *proportion of time that the U.S. industrial sector has spent in recession has remained fairly constant over the past two centuries.* This claim would suggest the possibility that the pre-Civil War economy may have experienced a Great Moderation after all.

Most remarkably, the alternative chronology in Table 2 reveals that the period from 1841 until 1856 was a 16-year, recession-free period, the longest U.S. economic expansion in American history. This would seem to qualify as America's First Great Moderation.

Admittedly, this last statement is a bold one, and we would agree that it requires greater empirical analysis, verification from other sources, and a deeper understanding. Two natural and immediate questions may include:

(1) Since this claim is based on annual IP data, is it corroborated by other statistics?, and

(2) How would America's Second Great Moderation look if judged using the same annual IP data as in the First? We address the second question first.

E. COMPARING TWO GREAT MODERATIONS

E1. Recessions, output gaps and growth recessions

We can get a general sense of the magnitudes of the two Great Moderations by creating trailing growth-to-volatility ratios in an annual IP index that spans <u>both</u> Great Moderations. We accomplish this by creating one extended annual IP series from 1790 through 2010 according to the procedures recommended in Davis (2004). Specifically, we can ratio-splice the annual Davis IP index to the Miron-Romer IP index in 1916 before ratio-splicing to annual values of the Federal Reserve IP index beginning in 1919. While we stress that we cannot conduct a formal statistical volatility break-point test on this long series given changes in series comparability and reliability over time, the *signal-to-noise ratio* in Figure 2 allows us to visually gauge changes over rolling 20-year periods.

Clearly, Figure 2 suggests that the combination of high IP growth and lower IP volatility during America's first Great Moderation—expressed as a trailing growth-to-volatility ratio (or, signal-to-noise ratio)—appears to have been as impressive in scale as America's second (modern-day) Great Moderation when measured against similar annual IP index data from the Federal Reserve.

We can also examine the business-cycle properties in the Second Great Moderation by dating recessions in a similar manner as was done in Table 2—that is, simply by declines in the annual IP index over the 1980-2010 period. As can be seen in Table 3, the recessions of 1991, 2001, and 2008-2009 clearly show up in the Federal Reserve's annual IP data.

We can also identify so-called "growth recessions" in either of the Great Moderation periods by calculating deviations from the trend in the annual log IP series (i.e., an "IP gap") of the Davis and Federal Reserve series, respectively. To span most definitions of fluctuations versus trends, we estimate trends two ways: (1) a one-sided, backward-looking Hodrick–Prescott (HP) filter, and (2) a two-sided HP filter that possesses look-ahead bias.

Table 3 shows that while America's First Great Moderation did not involve an outright decline in real output, the U.S. economy did experience several so-called "growth recessions" at times when real output increased at a below-trend pace. Important examples during the First Great Moderation include the early 1840s following the modest deflationary recovery from the Panic of 1839, as well as respites from otherwise strong growth in the late 1840s and the mid-1850s, periods that Thorp misclassified as recessions (see also Davis (2006)).

For the Second Great Moderation, similar growth recessions persist through roughly half of the 1984-2007 period. Using a one-sided real-time measure of deviation from trend, the U.S. economy has not grown above trend since the year 2000.

E2. Markov Models for Annual IP Growth

In this section, we estimate Markov regime-switching models to assess the statistical significance of America's First Great Moderation. We estimate the regime-switching models using time series of different frequencies: logarithmic growth rates in annual IP growth (1792-1914), and nominal stock returns (1826-1914). We then compare our results to America's Second Great Moderation using similar data and techniques for the post-WWII period.

Our primary specification is a univariate autoregressive non-linear Markov-switching model with two regimes and a constant mean (i.e., Hamilton, 1989). However, in our model, we allow the variances and autoregressive parameters to all vary between regimes. In particular, we assume that annual IP growth, Δy_t, depends on two underlying and unobserved states, V_t , $t = 1, 2$, such that:

$$\Delta y_t = \mu_{V_t} + \phi_{V_t} \Delta y_{t-1} + \varepsilon_t, \qquad \varepsilon_t \sim N\left(0, \sigma_{V_t}\right). \tag{1}$$

The results of this estimation for annual IP growth over the entire pre-WWI sample are reported in Table 4. The columns in the top panel of the table indicate the state of the variance parameter. The results show that industrial production grew at the rate of 4.3 percent. The standard deviation of the low volatility state was approximately seventy percent less than the high volatility state. The probability of remaining in a low volatility state is not statistically different from remaining in a high volatility state. The expected duration of a low volatility state is three years compared to slightly more than four years for the high volatility state. In the modern period, the standard deviation of the low volatility state was almost 1/30th the size of the high volatility state.

Panels A and B of Figure 3 shows the smooth state probabilities from the Markov-Models for the annual growth rates for the Davis and Federal Reserve Board Indices. The pre-WWI data suggest that a First Great Moderation occurred during the 1840s and 1850s with the probability of a low volatility state rises to nearly 90 percent in the late 1840s/early 1850s. In a similar fashion, the probability of a low volatility state is highest during America's Second Great Moderation. Again, the probability of a low volatility state peaks during the mid to late 1990s and early 2000s. Figure 4 compares the First Great Moderation with the Second Great Moderation by plotting the ratio of the conditional mean to the conditional standard deviation for the growth rate of the two industrial production series. The growth rate of the two IP series shows a spike in the ratio that coincides with a Great Moderation in the pre-WWI era as well as one in the modern era.

D. FIRST GREAT MODERATION IN STOCK MARKET DATA

D1. Higher Frequency Dataset

Importantly, we corroborate our annual IP-based results using *monthly* stock price data. Specifically, we employ Goetzmann, Ibbotson, and Peng's (2005, hereafter GIP) pre-CRSP era stock index from 1815-1913 to examine stock returns and stock volatility during the First Great Moderation. The GIP pre-CRSP era NYSE series is now widely viewed as the most comprehensive monthly stock market series for the nineteenth century. Panels A and B of Figure 5 show monthly stock returns for the First and Second Great Moderations. The periods of reduced macroeconomic volatility are shaded in the two graphs.

Table 5 shows that the average (Arithmetic) stock returns averaged .3 percent per month during the Great Moderation. Stock returns for the GIP Index was negative in the antebellum period and averaged .18 percent per month in the post-bellum period. Stock volatility, measured as the standard deviation of stock returns, averaged 3.4 percent during the First Great Moderation. Stock volatility averaged 3.9 percent per annum in the antebellum period before the onset of the First Great Moderation. In the post-bellum period, stock volatility averaged 3.9 percent. Stock volatility is more than 20 percent lower than the non-Great Moderation antebellum period and more than 10 percent lower in the postbellum period. The coefficient of variation for stock returns during the First Great Moderation, 11.44, was at least eighty percent less than the coefficient of variation in the antebellum period and more than 50 percent lower than the post-bellum period. Overall, we find that stock returns were more than 50 percent higher—and stock volatility 50 percent lower—than the rest of the pre-World War I period. This result is clearly visible when examining the monthly NYSE returns in Figure 5.

D2. Markov Models for Monthly Stock Returns

Table 6 reports the results of the Markov-Switching models using equation (2) for monthly stock returns. Panel A shows the analysis of antebellum stock returns from 1826-1860.
The average stock return for the GIP Index was .18 percent for the entire sample period. The probability of remaining in the low volatility state is 91 percent versus 71 percent in the high volatility state. The standard deviation of stock returns in the low volatility state (.06) was much lower than in the high volatility state (.51). The differences of the standard deviations are statistically significant at the one percent level. The expected duration of the low volatility state is 11.65 months compared to 3.4 months for the high volatility state.

As for the modern period, the average stock return is .69 percent. The standard deviation of stock returns in the high volatility state is more than four times higher than the low volatility state. Both the high and low volatility states are highly persistent (not statistically different from 90 percent). The expected duration of the low volatility regime is almost 20 months compared to seven months for the high volatility state.

Figure 6 shows the smoothed probabilities from the Markov switching models on monthly stock returns. Panel A clearly shows that the probability of a low volatility state was quite high during the First Great Moderation. The smoothed state probability is nearly 90 percent for the long economic expansion. Panel B suggests that there was not a Great Moderation in the postbellum period as the smoothed state probabilities rarely exceeded 80 percent for almost the entire period after the end of the Civil War. Finally, the post-WW II sample suggests that there were two periods of low volatility in stock returns: 1) 1950s-1960s and 2) most of the 1990s that coincides with the Second Great Moderation.

C. HISTORICAL VOLATILITY OF MACROECONOMIC TIME SERIES DURING THE FIRST GREAT MODERATION

Sources of the Great Moderation in Industrial Production

We can analyze the sources of decreased volatility and higher growth in aggregate IP for this period by decomposing the Davis IP index into two broad sub-indices – a *durable goods* IP index consisting of the chemical/fuels, machinery, and metal-producing sectors, and a non-durable goods IP index consisting of the food, textiles, and leather-producing sectors.[1] We then

[1] These sector classifications are similar to how the Federal Reserve today distinguishes between longer-term and generally more volatile durable-goods investment, and investment in and production of nondurable goods.

calculated growth rates and coefficients of variation for durable and nondurable goods in the same way as for the aggregate IP index.

The summary statistics are reported in Table 7. For nondurable goods production, annual growth rate averaged approximately 6.5 percent during the First Great Moderation and 6.3 percent for the remainder of the antebellum period, compared to a lower 4.9 percent average annual growth rate in the postbellum period. Growth in nondurable goods production was less volatile during the First Great Moderation as well, with a standard deviation of 6.3 percent during the First Great Moderation compared to 9 percent during the rest of the antebellum period. The coefficient of variation is lower during the First Great Moderation (.969) compared to 1.423 for the non-First Great Moderation period and almost one for the period after the Civil War.

Annual changes in durable goods production were both significantly higher and more stable during the First Great Moderation than either before or after this period. Durable goods production grew at an annual rate of 8.9 percent during the first Great Moderation, compared to 4.9 percent for the remainder of the antebellum period and 5.2 percent for the postbellum period. The standard deviation of growth for the first Great Moderation was significantly lower, 6.3 percent, than for the rest of the antebellum period, 10.6 percent, as well as for the postbellum period (9.9 percent). The coefficient of variation was .707 during the First Great Moderation compared to 2.163 for the rest of the antebellum period and 1.903 during the post-bellum period. The simple summary statistics suggest that durable goods production played an important role in promoting stability and growth during the first Great Moderation.

While the coefficients of variation for both durable and nondurable production were lower for the First Great Moderation than for the surrounding periods, the secular declines in these coefficients are not perfectly aligned. The coefficient of variation for nondurable goods reached their lowest level in the mid-1840s, while the coefficients of variation for durable goods production reached their lowest value several years later.

To test for the possibility that the First Great Moderation was led by a boom in the production of durable goods, we employ a bivariate Granger Causality Test. The two variables in the bivariate vector autoregression are the growth rate of durable goods and the growth rate of non-durable goods production. A lag length of two for the vectorautoregression was selected on the basis on the Akaike Information Criteria (AIC). We employ rolling Granger-Causality tests of 15 years to examine the relationship between the growth rates of durable and non-durable goods production during the first Great Moderation. The results of the rolling Granger Causality tests are presented in Figure 7. The growth rate of durable goods production only leads the growth rate of nondurable goods production during the first Great Moderation period. The F-statistic peaks at a value of 5.76 in 1853 which is statistically significant at the two percent level. This suggests that like many modern economic expansions, the first Great Moderation was led by an expansion in durable goods production.

The time series behavior of the coefficient of variation for durable and nondurable goods production during the first Great Moderation suggests that the correlation between the two sectors significantly declined during the long economic expansion. Indeed, Figure 8 reveals a marked decline in the correlation between the growth rates in durable and nondurable goods IP during the First Great Moderation. Figure 8 shows a rolling 10-year moving average correlation between the two sectors; for reference, we also show the same calculations for the 20^{th} century using related Federal Reserve IP data.

To test whether or not this change in cyclical relationships is statistically significant during the First Great Moderation, we regressed the growth rate of durable goods production growth on the growth rate of nondurable goods production, a First Great Moderation dummy, and the interaction between the growth rate of nondurable goods production and the Great Moderation dummy. The regression results are presented in Table 8.

The regression results suggest that there is an 80 percent correlation between the growth rate in durable and nondurable goods production over the entire sample period that is statistically significant at the one percent level. The First Great Moderation dummy is also statistically significant at the one percent level. The indicator variable suggests that the growth rate of durable goods production was six and a half percent higher during the First Great Moderation. The interaction variable between the growth rate of nondurable goods production and the First Great Moderation dummy is negative and statistically significant at the one percent level. The coefficient on the interaction variable suggests that the correlation between the growth rate in durable goods production and nondurable goods production fell from 80 percent to about 23 percent during the First Great Moderation. This suggests that there was a structural change in the relationship between the durable and nondurable goods sectors during the First Great Moderation. The large drop in the contemporaneous correlation coefficient suggests that the two sectors largely offset one another during the first Great Moderation which probably contributed to reduced macroeconomic volatility.

Markov-Switching Models of Individual Series

We further investigate the time series behavior of individual production and price series using constant mean Markov-Switching models where we allow the variance to differ across regimes. Our primary specification is a univariate autoregressive non-linear Markov-switching model with two (or three) regimes for the variance and a constant mean (i.e., Hamilton, 1989). Figures 9-11 show the smoothed probability of a low volatility state for 11 different economic time series. The first three panels of Figure 9 show the probability of low volatility state for cotton using two and three state Markov-switching models. The evidence suggests that there were significant fluctuations in cotton price changes during the First Great Moderation. The commercial paper market is generally in a low volatility state during the First Great Moderation except for a couple of dips in the 1840s and 1850s. Wholesale prices are also in a low volatility state during the First Great Moderation except for a brief period in the late 1840s as well as the mid 1850s.

Figure 10 present estimates of the smoothed probability of a low volatility states for production data. The top panel provides a comparison of the probability of a low volatility state for U.S. industrial production with U.K industrial production. The two figures show that US industrial production growth is in a low volatility state during the First Great Moderation while UK production growth is in a high volatility state. The bottom panel shows the probability of a low volatility state for US textile production and durable goods production. The smoothed probability of a low volatility state appears to be inversely related for the two series during the First Great Moderation: textile production growth is initially in a low volatility state early in the sample before jumping to a high volatility state in the 1850s. Durable goods, on the other hand, switched from a high to low volatility state at the onset of the First Great Moderation. The durable sector remained in a low volatility state for the remainder of the economic expansion.

Figure 11 shows the probability of a low volatility state for the US cotton crop, immigration growth rates, weather, and changes in the tariff rates on dutiable imports. The graph for cotton crop growth shows that the export stable was in a low volatility state from the early 1800s until the outbreak of the civil war. The growth rate for US immigration rates, on the other hand, does not appear to be in a low volatility state for much of the First Great Moderation. The remaining two series tell a different story, however. There is some evidence that weather patterns were generally quite stable during the First Great Moderation given that the probability of a low volatility state generally averaged above 60 percent during this stable economic period. Finally, changes in the tariff rates on dutiable imports are estimated to be in a low volatility state from the early to mid-1840s until the outbreak of the Civil War.

IV. UNDERSTANDING THE FIRST GREAT MODERATION

A. GREATER ADOPTION OF GENERAL PURPOSE TECHNOLOGIES

General purpose technology is defined as technological innovation that can impact an entire economy such as cars or the computer. While the initial emergence of a general purpose technology (GPT) can be associated with lower and more volatile productivity growth via creative destruction, the eventual wider adoption of a GPT across economic sectors is often associated with markedly higher rates of investment and economic growth (David, 1991). The first Great Moderation was characterized by the accelerated adoption of three important communication and transportation technologies: the *clipper and steam ships*, *railroad*, and the *telegraph*.

The period from 1842 until 1860 is known as the “The Clipper Ship Era.” The boom in the production of clipper ships can be traced to the 1830s when hulls became flatter with sharper bows. This produced a greater ratio of length to width which produced faster and more streamlined ships (Taylor, 1951). The production of clipper ships increased from an index value of 58.03 in 1841 to a value of more than 158.05 in 1856. The period 1848 until the mid-1850s represented the high point period –an index value of 266.31 in 1854--for the clipper ship which benefitted from the gold rush in California and China trade. Clipper ship production started to wane in the mid to late 1850s as the clipper ship gradually gave way to steam powered ships that could carry heavier loads across the Atlantic and Pacific Oceans.

Steam ship trade experienced a take-off during the First Great Moderation. The number of steamships involved in the Atlantic trade increased from 5,631 tons in 1847 to 97,296 tons in 1860 (Taylor, 1951, p. 116). Most of the steamships were produced in Great Britain as the country had a comparative advantage in the production of iron clad ships. Steamships garnered the bulk of the Atlantic trade by the end of the antebellum period. American merchants, on the other hand, generally continued to use sailing ships in the antebellum period.

Steam power was also used to power rolling stock during the Antebellum period. Although steam engines were introduced to the United States with the Baltimore and Ohio Railroad in 1828, the railroad took approximately two decades of innovation and capital investment to have a significant impact on the antebellum economy. Prior to the 1840s, canals served as the primary means of transportation for shipping commodities, especially from the West. The creation of the Erie Canal in 1817 posed the first serious challenge to previous transportation systems such as turnpikes, and allowed greater access to western hubs from New York and New England. Freight rates over the Erie Canal quickly decreased to an average of

1.68 cents per ton-mile for eastbound freight and 3.35 cents for westbound (Taylor, 1951). By comparison, freight rates for railroads in the mid-1830s were often 7-10 cents per ton-mile (Fishlow, 1965). Rail mileage accelerated through the 1830s and 1840s, reaching 3,328 miles in 1840 and 8,879 by 1850 (Taylor, 1951). Railroad mileage by 1850 had also outpaced canals in 25 states, including major production hubs like New York and Massachusetts, and in many states where this was not the case (such as Pennsylvania), canal mileage had not increased in the previous decade (Taylor, 1951).

Furthermore, comparing ton-mile rates for railroads and canals in 1853 and travel times for railroads and canals in 1852 reveals that rails could transport the goods in one-third to one-half of the time of canals, at 2-3 times the price, with that gap narrowing even further by 1860 (Taylor, 1951). As a result, rails began to replace many water routes in the 1840s and 1850s (with the notable exception of the Erie Canal, which maintained steady trade through the First Great Moderation). Both experienced an increase in tonnage in the West, but for water routes this was largely the result of massive Western migration, which increased demand across the board. This technological-diffusion process accelerated with the construction of almost 22,000 miles of track built in the 1850s. By the eve of the Civil War, railroads had replaced canals as the predominant means of transportation.

Railroads had a major impact on agricultural productivity in the 1850s. Fishlow (1965) examines agricultural yields for Western counties with and without water access in 1849 and 1859 (presumably before and after the arrival of railroads). He found that counties with water access in 1849 produced almost half of the total wheat and two-fifths of the total corn for the region with only one-third of the total land. By 1859, the gaps were narrowed to two-fifths and 37 percent, respectively. Removing some cities with relatively close access to water magnifies these differences. (Fishlow, 1965) While this does not prove that railroads increased agricultural yields, it does suggest that access to market is positively correlated with the amount of produce farmers had an incentive to create. Atack and Margo (2009) determined that even under the most conservative estimates, railroads were responsible for at least 25 percent of acreage improvements in the 1850s, and this impact was likely closer to 68 percent. The increased production was the result of both greater transportation of yields to market and improvements made by farmers in anticipation of these yields.

Many scholars have debated the affect of railroads on Antebellum industrialization. Atack, Haines, and Margo (2008) examine the impact rail access had on the development of factories in the 1850s. Factories, defined as manufacturers with sixteen or more employees, are used as a proxy for industrial production because firms of that size represented a shift away from the artisan shops that were widely used at the beginning of the century. More employees meant manufacturers could utilize a division of labor, a key component of industrial mass production. An examination of major Eastern cities found that rail access made it 19 percent more likely that a random firm would be a factory (Atack, Haines, and Margo, 2008). While one may argue that this doesn't necessarily imply causality (that is, the railroad may have been built to serve the factory, rather than vice-versa), there are two problems with that argument. First, Atack, Haines, and Margo reproduce these results with two other tests, indicating that there is some link between the initial railroad and subsequent factory development. Second, factories are by definition only useful in conjunction with effective transportation. Railroads, being both cheaper and faster than canals, could quickly transport the additional production of a factory with division of labor at a better per-ton-mile rate in the 1850s, especially compared to canals in the 1830s and 1840s. This indicates that the rise of the railroad was a precondition for factory development, and that division of labor would not be adopted without a railroad already available. Thus, railroads served to catalyze industrialization in the 1850s.

However, there is disagreement among scholars of the period as to what degree railroads impacted industrial growth during the first Great Moderation, especially during the 1840s. Rostow (1960) points to the 1840s and 1850s as the likely “take-off point” in the United States. In his view, this take-off was the result of two simultaneous trends: railroad and industrial growth in the East in the 1840s, and the western expansion of these technologies in the 1850s (p. 38 fn. 1). Davis (2004) points out the proximity of Rostow’s take-off point to a spike in industrial production starting around 1840. He de-emphasizes that peak’s proximity by comparing it to another, smaller spike in production in the 1830s, arguing that “industrial production advanced at a more rapid pace following the Civil War (p. 1116).” However, as established by our earlier analysis, this argument only holds if you take 1800-1860 as the same period. The twin supply shocks of industrialization and rail development, reflected by the twin peaks in production in the 1830s and 1840s, are more comparable to the postbellum period than the decades following the American Revolution. The first Great Moderation – which neatly overlaps Davis’ second peak – had a greater average growth rate than the postbellum period; furthermore, the growth rates achieved at the peak of the first Great Moderation are higher than at any other time before World War I, including the industrialization of the 1830s, further lending credence to the idea that more factors than just increased industrial production were at work in shaping the Great Moderation.

Fishlow (1965) disputes the notion that railroads had a hand in increased industrialization in New England in the 1840s, and provides several alternate explanations for strong industrial growth in the 1840s, such as low cotton prices leading to textile expansion and increased demand for materials and fuel for railroads. However, as established from our industrial production data, sectoral shifts such as these had very little impact on aggregate industrial growth during the first Great Moderation. Individual shifts in a sector could be equally construed as larger supply shocks, such as railroads, or the impact of a specific trade policy or pricing system for a set of years. Since total industrial production is less susceptible to individual sectoral shifts, it stands to reason that it features less of the noise that may disguise market-wide supply shocks such as railroads. Furthermore, these individual sector shifts cannot account for the low volatility of the period. The difficulty is in identifying to what degree railroads played a part in the high growth and low volatility of the 1840s, when they were in development. Fishlow's analysis of railroad's impact on industrial production aside, it is clear from the data that there was at least some portion of the 1840s where railroad proliferation was low enough to not account for the low volatility and high growth of the first Great Moderation.

Pastor and Veronesi (2008) find that there is approximately an eight-year period between the first decline in volatility of a new technology's stock and when the stock "bubble" bursts. For railroads, their data shows a steep decline in stock price volatility for railroads in 1847 and a subsequent steep increase in volatility in 1856, roughly consistent with their estimations. The increase in volatility is met with a similarly sharp increase in volatility in non-railroad stocks, indicating that market permeation of railroad technology had reached the point where fluctuations in railroad stock returns had a measurable impact on the market as a whole. The bubble burst in 1857 roughly coincides with our estimated end date for the first Great Moderation, further suggesting a decrease in the volatility of railroad stocks had some hand in the latter part of the Great Moderation. However, prior to 1847, there is little evidence that railroads had been adopted enough to have a measurable impact on volatility and growth.

One possible explanation for this discrepancy can be found in the aforementioned canals, which were still growing through the 1830s and in some states through the 1840s. The use of canals as a mechanism for shipment of industrial inputs would help account for the period of time before railroads became economically viable. However, while the 1830s, when canals became the primary means of long-distance freight transport, had growth comparable to that of the first Great Moderation, volatility was also much higher for the years preceding the crises of 1837 and 1839, indicating that canals only had a marginal impact on economic fluctuations. One possible reason for this is that canals could only reach producers with water access, and this limited its benefit to many Midwestern farmers. Fishlow demonstrates that agricultural production in areas with water (and, presumably, canal access) was disproportionately higher than for areas without. This meant that, while farms with canal access would grow faster, these benefits were limited to only about one-third of counties, which limited their economic impact. Thus, while they did have an impact on growth in the 1840s, canals alone cannot explain to a sufficient degree the high growth and low volatility present in the first Great Moderation.

Another new technology that contributed to economic development in the antebellum was the telegraph. The westward expansion of the period created new demand for eastern products. Prior to the telegraph, it often took a long time to order goods. Telegraphs provided a solution to this problem, and combined with the transportation innovations of the 1840s and 1850s, facilitated economic activities in the western territories. This in turn spurred rapid expansion of telegraph lines and increased competition, which catalyzed the stabilizing effects of the railroads and canals. (Du Boff 80) As each technology benefited from its use with the other, and demand pushed expansion westward, businesses were better able to reach consumers, increasing stability and growth.

B. FINANCIAL MARKET INTEGRATION

Bodenhorn (1992) examines monthly interest rates for antebellum cities to measure financial market integration during the Free Banking Period (1837-1862). During the 1830s, interest rates were highly variable and volatile. However, beginning in the early 1840s, regional interest rates in the United States began to converge. The convergence occurred despite the fact that President Jackson vetoed the bill to renew the Charter of the Second Bank of the United States (Temin, 1973). Bodenhorn argues that banks in this period were increasingly efficient at mitigating regional variations in interest rates and minimizing interest rate volatility. Comparing New York City and Charleston, Bodenhorn demonstrates that interest rate differentials for the two cities hovered around zero from 1844-1857, punctuated by minor brief episodes of greater differences (Bodenhorn 2000). Despite the geographic distance, interest rates in Charleston strongly resembled those in New York City during the first Great Moderation; it wasn't until the panic of 1857 that interest rates in the two cities diverged for an extended period of time.

These results are also seen in further examination of differences for all cities in Bodenhorn's (1999) sample. For each month, we calculated the average interest rate, the standard deviation, and the coefficient of variation rates in each city. Table 9 shows that interest rates began to converge in the 1840s. Interest rate volatility is relatively constant until the onset of the recession and the financial panic in 1857. The coefficient of variation is also low for the period 1843-1857. Although the empirical analysis is somewhat limited because of missing data for some cities, the results suggest that interest rate variability in individual states were very low during the first Great Moderation.

We have two possible explanations for interest rate convergence in the first Great Moderation. Bodenhorn (2000) notes that northeastern banks, which were chartered only in their particular states and thus could not spread their practices directly, began forming correspondent partnerships with banks in other states to facilitate interstate operations (p. 192). The 1830s saw the spread of many of these networks from New England into the Midwest and South. The interstate arrangements allowed banks to purchase bills of exchange from each other, exchanging their paper for currency with which one bank could adjust its reserves. This allowed banks to increase their loan supply and target interest rates as well as the ability to better adjust their portfolio to an unexpected shock to loan demand. Furthermore, improvements in transportation and communication technology meant that banks could more easily transfer money to markets with the largest demand for capital. Prior to 1840, transportation costs were high enough that banks often could not rely on other lenders to handle sudden increases in the demand for capital. Instead, banks would respond by increasing interest rates that would reduce investment. With the rise of canals and then railroads, banks could better target their reserves to reduce interest rate fluctuations. Bodenhorn (2000) emphasizes that transportation was still comparatively expensive, but we would contend that its existence helped promote growth by allowing banks to loan additional funds, with the knowledge that it could acquire emergency funds from another bank quickly. The rise of telegraphs, which were frequently constructed with railroads during the 1840s and 1850s, provided banks with quicker access to funds that minimized interest rate fluctuations between different regions in the United States.

Financial market integration probably played an important role in the high growth rates and low macroeconomic volatility of the first Great Moderation. Capital could more easily flow to its greatest source of need. In addition, low interest rate volatility reduced the uncertainty of future investment and raised consumer confidence (Evans, 1984). Davis (1960), for example, finds that the small fluctuations in short-term interest rate in the two decades prior to the Civil War promoted economic growth in New England textile mills. Davis' analysis suggests that stable credit markets contributed to the low volatility in industrial production of the first Great Moderation.

C. IMMIGRATION AND WESTERN EXPANSION

Immigration and Western migration accelerated through the antebellum period, spurred on by the prospect of economic opportunity and inexpensive land for agriculture (Vandenbroucke 2008). More than 3.5 million people migrated to the United States during the first Great Moderation which increased the demand for American industrial products. One prominent theory, first posed by Turner (1921), held that western expansion served as a "safety valve" for immigrants and the unemployed in the East, who could transition into western agriculture. Many scholars have identified several flaws with Turner's theory, such as the relative cost of moving west (Kim and Margo, 2003). Nonetheless, Turner's theory does indicate that western expansion during the first Great Moderation may have produced steady economic growth and created new markets in the Western United States.

Ferrie (1997) examines the conditions and outcomes of migrants to the West to determine the validity of Turner's safety-valve hypothesis. Using data on a sample of men in the 1850 census and collecting data on their backgrounds, decision on whether or not to travel west, and outcomes, Ferrie constructs a model for the probability of western migration and change in real wealth. His regression shows that moving to the frontier translated into a 45 percent gain in real wealth during the 1850s, indicating that it was advantageous for at least some migrants to head west. Ferrie's regressions also indicate that those most likely to migrate were laborers in cities with population greater than 10,000, consistent with Turner's theory. It is important to note that not all of these gains were the result of finding new employment in the West. Margo (1998, 1999), building on a hypothesis first posited by Coelho and Shepherd (1976), indicates that real wages for common labor in the West were 11 percent higher than in the East.

Since many workers went west to find employment in agriculture, (Ferrie, 1997) some of this economic growth was the result of increased production (and, presumably, demand for workers) from railroad expansion, at least for the period of Ferrie's study. The large railroad expansion of the 1850s may also have fueled individual gains, at least in agricultural sectors, as increased production in farms would increase the marginal product of labor and thus make more money without indicating greater economic growth. However, this does not take into account potential gains from population growth in the Midwest resulting from railroads. Vandenbroucke (2008) found that removing growth in transportation costs for households led to noticeably lower growth in land improvement and population, particularly in the antebellum period. Not only does this indicate the importance of railroads in western migration, it indicates that land improvement without that migration would have been significantly blunted.

Western migration also decreased national economic volatility through the development of a national labor market. Margo (1999) argues that the antebellum period was a period of significant real wage convergence. In the 1830s, Midwestern real wages for common labor were 30.5 percent higher than the East. However, during the 1840s and 1850s, this value dropped to 10.1 percent and 11.4 percent respectively. Vandenbroucke (2008) demonstrates that western/eastern real wage ratios, which had widely varied prior to the early-to-mid 1840s, declined and remained relatively stable for the remainder of the antebellum and postbellum periods (Vandenbroucke 2008, p. 89). This decline suggests that real wages across the United States were converging, forming the beginnings of a "national labor market" (Margo 1998;1), in which real wages are stable across the country. As discussed by Vandenbroucke (2008), the convergence in eastern and western wages converge during the first Great Moderation was also accompanied by lower volatility in the labor market after 1843. The convergence of wages contributed to macroeconomic stability by integrating labor markets and making them more efficient. Overall, real wage convergence appears to have been an important factor in reducing macroeconomic volatility during the first Great Moderation.

D. GLOBAL ECONOMIC AND POLITICAL CLIMATE

Another factor that may have contributed to the reduced macroeconomic volatility of the Great Moderation is the absence of global warfare. A lower probability of global warfare might increase investment by firms and raise consumer confidence in the United States. Brown, Burdekin, and Weidenmier (2005), for example, find that the volatility of British Consols, the world's bellwether security, decline by more than 50 percent during the period of Pax Britinnica (1830-1913) compared to the periods 1729-1829 and 1914-2005. A significant portion of the volatility in the Consol market can be linked to major wars – the American and French Revolutions, the Napoleonic era, and World Wars I and II. By contrast, during the period 1831-1910, consol prices never fell below 80 percent of par. The time period largely coincides with the reign of Queen Victoria and a lack of major military conflicts involving the British Empire. (696)

Although the absence of global war shocks may have played a role in the First Great Moderation, its impact was probably indirect. For example, the period between the War of 1812 and the Civil War was largely free of military conflict in the United States. However, our industrial production index shows that growth and volatility for the period 1815-1840 were near-identical to that of 1791-1840. Nevertheless, the First Great Moderation ended with the financial panic and recession of 1857 that some scholars have attributed to the Dred Scott case (Calomiris and Schweikert, 1990). The America Civil War began shortly thereafter and probably ended any possibility of a return to a period of rapid economic growth and low business cycle volatility.

E. TRADE POLICY AND INSTITUTIONAL FACTORS

Another factor that may have contributed to stable economic growth during the First Great Moderation was the sustained downward trend in U.S. import tariffs beginning during the early 1830s and running until 1860. According to Irwin (2008), import tariffs were steadily and consistently reduced over time. The explanation for the secular tariff decline between 1833 and 1860 is the shifting political coalitions between the various regions of the country. Through the antebellum period, the North tended to favor high tariffs and the South strongly favored low tariffs, while the West was a pivotal player in tariff politics. Over the course of the 1820s, a coalition in Congress between the North and West linked the issues of tariffs and internal improvements and succeeded in raising average tariffs. This coalition fell apart in 1830 when President Andrew Jackson effectively delinked the two issues by vetoing internal improvement bills and the Compromise of 1833 put tariffs on a downward path for nine years. However, the Great Compromise of 1833 was not a credible commitment to a lower tariff regime. But as events unfolded, it proved to be a secure political equilibrium. Lower transportation costs as a result of railroads gave the West a growing stake in export markets and hence an economic interest in low tariffs. The economic interests of both the South and the West favored low tariffs, and together they controlled a clear majority of the seats in Congress. As a result, average tariffs exhibited a secular decline from 1833 until 1860.

Changes in state finance and general incorporations laws also probably played a role in sustaining the first Great Moderation. Eleven states wrote new constitutions between 1842 and 1852 that redefined the rules of the game for debt finance by the state and incorporation by businesses. The constitutional changes were driven by the fact that many states heavily invested in transportation and infrastructure projects during the 1820s and 1830s that went belly-up in the late 1830s and early 1840s. Eight states were in default and three more had severe financial problems by 1842 (Wallis, 2005). Eight states mandated general incorporation laws in their new constitutions. States required voters to approve tax increases for projects before the state could borrow money. The constitutional changes separated corporate chartering from state debt issue to avoid the problems of the late 1830s and early 1840s. Wallis (2005) argues that the divide created between corporate chartering and state debt issue during the 1840s was a successful and important institutional change that remains in place today.

V. CONCLUSION

The Great Moderation is regarded by many economists as one of the longest periods of economic growth and low business cycle volatility in American history. In this paper, we identify an earlier period of high economic growth and low economic and financial market volatility. We refer to this period as the First Great Moderation that lasted from 1840 until 1856. The growth rate of industrial production averaged 8 percent per annum during this period, the fastest 17 years of economic growth in the 19th century. The rapid economic growth was accompanied by low business cycle volatility as well as high stock returns and low stock volatility.

We then examine the economic factors behind the first Great Moderation. Our analysis suggests that the adoption of general purpose technology, increased financial market integration, immigration and western expansion, the absence of global conflict, low and stable tariffs, and government reforms regarding state finance and incorporations laws probably contributed to the longest economic expansion in American history.

Although the first Great Moderation occurred more than 150 years ago, we believe that it has many similarities with the second Great Moderation as shown in Table 10. First, both moderations experienced a change in the structure of the economy. The first Great Moderation witnessed the widespread adoption of important general purpose technologies: clipper and steam ships, railroads, and the telegraph. The modern Great Moderation saw structural change in terms of the movement of production from goods to services, the information technology revolution that led to better inventory management, and financial innovations that allowed households and firms to better smooth consumption and investment. Second, the first and second moderations have been characterized by improved economic policymaking. Many states during the first Great Moderation wrote new constitutions that redefined the rules of the game for business and the government. At the Federal level, low and stable tariffs promoted improved economic performance. As for the modern period, many scholars have argued that good monetary policy was an important factor in the Great Moderation from 1984-2007. Finally, both periods seem to have benefitted from good luck. The first Great Moderation occurred during a period of stable cotton prices as well as the era of Pax Brittanica—a period of global peace. The second Great

Moderation, on the other hand, appears to have been a period of generally low and stable oil prices coupled with few negative productivity shocks.

In summary, our analysis suggests that the First Great Moderation is an unparalleled period in the history of U.S. business cycles characterized by high economic growth rates and low business cycle volatility. Like the modern-day Great Moderation, however, the end of America’s first Great Moderation was abrupt, pronounced, and notable for its magnitude following years of relative stability.

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Table 1: Summary Statistics for US IP, 1791-1915

Davis IP Index	1791-1839	1840-1856	1866-1915
Mean Growth %	0.050	0.081	0.051
Standard Deviation	0.068	0.054	0.076
Coefficient of Variation	1.37	0.67	1.51

Sources: Davis (2004); authors' calculations

Table 2: NBER Recession Chronology vs. Davis (2005) Recession Chronology

NBER Chronology		Davis (2005) Chronology		*Net change to NBER phase duration (in yrs.)*
Peak	**Trough**	**Peak**	**Trough**	
		Antebellum industrial cycles		
1802	1804	1802	**1803**	*less 1*
1807	1810	1807	**1808**	*less 2*
1811	1812	1811	1812	
1815	1821	1815	**1816**	*less 5*
1822	1823	1822	1823	
1825	1826			**no recession***
1828	1829	1828	1829	
1833	1834	1833	1834	
1836	1838	1836	**1837**	*less 1*
1839	1843	1839	**1840**	*less 3*
1845	1846	America's First Great Moderation		**no recession**
1847	1848			**no recession**
1853	1855			**no recession***
1856	1858	1856	1858	
		Civil War industrial cycles		
1860	1861	1860	1861	
1864	1867	1864	**1865**	*less 2*
		Postbellum industrial cycles		
1869	1870			**no recession***
1873	1878	1873	**1875**	*less 3*
1882	1885	**1883**	1885	*less 1*
1887	1888			**no recession***
1890	1891			**no recession***
1892	1894	1892	1894	
1895	1896	1895	1896	
1899	1900			**no recession***

Notes: All reference dates are calendar-year cycles. Bolded text reflects deviation from current NBER record. **No recession*** indicates a "growth recession," or a slowdown in the rate of economic growth based upon detrended values of the IP index. Victor Zarnowitz (1992) summarized the annual NBER peak-trough chronology from 1790 in Glasner ed. (1997, 731–33, tables 1–2). For the pre-WWI era, the annual chronology ultimately corresponds to Thorp's verbal assessment (1926, 113–45) later summarized in Burns and Mitchell (1946, 78, table 16) and Moore and Zarnowitz (1986, 746, table A.2). Source: Davis (2006), Table 1.

Table 3: Comparing the two Great Moderations using Annual IP data

	Davis IP index (annual frequency)				Federal Reserve IP index (annual frequency)		
Year	Log growth rate (%)	1-sided HP filter	2-sided HP filter	Year	Log growth rate (%)	1-sided HP filter	2-sided HP filter
1830	16.81	3.27	(6.89)	1980	(2.58)	(2.70)	1.18
1831	16.55	10.24	2.96	1981	1.33	(2.67)	0.75
1832	11.58	10.70	7.80	1982	(5.30)	(6.66)	(6.31)
1833	10.85	9.67	12.10	1983	2.71	(3.56)	(5.48)
1834	(4.57)	(1.60)	1.26	1984	8.53	2.41	1.01
1835	11.24	1.42	6.52	1985	1.20	1.35	0.04
1836	6.88	0.46	7.69	1986	1.00	0.44	(1.25)
1837	(1.43)	(5.50)	0.74	1987	5.04	2.40	1.37
1838	2.53	(6.33)	(2.21)	1988	5.03	3.46	3.90
1839	12.37	(0.08)	4.55	1989	0.88	1.21	2.18
1840	(4.84)	(7.06)	(6.18)	1990	0.95	(0.29)	0.41
1841	5.47	(4.38)	(7.06)	1991	(1.56)	(2.82)	(4.03)
1842	2.78	(4.03)	(11.22)	1992	2.79	(1.43)	(4.36)
1843	10.82	1.64	(7.98)	1993	3.21	(0.16)	(4.51)
1844	11.29	5.43	(4.86)	1994	5.15	1.90	(2.95)
1845	9.47	6.26	(4.02)	1995	4.64	2.73	(2.05)
1846	14.99	9.80	2.07	1996	4.35	2.86	(1.48)
1847	14.03	10.67	7.17	1997	6.96	4.39	1.77
1848	8.26	6.69	6.65	1998	5.65	4.17	3.92
1849	3.56	0.62	1.73	1999	4.20	2.77	4.95
1850	4.04	(3.00)	(2.36)	2000	3.94	1.49	6.12
1851	4.73	(4.64)	(5.36)	2001	(3.47)	(4.17)	0.33
1852	15.92	1.84	3.32	2002	0.21	(5.10)	(1.38)
1853	14.21	4.73	10.90	2003	1.26	(4.62)	(1.67)
1854	3.41	(0.70)	8.37	2004	2.30	(3.28)	(0.56)
1855	1.59	(5.27)	4.70	2005	3.19	(1.60)	1.77
1856	4.90	(5.65)	4.92	2006	2.17	(1.04)	3.44
1857	(1.48)	(9.51)	(0.80)	2007	2.63	(0.31)	5.89
1858	(5.54)	(13.81)	(10.34)	2008	(3.78)	(3.91)	2.22
1859	13.51	(3.29)	(0.79)	2009	(11.83)	(11.04)	(9.33)
1860	1.73	(3.84)	(3.05)	2010	5.15	(3.86)	(3.86)

Notes: Hodrick-Prescott filters used lambda=100. Sources: Authors' calculations based on data from Davis (2004) and U.S. Federal Reserve

Table 4: Markov-Switching Models, Annual U.S. Industrial Production Growth

Specification: Constant mean, switching variance, and switching AR(1) Markov model

	Panel A: Annual Sample, 1792-1914					Panel B: Annual Sample, 1950-2010			
	State V? (Low Volatility)		State V? (High Volatility)			State V? (Low Volatility)		State V? (High Volatility)	
Parameter	**Estimate** *std error* **[p-value]**		**Estimate** *std error* **[p-value]**		***Parameter***	**Estimate** *std error* **[p-value]**		**Estimate** *std error* **[p-value]**	
μ	**0.0429**			***	μ	**0.0226**			***
	0.0074					0.0051			
	[0.00]					**[0.00]**			
ϕ	**0.4111**	***	**(0.2605)**	*	ϕ	**0.4772**	***	0.0113	
	0.1061		0.1380			0.1024		0.1669	
	[0.00]		**[0.06]**			**[0.00]**		[0.95]	
σ	**0.0016**	***	**0.0057**	***	σ	0.0001		**0.0030**	***
	0.0005		0.0011			0.0001		0.0006	
	[0.00]		**[0.00]**			[0.12]		**[0.00]**	
Log-likelihood	158.25		Ratio (σ? / σ?)	0.27	Log-likelihood	103.88		Ratio (σ? / σ?)	0.04

Panel A — Transition probabilities matrix: (std. error, p-value):

0.67 (0.13,0.00)	0.24 (0.11,0.03)
0.33 (0.14,0.02)	0.76 (0.11,0.00)

Expected duration of Regime #1: 3.02 time periods
Expected duration of Regime #2: 4.13 time periods

Panel B — Transition probabilities matrix: (std. error, p-value):

0.63 (0.24,0.01)	0.15 (0.10,0.15)
0.37 (0.25,0.14)	0.85 (0.18,0.00)

Expected duration of Regime #1: 2.70 time periods
Expected duration of Regime #2: 6.65 time periods

*denotes significance at the 10 percent level;
**denotes significance at the 5 percent level;
***denotes significance at the 1 percent level.

Table 5: Summary Statistics for Early U.S. Stock Returns

NYSE Index	1820-1839	1840-1856	1866-1915
Mean Growth %	-0.001	0.003	0.002
Standard Deviation	0.045	0.035	0.039
Coefficient of Variation	68.773	11.445	21.390

Sources: NYSE History Research Project

Table 6: Markov-Switching Models, Monthly U.S. Stock Returns

Specification: Constant mean, switching variance, and switching AR(1) Markov model

Sample A: Monthly Data, 1826M1-1914M12

Parameter	**State V_1** (Low Volatility) **Estimate** / *std error* / **[p-value]**	**State V_2** (High Volatility) **Estimate** / *std error* / **[p-value]**
μ	**0.0018** *	
	0.0009	
	[0.06]	
ϕ	0.0324	0.0774
	0.0369	0.0766
	[0.38]	[0.31]
σ	**0.0006** ***	**0.0051** ***
	0.0000	0.0004
	[0.00]	**[0.00]**
Log-likelihood	2,032.31	Ratio (σ_1 / σ_2) 0.12

Transition probabilities matrix: (std. error, p-value):

0.91 (0.03,0.00)	0.29 (0.07,0.00)
0.09 (0.02,0.00)	0.71 (0.05,0.00)

Expected duration of Regime #1: 11.65 months
Expected duration of Regime #2: 3.40 months

Sample B: Monthly Data, 1950M1-2010M12

Parameter	**State V_1** (Low Volatility) **Estimate** / *std error* / **[p-value]**	**State V_2** (High Volatility) **Estimate** / *std error* / **[p-value]**
μ	**0.0069** ***	
	0.0012	
	[0.00]	
ϕ	**0.2036** ***	**0.2648** ***
	0.0456	0.0793
	[0.00]	**[0.00]**
σ	**0.0006** ***	**0.0028** ***
	0.0000	0.0003
	[0.00]	**[0.00]**
Log-likelihood	1,474.50	Ratio (σ_1 / σ_2) 0.21

Transition probabilities matrix: (std. error, p-value):

0.95 (0.04,0.00)	0.14 (0.05,0.00)
0.05 (0.02,0.00)	0.86 (0.05,0.00)

Expected duration of Regime #1: 19.83 months
Expected duration of Regime #2: 7.06 months

Notes: Stock return data reflect month-end values on the Yale / NYSE price-weighted capital appreciation monthly index (excludes dividends) through December, 1925, and spliced thereafter to month-end values of the S&P500 Index (price index, excludes dividends, not a total return index).
*denotes significance at the 10 percent level;
**denotes significance at the 5 percent level;
***denotes significance at the 1 percent level.

Table 7: Durable and Nondurable Goods IP Statistics

	Nondurable Goods 1827-1840	1841-1856	1866-1915
Average Annual Growth	0.063	0.065	0.049
Growth Std. Dev.	0.090	0.063	0.048
Coefficient of Variation	1.423	0.969	0.980

	Durable Goods 1827-1840	1841-1856	1866-1915
Average Annual Growth	0.049	0.089	0.052
Growth Std. Dev.	0.106	0.063	0.099
Coefficient of Variation	2.163	0.707	1.903

Sources: Davis (2004), authors' calculations

Table 8: **Dependent Variable- Growth Rate of Durable Goods Production**

Variable	Coefficient
Constant	0.009 (0.012)
Non-Durable Goods Production	0.803 (0.223)***
First Great Moderation	0.065 (0.018)***
Non-Durable Goods Production*First Great Moderation	-0.571 (0.256)***

*denotes significance at the 10 percent level;
**denotes significance at the 5 percent level;
***denotes significance at the 1 percent level.

Sources: Davis (2005); authors' calculations

Table 9: Interest Rates in Major Cities, 1836-1856 – Summary Statistics

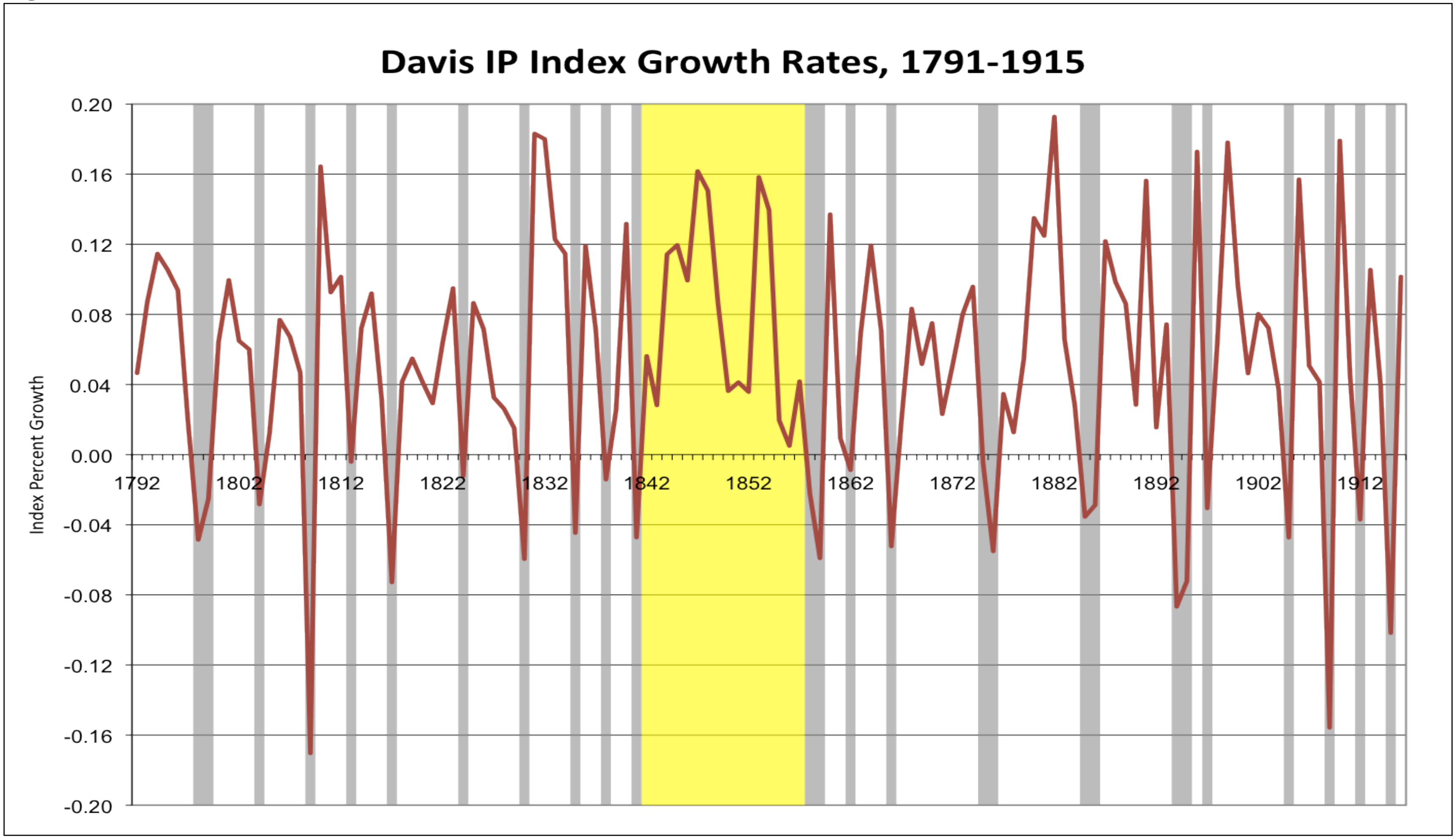
		Boston (1)	Boston (2)	New York	Philadelphia	Charleston	New Orleans
Mean Rate	1836-1842	11.069	11.198	9.194	10.605	11.937	13.274
	1843-1856	8.653	8.764	6.774	8.323	7.339	8.489
Standard Deviation	1836-1842	6.477	7.542	3.744	4.527	5.074	5.766
	1843-1856	3.085	3.530	2.080	3.051	2.181	3.111
Coefficient of Variation	1836-1842	0.585	0.674	0.407	0.427	0.425	0.434
	1843-1856	0.357	0.403	0.307	0.367	0.297	0.366

Sources: Bodenhorn (1992), authors' calculations

Table 10: Comparing the Great Moderations

Time Period	Structure of the Economy	Economic Policy	Good Luck
First Great Moderation (1841-1856)	Adoption of GPT: Clipper and steam ships, railroad, and telegraph; Innovations in financial markets; Immigration and westward expansion	Low and stable tariffs; Changes in state constitutions that define the rules of the game for government and the private sector	Pax Britannica
Second Great Moderation (1984-2007)	Goods to services; IT revolution and better inventory management; Innovations in financial markets	Good monetary policy	Stable oil prices; Few large negative productivity shocks

Figure 1: Growth rates in annual Davis IP index, 1791-1915



Notes: Gray areas represent declines in the Davis IP index, which we associate here with recessions, as in Davis (2006). The yellow area represents the First Great Moderation.

Sources: Davis (2002, 2004, 2006); authors' calculations.

Figure 2: Time-variation in rolling correlation between growth rates in durable-goods and nondurable-goods production

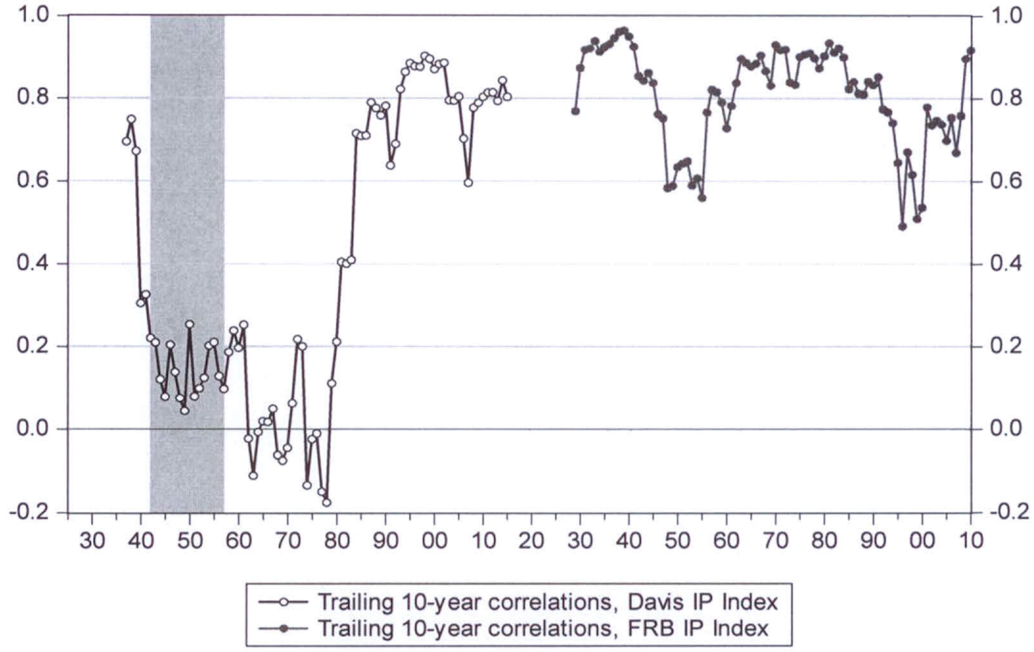
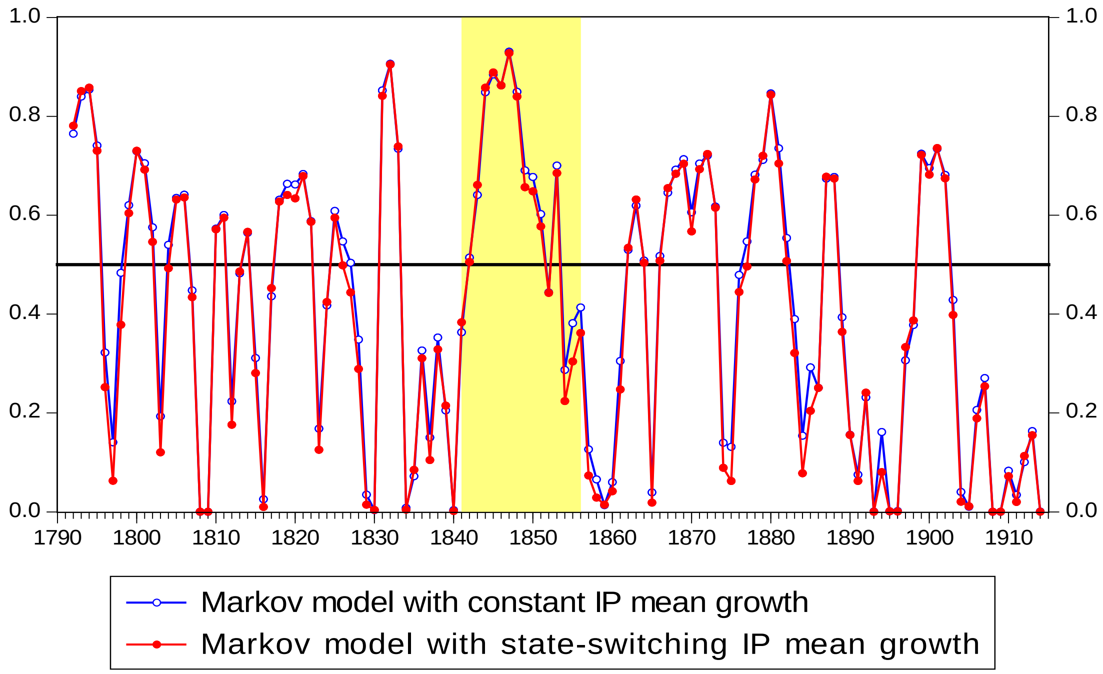
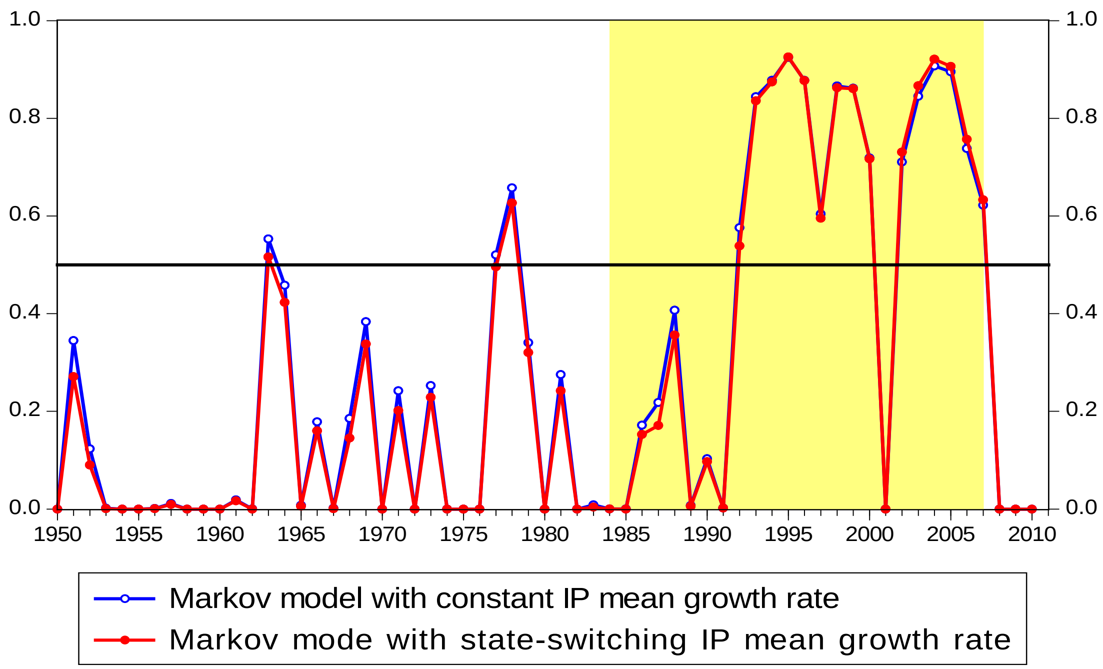


Figure 3: Low-volatility state probabilities for annual U.S. IP growth rates

Panel A: Davis IP Index, 1792-1914, for Markov switching-variance, switching AR(1) model

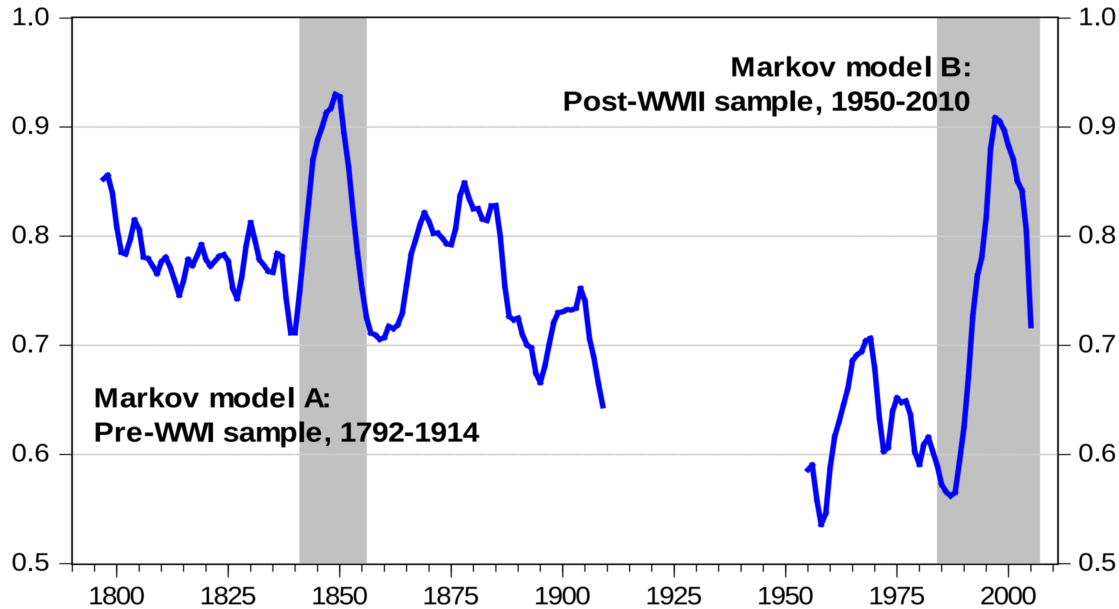


Panel B: FRB IP Index, 1950-2010 for switching-variance, switching AR(1) model



Sources: Authors' calculations. Probabilities are smoothed state probabilities.

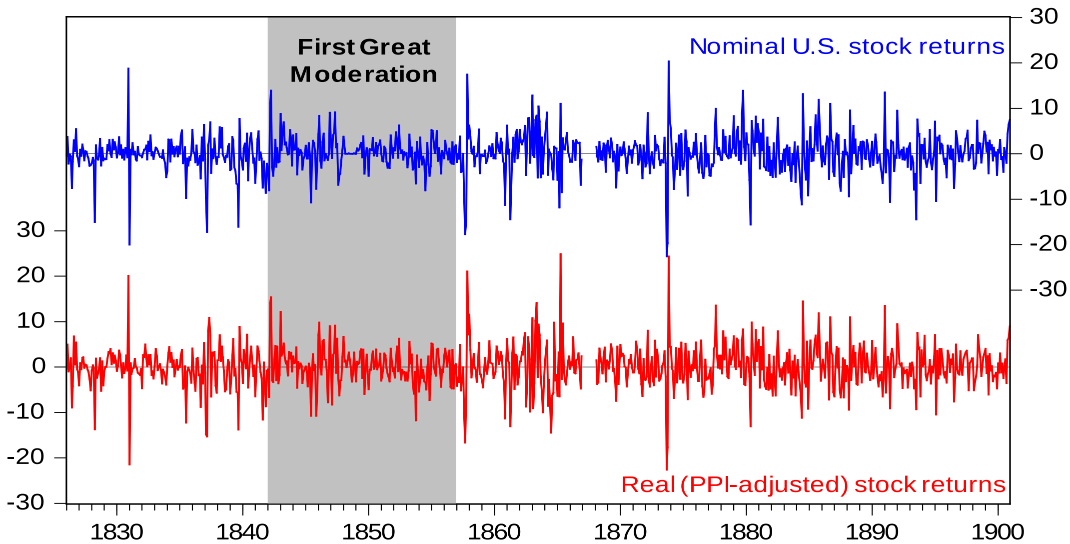
Figure 4: Ratio of conditional mean to conditional standard deviation for annual IP, as estimated from two Markov regime-switching models



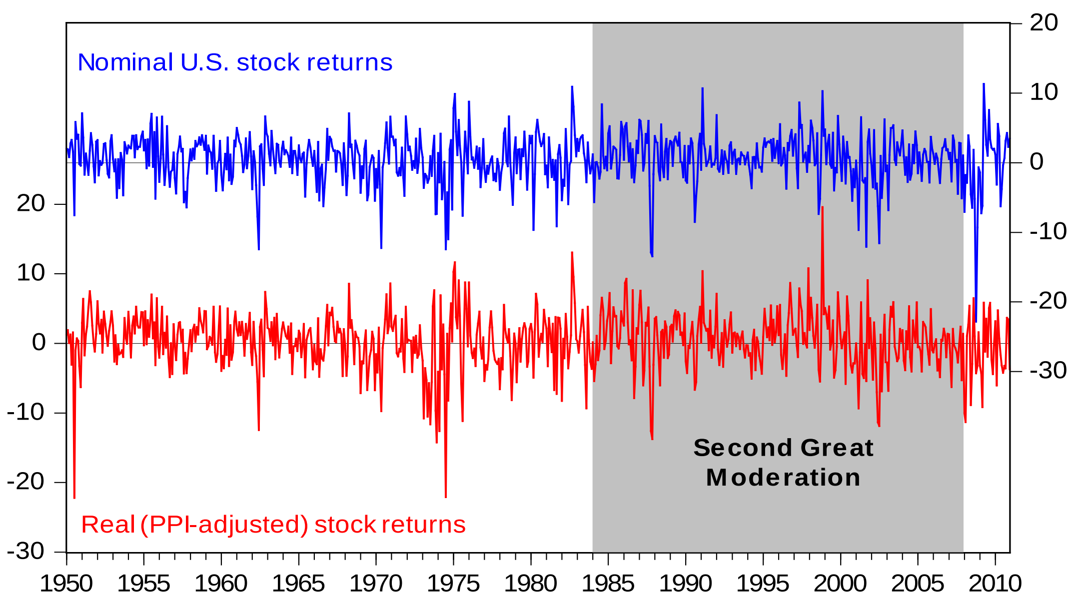
Note: Conditional means and standard deviations in each Markov regime-switching model were calculated based only on the filtered probabilities prior to time *t*. The Markov model was specified with switching volatilities and AR(1) terms but a constant mean; results are nearly identical with a switching-mean specification. Shaded regions demarcate America's First and Second Great Moderations. Lines reflect centered 10-year moving averages in the ratio of conditional mean to conditional standard deviation

Figure 5: Monthly U.S. stock market returns

Panel A: 19th century returns, January 1826 – December 1899



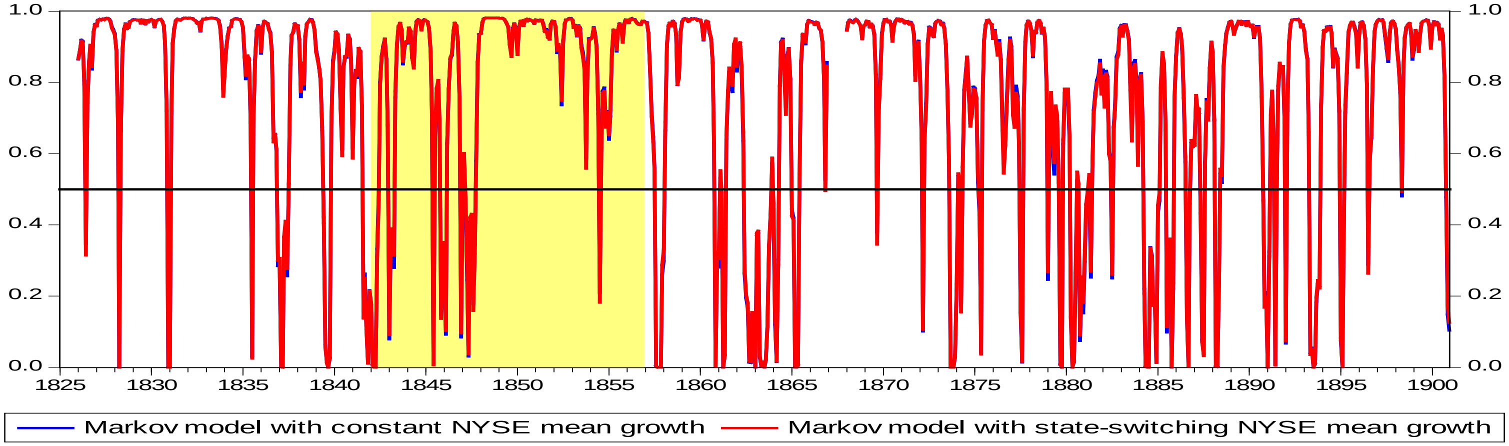
Panel B: Modern-day returns, January 1950 – December 2010



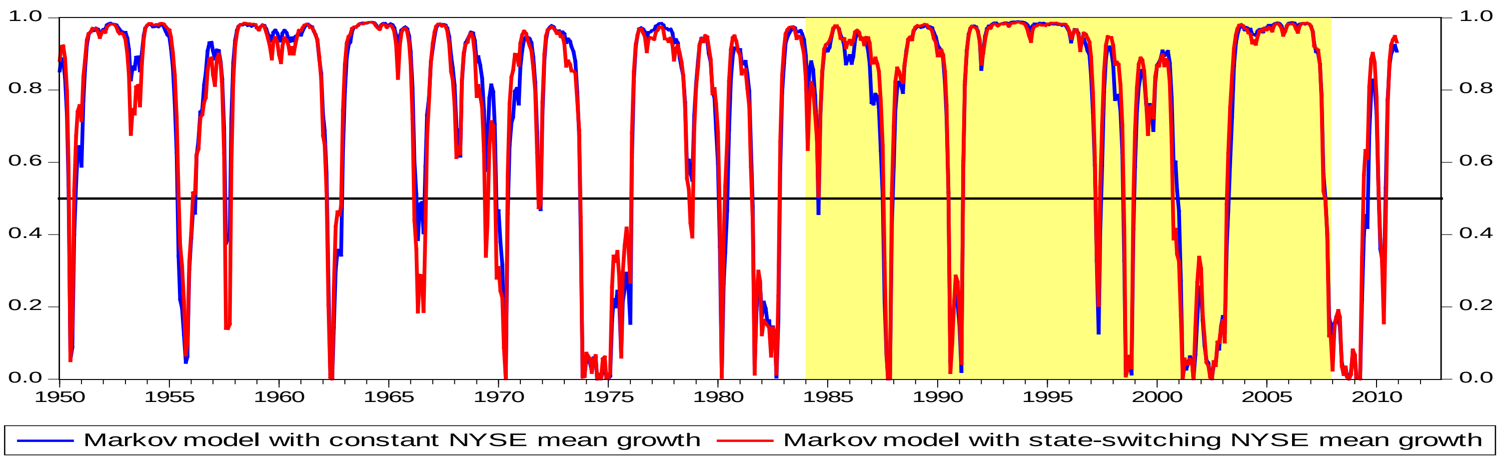
Sources and notes: Nominal returns before 1926 reflect logarithmic percentage change in the GIP-NYSE price-weighted capital appreciation index from the NYSE History Research Project. Stock returns beginning in 1926 reflect logarithmic percentage changes in the S&P500 index; we excluded dividend reinvestment (i.e., the series does not reflect total returns) in order for comparability with the GIP-NYSE index. Observations for the calendar year 1867 are missing in the monthly GIP-NYSE index. Real returns were deflated by the WPI/PPI. The GIP-NYSE index before 1826 is judged less reliable as the number of securities in the index often totals less than 30. For details, see Goetzmann, Ibbotson, and Peng (2000).

Figure 6: Low-volatility state probabilities for monthly U.S. stock returns

Panel A: NYSE returns, January 1826 – December 1914 for switching-variance, switching AR(1) model



Panel B: S&P500 returns, January 1950 – December 2010 for switching-variance, switching AR(1) model



Sources: Authors' calculations. The Markov model in Panel A was fit over the January 1826-December 1914 period, excluding the missing NYSE observations for 1867

Figure 7. Rolling Granger-Causality Tests for Durable Goods Production

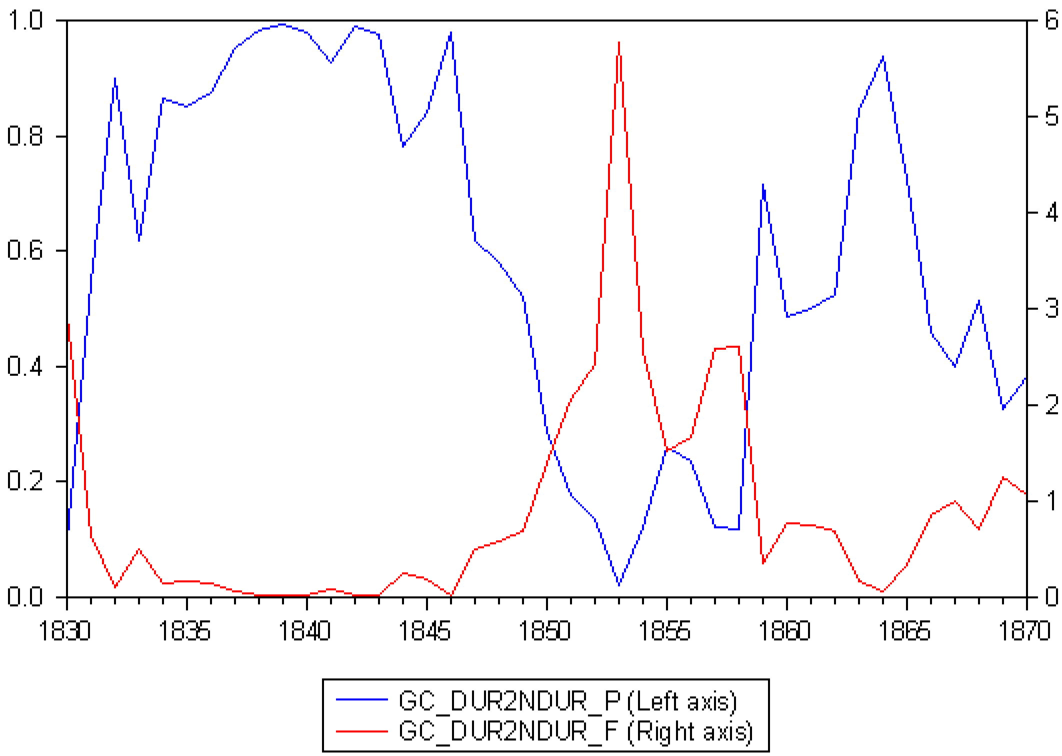


Figure 8: Time-variation in rolling correlation between growth rates in durable-goods and nondurable-goods production

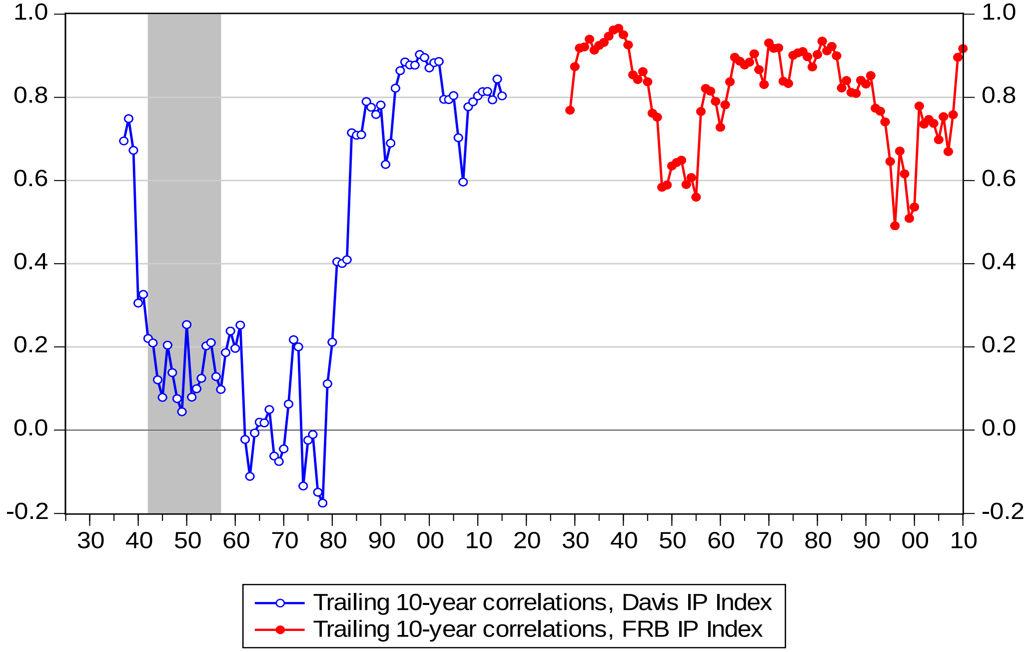
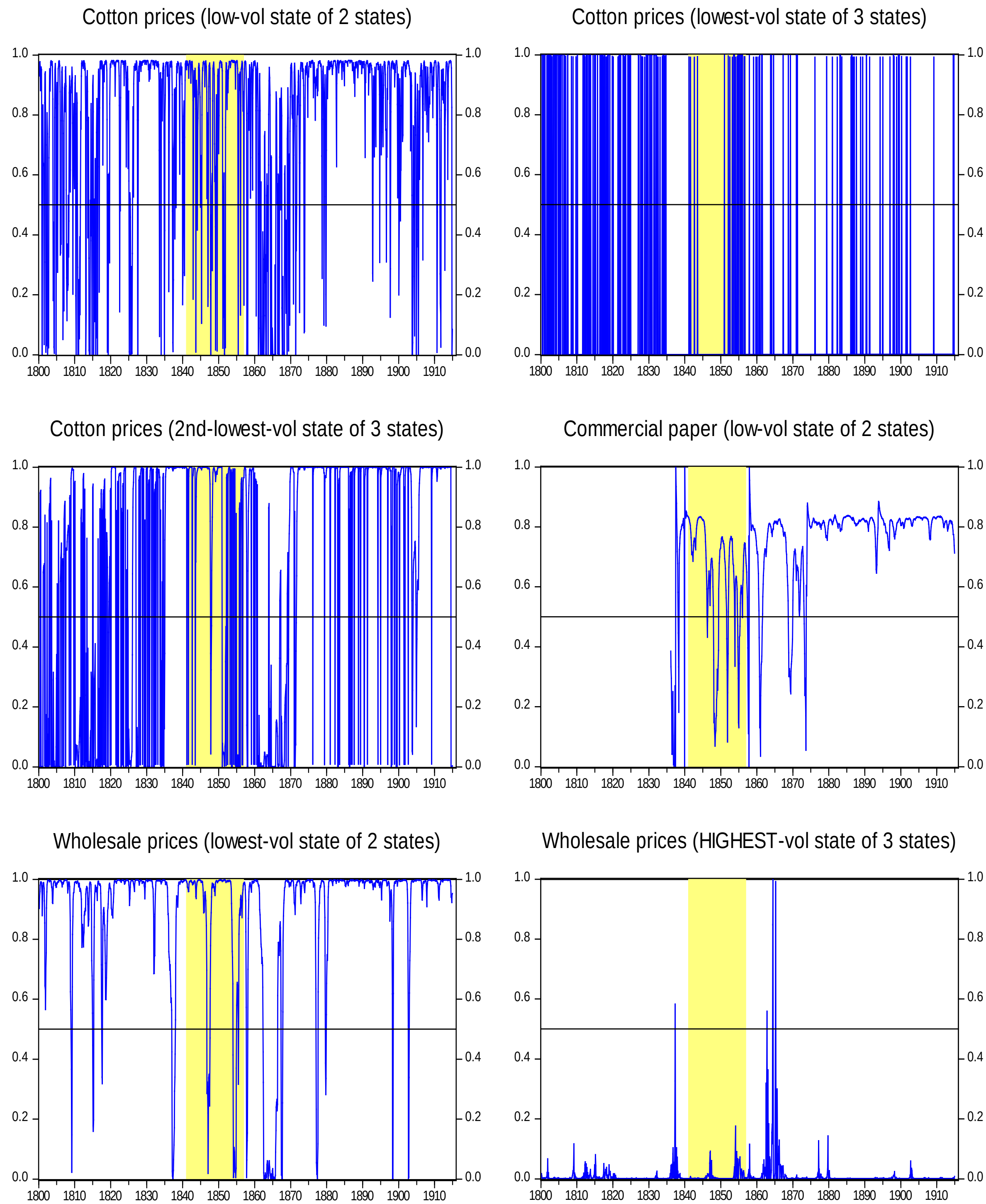


Figure 9: Graphs of Markov-Switching Low Probability States



Figures reflect smoothed probabilities from Markov model, as described in regression table. Cotton and wholesale prices were modelled as monthly log growth rates; CP rates were modelled as monthly first differences given the presence of a unit root.

Figure 10: Graphs of Markov-Switching Models

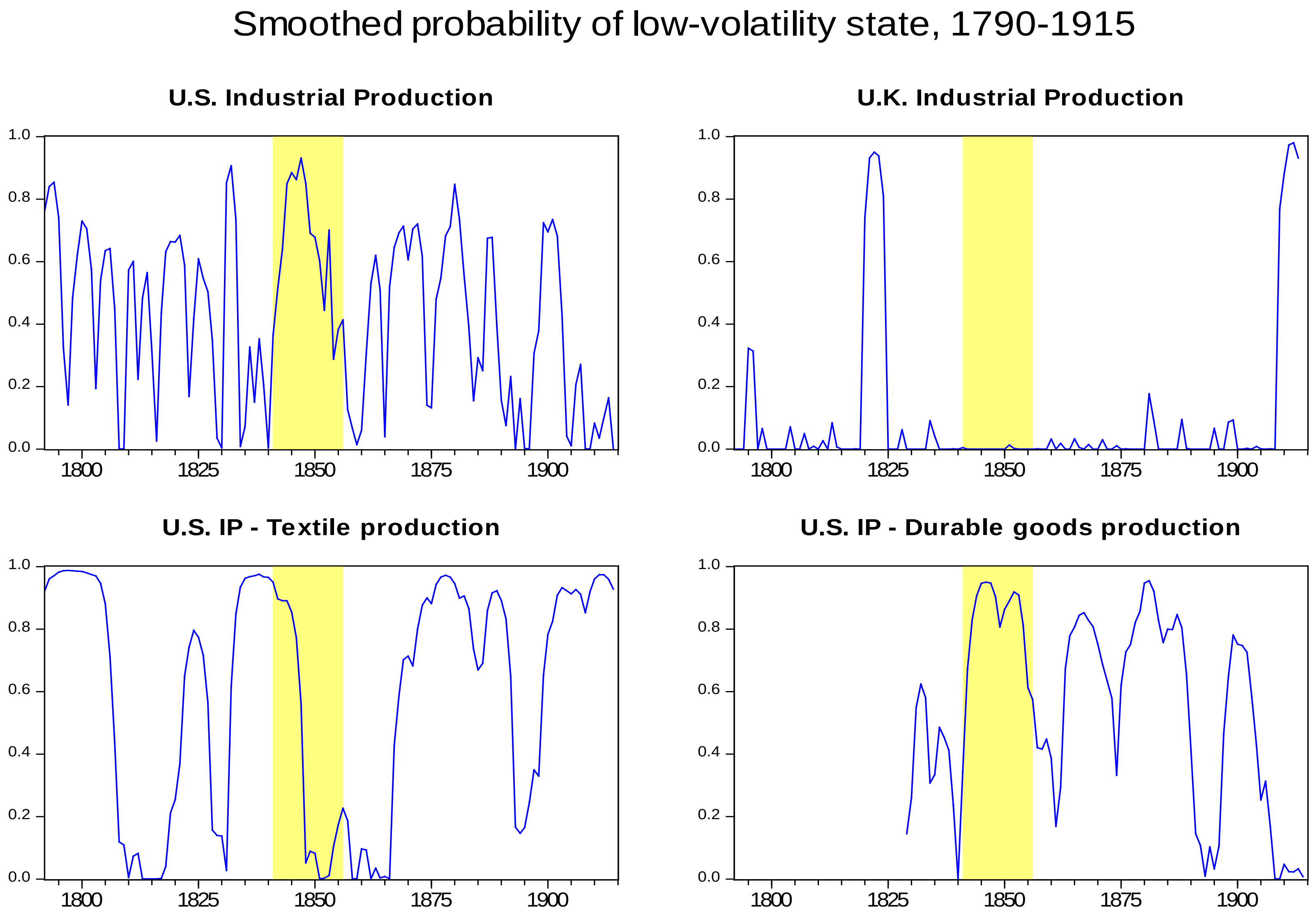
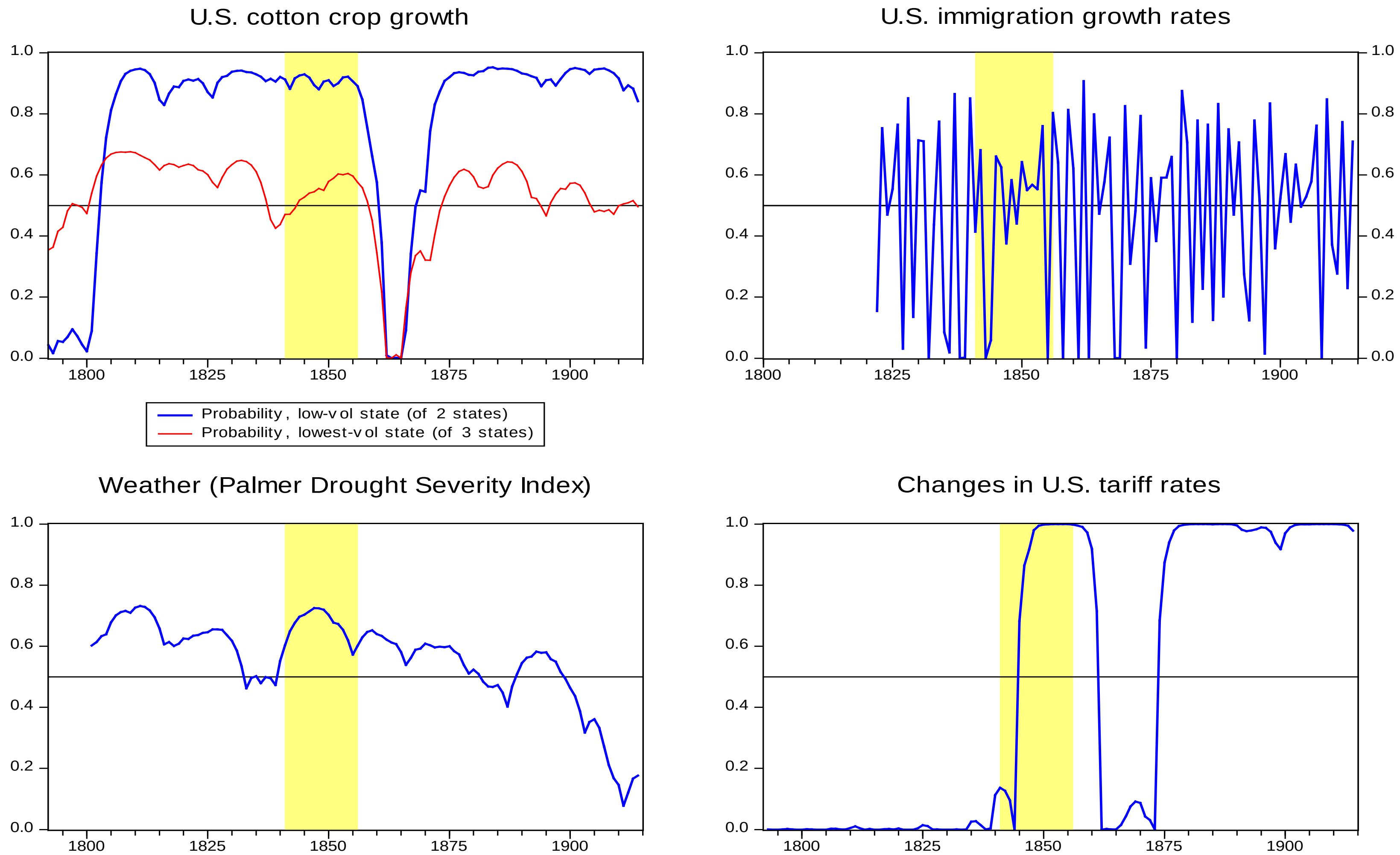


Figure 11: Graphs of Markov-Switching Low-Probability States



Figures reflect smoothed probabilities from Markov model, as described in regression table.