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America's First Great Moderation

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"AMERICA'S FIRST GREAT MODERATION"

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I. INTRODUCTION

Current economic conventional wisdom indicates that the economy of the United States prior to the Civil War was unstable and fraught with recessions. The collapse of the Second Bank of the United States by Andrew Jackson's hand left the United States without a central bank or lender of last resort, and many state banks produced their own banknotes for currency exchange. These different currencies made it difficult to unite interest rates across state lines, inhibiting interstate commerce, and banking panics in the antebellum period often led to declines in lending and investment that drove recessions.[1] The National Bureau of Economic Research,[2] the premier authority on business cycle dating, identifies five recessions in the two decades prior to the Civil War.

By comparison, the period from 1984 to 2007, more commonly referred to as the Great Moderation, was unusually stable and productive. With the exception of two brief downturns in 1991 and 2001, the period was characterized by low economic volatility and rather constant growth.[3] Many explanations have been provided for this heretofore-unknown economic condition, including enhanced monetary policy, improved investment management, and technological breakthroughs. Without a comparable period of economic stability available, and in the light of the recent recession, though, it is difficult to determine fully the cause of this Great Moderation.

While these two periods may appear to be radically different in their economic climate, a closer examination of the data reveals both periods were very economically stable and

[1] Arthur J. Rolnick, Bruce D. Smith, and Warren E. Weber, "The Suffolk Bank and the Panic of 1837: How a Private Bank Acted as a Lender-of-Last-Resort," Federal Reserve Bank of Minneapolis Research Department Working Paper 592, 1998, p. 4.
[2] Henceforth, NBER.
[3] James H. Stock and Mark W. Watson.,"Has the Business Cycle Changed and Why?" NBER Macroeconomics Annual, Vol. 17 (2002), p. 160.

productive in the United States. Joseph Davis' industrial production series for the United States from 1790[4] indicates that the period from 1841 to 1856 was marked by low volatility and high growth relative to the rest of the antebellum and even the postbellum periods. Furthermore, these periods both featured improvements in investment management and technological breakthroughs – information technology and telegraphs, railroads, and canals, respectively – that accelerated industrial production.

This paper examines the economic climate of the period of 1841 to 1856, which I term the "first" Great Moderation. Using Davis' industrial production index, I use basic economic calculations to measure growth and volatility in the antebellum and postbellum period. I compare these results to measures taken from an index of the New York Stock Exchange to better identify declines in volatility. I will then compare these numbers to sectoral indexes to evaluate whether this stability was the result of economy-wide or individual shifts, as well as to railroad development to measure how it may have precipitated industrial growth.

My analysis indicates that volatility in industrial production and stock markets declined significantly during the first Great Moderation. These results are important due to the economic condition of the time. For example, the lack of a central financial authority during this period, termed the "free banking period", creates doubts about the impact of monetary policy on wide-scale economic volatility. These results also indicate factors that may more reliably contribute to great moderations.

[4] Joseph Davis, "An Annual Index of US Industrial Production, 1790-1915," The Quarterly Journal of Economics, Vol. 119, No. 4 (Nov. 2004), pp. 1177-1215.

II. LITERATURE REVIEW

A. CAUSES OF GREAT MODERATIONS

The "second" Great Moderation was a period of significantly low economic volatility from1984-2002. During that time, the standard deviation of GDP growth was only 59% of that from 1960 to 1983.[5] To better understand the economic climate of the first Great Moderation, I will start by examining the possible causes of periods of low volatility. I can identify three primary explanations (excluding luck) for the low volatility of the period.

The most popular of these explanations is the use of monetary policy. Beginning in the early 1980s under Paul Volcker, the Federal Reserve shifted from a monetary policy aimed at economic growth to one targeting the inflation rate. Boivin and Giannoni, using counterfactual analysis of models comparing monetary policy and private-sector parameters before and after 1979, determine that monetary policy after 1979 is more effective at addressing economic shocks. Furthermore, output volatility decreased between pre- and post-1980 samples, but only for models with post-1979 monetary policy, indicating that while monetary policy did not entirely contribute to the decline in output volatility of the Great Moderation, it did have a significant impact.[6]

Second, improvements in inventory management and investment led to reduced investment volatility. McConnell and Perez-Quiros emphasize the effect of improved inventory management techniques in reducing investment volatility. Analyzing inventory-to-sales ratios for durable and nondurable product industries, they find that these ratios have been declining rather constantly since 1983. This shift coincides with a decrease in the amount of time in advance

[5] James H. Stock and Mark W. Watson.,"Has the Business Cycle Changed and Why?" NBER Macroeconomics Annual, Vol. 17 (2002), p. 164.
[6] Jean Boivin and Marc P. Giannoni, "Has Monetary Policy Become More Effective?" *The Review of Economics and Statistics*, Vol. 88 No. 3 (August 2006), p. 458

producers order their materials, which allows the producers to save money on inventory management. This decrease in cost would be reflected in a decrease in investment volatility, as shorter lead times and cheaper inventory management would make production cheaper and more predictable. While this decrease in inventory-to-sales ratios does not occur for nondurable goods, McConnell and Perez-Quiros indicate that a decline in durables volatility during that period would be "sufficient to account for the break in the volatility of aggregate output."[7]

Blanchard and Simon, breaking down GDP into its component parts and measuring the volatility of each from 1952 to 2000, indicates a large decrease in the volatility of investment, especially inventory investment. Comparing inventory investment growth to the growth in output, they find that beginning in around 1984, inventory investment is negatively correlated with output growth.[8] This supports McConnell and Perez-Quiros' conclusion that output increased due to a shift from procyclical to countercyclical inventory investment, as this decrease in inventory investment correlation coincides with the decrease in output volatility.

Finally, technological advances such as the Internet revolution may have decreased market volatility. Pastor and Versonesi, examining market beta, volatility, value, and productivity found similarities between a predicted model and the NASDAQ, NYSE, and private sector during the tech bubble of the 1990s. In both cases, stock price was lower for 6-8 years after the initial technological breakthrough, before peaking sharply. In the case of the tech bubble, market volatility was lower in the mid-1990s, before peaking sharply in the late 1990s and early 2000s, when the bubble burst. This is consistent with the model's prediction of a sharp

[7] McConnell, Margaret, and Gabriel Perez-Quiros (2000). "Output Fluctuations in the United States: What Has Changed since the Early 1980s?" *American Economic Review*, 90, pp. 17-18, 23

[8] Olivier Blanchard and John Simon, "The Long and Large Decline in U.S. Output Volatility," Vol. 2001 No. 1 (2001), pp. 157, 161

increase in systemic risk.[9] While this indicates that technological revolutions lead to market instability prior to widespread adoption, they also appear to contribute to declines in volatility during the years following a breakthrough.

B. ANTEBELLUM ECONOMY

Measurements for the antebellum economy are sparse, due to the scarcity of data for the period. Nonetheless, there have been several attempts at producing an effective series to measure antebellum economic movements. However, many of these involve interpolation of scant data signs, producing highly erratic series. Calomiris and Hanes point to two notable examples – series by Robert Gallman and by Thomas Berry – which suffered from a lack of accuracy prior to the Civil War and attempted to fill in these gaps via assumption. Calomiris and Hanes themselves construct a series for antebellum output, but also hesitate to label their results more than the beginning of such an endeavor.[10]

Nonetheless, many studies have examined the economic conditions of the antebellum period. Calomiris and Hanes themselves find evidence that volatility was potentially higher in the antebellum period than the postbellum. However, they reason that aggregate volatility should appear in the data as volatility in each individual series, and these variations occur only in some of their products.[11]

Goldin and Margo test the impact of deflation on unemployment during the 1839 downturn by comparing real wage trends to a factor for persistence of shocks. They determined that price shocks had less of an impact in the heavily-agricultural Midwest than in productive

[9] Ľuboš Pástor and Pietro Veronesi. "Technological Revolutions and Stock Prices." NBER Working Paper 11876. 2005. pp. 36-37
[10] Calomiris, Charles W. and Christopher Hanes. "Consistent Output Series for the Antebellum and Postbellum Periods: Issues and Preliminary Results." *The Journal of Economic History*, Vol. 54 No. 2 (June 1994), pp. 410
[11] *Ibid.*, p. 416.

hubs like the Northeast, indicating that deflation produced unemployment in "industry and urban areas." The comparative constancy of real wages in agriculture suggests that it was likely less volatile as a whole than manufacturing, at least around 1839. Goldin and Margo also find that the antebellum period was marked by volatile real wages and periods of significant deflation, especially around recessive periods.[12]

Rostow, by contrast, argues that the 1840s and 1850s represent a period of rapid growth in the United States. Christening this period the American "take-off period", Rostow emphasizes the rapid development of railroad technology and industrial production, and their subsequent diffusion into the Midwest, as a catalyst for sustained growth.[13] Similarly, David, while skeptical of a "take-off" in the two decades prior to the Civil War, indicates that growth in the United States around 1840 was not significantly lower than in prior decades. For example, despite the downturn of the late 1830s, real GDP per capita increased approximately 19% to 22% from 1830 to 1840.[14] This indicates that the United States was economically stronger in 1840 and subsequent years than the effects of the Crisis of 1837 would initially suggest.

C. RECESSION CHRONOLOGIES

Despite these impressions, the most commonly accepted business cycle chronology, the NBER chronology of US business cycle expansions and contractions, reports fifteen separate periods of recession from 1796 to the beginning of the Civil War, including seven between 1830 and 1860. This reflects the primary findings of two NBER studies that laid the groundwork for

[12] Claudia Goldin and Robert A. Margo. "Wages, Prices, and Labor Markets Before the Civil War." NBER Working Paper No. 3198, 1989. p. 19.
[13] W.W. Rostow, *The Stages of Economic Growth: A Non-Communist Manifesto*. 3rd Edition. Cambridge, United Kingdom: Cambridge University Press. 1990. p. 38
[14] Paul A. David. "The Growth of Real Product in the United States Before 1840: New Evidence, Controlled Conjectures." *The Journal of Economic History*, Vol. 27 No. 2 (Jun. 1967), p. 184.

early business cycle dating, Thorp's *Business Annals* and Burns and Mitchell's *Measuring Business Cycles*. These two studies argue that antebellum business cycles were erratic due to a series of financial panics in the 1830s, 1840s, and 1850s which, when coupled with the lack of a central banking structure after the collapse of the Second Bank of the United States, led to prolonged periods of deflation and recession.[15] These panics, and the perilous economic conditions that produced them, would seem to inhibit long-run economic stability.

However, recent reevaluations of these studies show data errors that overstate the impact of downturns. Thorp's data is based on qualitative reports of the time, rather than quantitative data, which "tended to portray business conditions as 'still weak' following a downturn" and fails to always correctly differentiate between an absolute recession and a relative decline in growth.[16] Burns and Mitchell, meanwhile, use a combination of Thorp's *Annals* and historic indexes to measure out turning points. However, Romer indicates that their dating for the years between 1884 and 1927 used detrended data that places peaks earlier and troughs later when determining recessions when compared to post-1945 NBER dating methods.[17] Watson also demonstrates that these variations between business cycle measurements disappear when cyclical data is limited to nominal prices for commodities, crude materials, and financial instruments.[18] This would indicate that an index based solely on quantitative measures of key economic indicators would better reflect absolute peaks and troughs in economic growth.

By comparison, Davis uses his index of industrial production, based on quantitative measures of key economic indicators, to construct an alternate business cycle chronology for

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[15] Willard Long Thorp. *Business Annals*. NBER General Series, No. 8. New York: NBER, 1926; Arthur F. Burns and Wesley C. Mitchell. *Measuring Business Cycles*. New York: NBER, 1946.
[16] Joseph Davis. "An Improved Annual Chronology of U.S. Business Cycles," *Journal of Economic History*, Vol. 66 (2006), pp. 103–121.
[17] Christina D. Romer. "Remeasuring Business Cycles." *The Journal of Economic History*, Vol. 54 No. 3 (Sep. 1994), pp. 576-582
[18] Mark W. Watson. "Business-Cycle Durations and Postwar Stabilization of the U.S. Economy." *American Economic Review* Vol. 84 No. 1 (1994), pp. 38-39

1790-1915, which is reproduced in table 2. This new chronology indicates that the NBER chronology, especially prior to the Civil War, overstates the duration and number of recessions. These results are consistent with Romer's and Watson's cycles for after 1884. In addition, the Davis chronology supports Romer's conclusion that antebellum business cycles were no more volatile than those after the Civil War.[19] This indicates that the Davis index, upon which the chronology is based, is a more accurate depiction of economic activity for the 19th century.

One consideration is that Davis' index largely reflects industrial production for a time period with a largely-agricultural economy. As Davis emphasizes, though, industrial production is reliant upon non-industrial inputs, which represent a cross-section of a nation's economy.[20] Since Davis' data is largely taken from measurements at major trade hubs and trade journals, there is some production, especially in agriculture, that may go unmeasured, but we would argue that the impact of these goods would be small as a result. Since such a large percentage of trade goods in that time went through only a few cities, especially in the developing West, and these centers were also transportation hubs, any goods that aren't measured in our index likely were not destined for industrial production, but rather local or individual consumption. Without going far, these goods would as a result have only a minor impact on the market, we argue these unmeasured goods constitute an insignificant portion of the market, and thus do not undermine the validity of Davis' index.

[19] Romer. "Remeasuring Business Cycles." p. 602
[20] Joseph Davis. "An Annual Index of US Industrial Production, 1790-1915." *The Quarterly Journal of Economics*, Vol. 119, No. 4 (Nov. 2004), pp. 1180

III. DATA ANALYSIS

A. INDUSTRIAL PRODUCTION

For the data, we began by calculating annual growth rate for each year. Using this data, we proceeded to calculate annual volatility by taking the standard deviation of the growth rate of each year and the two preceding for each year with such available data. It is worth noting that this data does leave our volatility measurements susceptible to sudden economic shifts from previous years, but we argue that, since a year's economic climate is necessarily the product of these shifts, it is reasonable to expect that an economy may be measurably volatile as a result of previous shocks. Three-year samples ensure that variations from previous years are measurable without diluting their significance. To obtain a rough estimate of growth and volatility in each of our three measurement periods – prior to 1840, 1841-1856, and after 1866 – we also calculated the average and standard deviation of the growth rates for these three periods.

Table 1 shows the results of these calculations. During the first Great Moderation, industrial production as represented by the Davis index grew at approximately 60 percent faster than during the rest of the antebellum or during the postbellum. These results are confirmed by Figure 1, which shows growth rates in the Davis Index from 1790 to the present. Not only are growth rates consistently positive during the first Great Moderation, comparing that period to the second Great Moderation shows that economic growth during the former period was also generally greater. Likewise, the standard deviation and coefficient of variation (the ratio of the standard deviation and average of growth) of IP growth were respectively at least 20 and 50 percent lower during the first Great Moderation. These results are confirmed as well by Figure 2, which shows the growth-to-volatility ratio (the inverse of the coefficient of variation) peaked during the first Great Moderation, even exceeding the levels of stability reached during the

second Great Moderation. These results indicate that not only was growth greater during the first Great Moderation, it was also much more stable, even when compared to modern business cycles.

To better measure differences in growth between the three periods, we performed t-tests comparing growth rates for 1841-1856 with pre-1840 and post-1866. These tests showed that average growth was greater for the first Great Moderation than the rest of the antebellum or the postbellum at a 5% significance level.

B. MONTHLY STOCK DATA

I can corroborate these findings that the first Great Moderation was very productive and stable in stock returns of the period. I use Goetzmann, Ibbotson, and Peng's monthly stock index from 1815-1926 to measure stock returns and volatility for the first Great Moderation in the same manner as with the Davis IP index. Goetzmann, Ibbotson, and Peng's index uses methods akin to that of the CRSP index for stock prices after 1926 to ensure the data for both periods is comparable, and assembles data for all stocks with publicly posted prices. Thus, this index is an ideal source for our measurements of variation in stock prices before, during, and after the first Great Moderation.[21]

Table 1 shows that the average (arithmetic) stock returns averaged .3 percent per month during the Great Moderation. As with the Davis IP index, stock returns for the first Great Moderation were at least fifty percent greater than prior years or during the postbellum. In addition, the standard deviation and coefficient of variation of those returns were lower for the first Great Moderation than other periods, again by at least half. This indicates that the stable, high growth indicated by the Davis index were not just the result of isolated variations, but rather

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a market-wide increase in productivity and decrease in volatility. Figure 3 further demonstrates this result – fluctuations in price appear to be generally more positive and less volatile than in other periods measured.

C. SECTORAL PRODUCTION AND ECONOMIC INDICATORS

I next constructed IP indices for durable and nondurable goods from the Davis IP dataset. The durable goods sector includes chemical fuels, machinery, and metals. The non-durable goods sector consists of food, textiles, and leather products. I then calculated growth rates and coefficients of variation for durable and nondurable goods in the same way as for the industrial production index.

The summary statistics are reported in Table 5. For nondurable goods production, annual growth rate averaged approximately 6.9 percent during the First Great Moderation and the remainder of the antebellum period. During the postbellum period, the growth rate of nondurable production dropped to 4.9 percent per annum. Economic growth in nondurable production was less volatile during the First Great Moderation. The standard deviation of the growth rate of nondurable production averaged 6.7 percent during the First Great Moderation compared to 9.8 percent during the rest of the antebellum period. The standard deviation of nondurable goods production averaged only 5 percent during the postbellum period. The coefficient of variation is lower during the First Great Moderation (.971) compared to 1.417 for the non-First Great Moderation period and 1.02 for the period after the Civil War.

Durable goods production, meanwhile, was both significantly higher and more stable during the first Great Moderation. Durable goods production grew at an annual rate of 9.5 percent during the first Great Moderation, compared to 5.5 percent for the remainder of the

antebellum period and 5.7 percent for the postbellum period. The standard deviation of growth for the first Great Moderation was significantly lower, 6.8 percent, than for the rest of the antebellum period, 10.7 percent, as well as for the postbellum period (10.9 percent). The coefficient of variation was .72 during the First Great Moderation compared to 1.92 for the rest of the antebellum period and 1.901 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. This suggests that the correlation between the two sectors significantly declined during the First Great Moderation. To test this hypothesis, I 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 6.

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, which would explain why growth rates in nondurable goods were unchanged through the antebellum. These results in turn indicate that increases in the production of durable goods played a major role in the overall economic growth of the period.

III. UNDERSTANDING THE FIRST GREAT MODERATION

A. COTTON AND AGRICULTURAL MARKETS

Stability in agricultural markets, especially cotton, played a major role in reducing volatility during the First Great Moderation. More than half of the country's economic output was in the form of agricultural products and textiles,[22] which represented approximately one-third of antebellum GNP.[23] This was especially true in the south where the production of cotton constituted a large percentage of overall economic activity. Textiles represent more than 20 percent of the Davis IP index in the antebellum period.[24]

As shown in Table 4, cotton prices grew faster during the first Great Moderation and with more stability than during prior years or the years following the Civil War. Prices during the first Great Moderation grew approximately three times as fast as in prior years, although those rates represent fractions of a percent; furthermore, the coefficient of variation of price changes for the first Great Moderation are only one-third those of the rest of the antebellum and the postbellum. The similarity of the coefficients of variation for these two periods in particular indicates that cotton markets during the first Great Moderation were uniquely stable compared to in other periods, which would significantly contribute to the stability of the economy as a whole.

Temin argues that supply shocks such as weather played an important role in determining cotton supply. For the period of 1820-1859, Temin constructs regressions for American cotton supply to identify the factors that influenced that production – specifically, the impact of the prior year's price on production via different land apportionments. He finds that the only factor

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[22] Joseph Davis. "An Annual Index of US Industrial Production, 1790-1915." *The Quarterly Journal of Economics*, Vol. 119, No. 4 (Nov. 2004), pp. 1177-1215.
[23] Joseph Davis, Christopher Hanes, and Paul W. Rhode. "Harvests and Business Cycles in Nineteenth-Century America." *The Quarterly Journal of Economics*, vol. 124 no. 4 (2009), pp. 1675-1727.
[24] Davis, "US Industrial Production", p. 1188

that directly influenced quantity was time, which serves most obviously as a proxy for population growth. Domestic prices for cotton had an insignificant effect on what farmers would produce in future years; nor does Temin find any evidence that farmers willingly held stock back to account for unusually good harvests.[25] Furthermore, when Temin's supply regression is factored into his equation for British prices, the time variables in those two equations nearly cancel each other out, indicating that time-related factors in supply and demand such as population growth had a relatively small impact on prices. Thus, the only factors that appear to independently influence cotton prices are general price levels and random factors affecting supply, the most prominent of which are weather-related harvest fluctuations. This indicates that long-term weather events, such as droughts, would have a corresponding long-term effect on prices.

To evaluate these weather effects, I obtained Palmer drought severity index (PDSI) for the southeastern United States to measure variations in weather effects for the region over time. (See Figure 4.) These index values reveal that, through the first Great Moderation, the southeastern United States experienced a period of almost constant, albeit mild to moderate, drought. This came at a time when cotton consumption exploded both domestically and internationally. During the first Great Moderation, United States produced 80% of the world's cotton; not only would such a collapse in production directly affect domestic prices, these two factors contributed to more inelastic export demand, which would explain higher prices in droughts like those of the first Great Moderation both internationally and domestically.[26] The

[25] Peter Temin. "The Causes of Cotton-Price Fluctuations in the 1830s." *The Review of Economics and Statistics*, Vol. 49 No. 4 (Nov. 1967), pp. 467-8.

[26] See also Douglas A. Irwin. "The Optimal Tax on Antebellum U.S. Cotton Exports." *Journal of International Economics*, Vol. 60 (2003). p. 276. Irwin estimates the elasticity of export demand at only -1.7 – still inelastic, but not tremendously so. Nonetheless, due to the sheer size of the United States' share of the world cotton supply, one would expect any significant weather event such as the droughts of the first Great Moderation to significantly affect prices both internationally and domestically.

persistence of these droughts during the first Great Moderation, in turn, would reduce price volatility

Taken together, these two factors seem to explain much of the price stability during the first Great Moderation. As shown in Table 1, cotton price volatility during the first Great Moderation was lower than for the preceding or succeeding periods as measured by the standard deviation in price changes. The coefficient of variation for cotton prices was approximately two-thirds lower than the pre-First Great Moderation period or the postbellum period (1866-1913). This can probably be attributed to increasing demand for cotton in Britain and stable weather patterns. Low price elasticity in Britain would keep price shifts steady, reducing price volatility and diminishing the impact of other shocks. In addition, good weather through the first Great Moderation prevented price spikes such as those in the 1830s that increased market volatility. These factors kept agricultural production, representing a significant portion of the Davis index, stable between 1841 and 1856.

B. TECHNOLOGICAL INNOVATION

The first Great Moderation was characterized by the widespread adoption and use of several important technologies: railroads, canals, and the telegraph. While steam railroads were introduced to the United States with the Baltimore and Ohio Railroad in 1828, it 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.[27] By comparison, freight rates for railroads in the mid-1830s were often 7-10 cents per ton-mile.[28] Rail mileage accelerated through the 1830s and 1840s, reaching 3,328 miles in 1840 and 8,879 by 1850. 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.[29]

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. 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.[30] This 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 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,

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[27] George R. Taylor. *The Transportation Revolution 1815-1860*. New York: Rinehart & Company. 1951, p. 137.
[28] Albert Fishlow. *American Railroads and the Transformation of the Ante-bellum Economy*. Cambridge, MA: Harvard University Press. 1965. pp. 323-324.
[29] Taylor, *Transportation Revolution*. p. 79.
[30] *Ibid*, pp. 135, 137, 139, 165.

respectively. Removing some cities with relatively close access to water magnifies these differences.[31] 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 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.[32]

Many scholars have debated the affect of railroads on antebellum industrialization. Atack, Haines, and Margo 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. Their examination of major Eastern cities finds that rail access made it 19 percent more likely that a random firm would be a factory.[33] 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.[34] Second, factories are by definition only useful in conjunction

[31] Fishlow. *American Railroads*, pp. 209-211.
[32] Jeremy Atack and Robert A. Margo. "Agricultural Improvements and Access to Rail Transportation: The American Midwest as a Test Case, 1850-1860." NBER Working Paper 15520. 2009, pp. 17
[33] Jeremy Atack, Michael R. Haines, and Robert A. Margo. "Railroads and the Rise of the Factory: Evidence for the United States, 1850-1870." NBER Working Paper 14410. 2008, pp. 20
[34] *Ibid*, pp. 17-21

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 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.[35] Davis 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."[36] However, as established by my 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

[35] W.W. Rostow. *The Stages of Economic Growth: A Non-Communist Manifesto*. 3rd Edition. Cambridge, United Kingdom: Cambridge University Press. 1990. p. 38 fn. 1
[36] Davis, "US Industrial Production", p. 1116

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 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.[37] As previously noted, stable and low cotton prices did contribute somewhat to the stability of the greater economy during the first Great Moderation. However, in the Davis IP index and the economy of the time, these other sectors represent comparably far smaller segments of overall production than cotton, and thus had a far smaller impact on aggregate industrial growth during the first Great Moderation.[38] 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 find that there is approximately an 8-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

[37] Fishlow. *American Railroads*, pp. 240-261.
[38] Davis, "US Industrial Production", pp. 1186-1188

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.[39] The bubble burst in 1857 roughly coincides with my 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.[40] 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.

[39] Ľuboš Pástor and Pietro Veronesi. "Technological Revolutions and Stock Prices." NBER Working Paper 11876. 2005. pp. 1451-1483.
[40] Fishlow. *American Railroads*, pp. 209-211.

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.[41] 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.

C. FINANCIAL INTEGRATION

Bodenhorn 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, the closest antebellum equivalent to a central bank. 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 variation. 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

[41] Richard B. Du Boff. "Business Demand and the Development of the Telegraph in the United States, 1844-1860." *The Business History Review*, vol. 54 no. 4 (Winter 1980), pp. 471-478

1857 that interest rates in the two cities diverged for an extended period of time, though even in that crisis rates still remained generally consistent compared to crises prior to the first Great Moderation.[42]

These results are also seen in further examination of differences for all cities in Bodenhorn's sample. For each month, I calculated the average interest rate, the standard deviation, and the coefficient of variation rates in each city. Table 4 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, which would contribute to greater economic stability.

I have two possible explanations for interest rate convergence in the first Great Moderation. Bodenhorn 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.[43] 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

[42] Howard Bodenhorn. "Capital Mobility and Financial Integration in Antebellum America." *The Journal of Economic History*, Vol. 52 No. 3 (Sep. 1992), pp. 586-594; Howard Bodenhorn. *A History of Banking in Antebellum America: Financial Markets and Economic Development in an Era of Nation-Building*. Cambridge, United Kingdom: Cambridge University Press. 2000. p. 156

[43] Bodenhorn. *A History of Banking*. p. 192

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 emphasizes that transportation was still comparatively expensive, but I 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, further reducing interest rate fluctuations between different regions in the United States.[44]

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. Lance Davis, for example, finds that the low variation in short-term interest rates in the two decades prior to the Civil War promoted economic growth in New England textile mills.[45] These results are consistent with what we would expect to occur in all industrial sectors of the economy, indicating that low interest rates catalyzed such development.

D. WESTERN EXPANSION

[44] Bodenhorn. "Capital Mobility." p. 589
[45] Lance E. Davis. "The New England Textile Mills and the Capital Markets: A Study of Industrial Borrowing 1840-1860." *The Journal of Economic History*, Vol. 20 No. 1 (Mar. 1960), pp. 10-13.

Western migration accelerated through the antebellum period, spurred on by the prospect of inexpensive land for agriculture.[46] One prominent theory, first posed by Turner, held that western expansion served as a "safety valve" for the unemployed in the East, who could transition into western agriculture.[47] Many scholars have identified several flaws with Turner's theory, such as the prohibitive cost of moving west for some workers.[48] Nonetheless, Turner's theory does indicate that western expansion during the first Great Moderation may have produced steady growth in industrial production.

Ferrie 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 – indeed, the regression indicates that expected wealth gains had a statistically significant impact on the probability of moving west. Ferrie's regressions also indicate that those most likely to migrate were laborers in cities with population greater than 10,000, also consistent with Turner's theory.[49] Margo, building on a hypothesis first posited by Coelho and Shepherd, indicates that real wages for common labor and artisans were respectively 11 percent and 24

[46] Guillame Vandenbroucke. "The US Westward Expansion." *International Economic Review*, Vol. 49 No. 1 (Feb. 2008), pp. 82-83
[47] Frederick J. Turner. *The Frontier in American History*. New York: Henry Holt and Company, 1921. Hypertext version, ed. Michael W. Kidd, University of Virginia. http://xroads.virginia.edu/~hyper/turner/
[48] Sukkoo Kim and Robert A. Margo. "Historical Perspectives on US Economic Geography." NBER Working Paper 9594. 2003. pp. 4-5
[49] Joseph P. Ferrie. "Migration to the Frontier in Mid-Nineteenth Century America: A Re-Examination of Turner's 'Safety Valve'." Department of Economics, Northwestern University manuscript. 1997. pp. 14, 20-21

percent higher in the Midwest than in the Northeast in the 1850s, an increase from 10 percent and 21 percent in the 1840s.[50]

Since many workers went west to find employment in agriculture, 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 found that removing growth in transportation costs for households led to noticeably lower growth in land improvement and population, particularly in the antebellum period.[51] 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 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, but as previously mentioned this ratio fell to just over ten percent during the first Great Moderation.[52] Vandenbroucke 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. This decline suggests that real wages across the United States were converging, forming the beginnings of a "national labor

[50] Robert A. Margo. "Regional Wage Gaps and the Settlement of the Midwest." *Explorations in Economic History*, Vol. 36 (1999), p. 139; see also Philip R.P. Coelho and James F. Shepherd. "Regional Differences in Real Wages: The United States, 1851-1880." *Explorations in Economic History*, Vol. 13 (1976).
[51] Vandenbroucke. "The US Westward Expansion." p. 105
[52] Margo. "Regional Wage Gaps." p. 139.

market," with stable real wages across the country. Vandenbroucke emphasizes that 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.[53] 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 determinant of reduced economic volatility during the first Great Moderation.

E. WAGES AND PRICES

This conclusion appears at first glance inconsistent with perceived volatility in wage and wholesale price data during the first Great Moderation. However, I argue that, in addition to wage convergence, greater market mobility and variation contributed to wage-price flexibility, which reduced the duration of real wage shocks.

Table 1 shows the average, standard deviation, and coefficient of variation of growth rate for wages and wholesale prices. For wages, I found that coefficients of variation for the first Great Moderation were lower than the rest of the antebellum and the postbellum respectively. Growth rates for wages were also higher during the first Great Moderation than for the postbellum, though not significantly. I found similar results for wholesale prices – coefficients of variation and growth rates were respectively lower and higher for the first Great Moderation than for the antebellum or postbellum, though again not to a statistically significant degree.

However, the fifteen-year rolling averages tell a different story. Coefficients of variation for both wages and prices prior to the Civil War were more erratic and generally higher than the postbellum years. For example, while fifteen-year standard deviations of wage growth rates decreased steadily through the first Great Moderation, wage fluctuations contributed to unstable

[53] Vandenbroucke. "The US Westward Expansion." p. 89

variations. One explanation for this difference is that the duration of major increases in coefficients of variation are small, especially when considering the large test period. This means that the impact of these spikes were relatively small, especially during the first Great Moderation. These fluctuations in wholesale prices and wages pose a second question, however: why was industrial production so strong at the same time prices were so unpredictable?

Goldin and Margo argue that wage-price flexibility during the antebellum period stabilized industrial production against wage and price fluctuations. With land expansion in the west and greater access to that land via transportation technology, the theory holds, laborers in the east who found themselves out of work could shift to agricultural production in the west with minimal effort, thus minimizing the impact of shocks. In addition, Goldin and Margo find that prices and nominal wages were more flexible in response to price fluctuations. This flexibility occurred despite demonstrably greater price and nominal wage fluctuations during that period.[54] During the first Great Moderation, no central bank existed to offset price flows due to bimetallism and crop yields. This, coupled with monetary fluctuations such as the California Gold Rush of 1849-1850, meant that price shocks were more severe and thus banking panics would be more common. However, because consumers and producers were more likely to respond to price changes, in the long run lower nominal wages would lead to increased production to offset the fluctuations. Therefore, the theory holds, greater employment and wage flexibility during the first Great Moderation minimized the effect of these shocks on long-run production.

While Goldin and Margo do find signs that long-term markets were generally self-correcting in the long run, they find that shocks did have a significant short-term effect.

[54] Claudia Goldin and Robert A. Margo. "Wages, Prices, and Labor Markets Before the Civil War." *Strategic Factors in Nineteenth Century American Economic History: A Volume to Honor Robert W. Fogel*. Chicago: University of Chicago Press, 1992. pp. 71-72

Measuring the random-walk component of wages for 1820-1856, Goldin and Margo show that, while for most professions the impact of shocks declined over time, and mostly disappeared within the fifteen-year window, this decline was gradual compared to a baseline white-noise measure.[55] At the same time, it is important to note the regional and occupational variations in these declines. For example, in the Midwest, random-walk components for unskilled laborers actually follow the white-noise baseline exactly for the first three years of the window before leveling off. Since unskilled labor was an essential component of the burgeoning agricultural production in the Midwest during that period, this suggests that nominal wages in the Midwest followed prices more closely, reducing the duration of shocks. Thus, while generally wages for the first Great Moderation did suffer from short- if not long-run fluctuations, the availability of labor in the expanding west, coupled with more flexible nominal wages for those professions, likely contributed to the low productive volatility of the period.

F. 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 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

[55] *Ibid.* pp. 82-84

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.[56]

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, the industrial production index shows that growth and volatility for the period 1815-1840 were nearly identical to that of 1791-1840, despite the interruption of trade caused by the War of 1812.

Ultimately, the First Great Moderation ended with the financial panic and recession of 1857. The collapse of Ohio Life Insurance and Trust triggered a liquidity crisis as markets feared that banks across the nation, interconnected through the Great Moderation, might collapse in unison. Meanwhile, falling wheat prices threatened the success of western farmers, and the Supreme Court's decision in *Dred Scott v. Sanford* made "free soil" in the burgeoning west more economically tenuous, hindering western expansion.[57] While the panic had subsided by 1859, the advent of the Civil War signaled the end of the high growth and low volatility of the Great Moderation.

[56] William O. Brown, Richard C.K. Burdekin, and Marc D. Weidenmier. "Volatility in an Era of Reduced Uncertainty: Lessons from Pax Brittanica." *Journal of Financial Economics*, Vol. 79 (2006), p. 696

[57] Charles W. Calomiris and Larry Schweikart. "The Panic of 1857: Origins, Transmission, and Containment." *The Journal of Economic History*, Vol. 51 No. 4 (Dec. 1991), pp. 815-818.

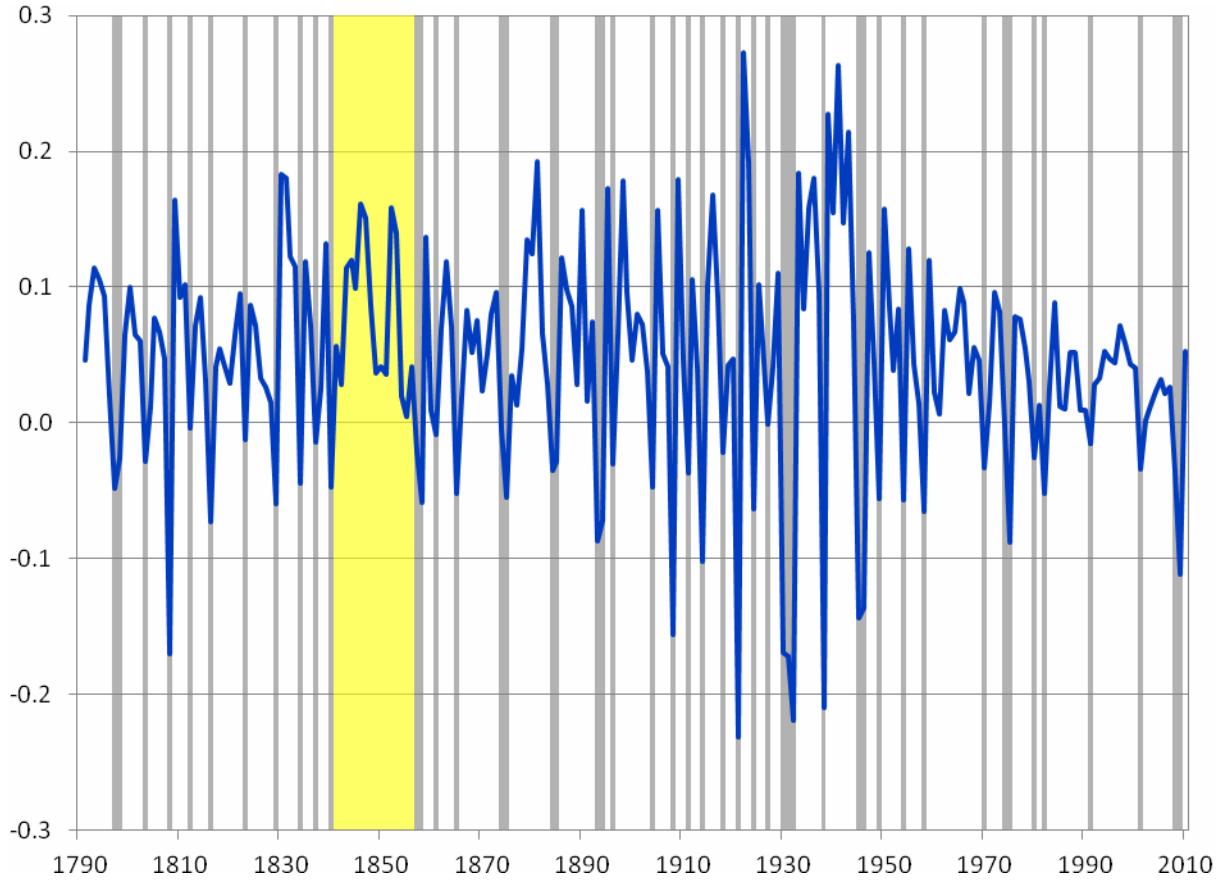
V. CONCLUSION

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, I identify an earlier period of high economic growth and low economic and financial market volatility. I 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.

I then examine the economic factors behind the First Great Moderation. My analysis suggests that favorable agricultural supply shocks, the widespread adoption of new railroad technology, increased financial market integration, real wage convergence, and western expansion contributed to the longest economic expansion in American history. Other factors, such as the absence of large global shocks (i.e. no major global wars) probably produced a stable economic climate. Unlike today, monetary and fiscal policy probably did not play a role in the First Great Moderation given that the United States did not have a central bank and government spending was a very small percentage of the US economy. In summary, my 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.

DATA APPENDIX

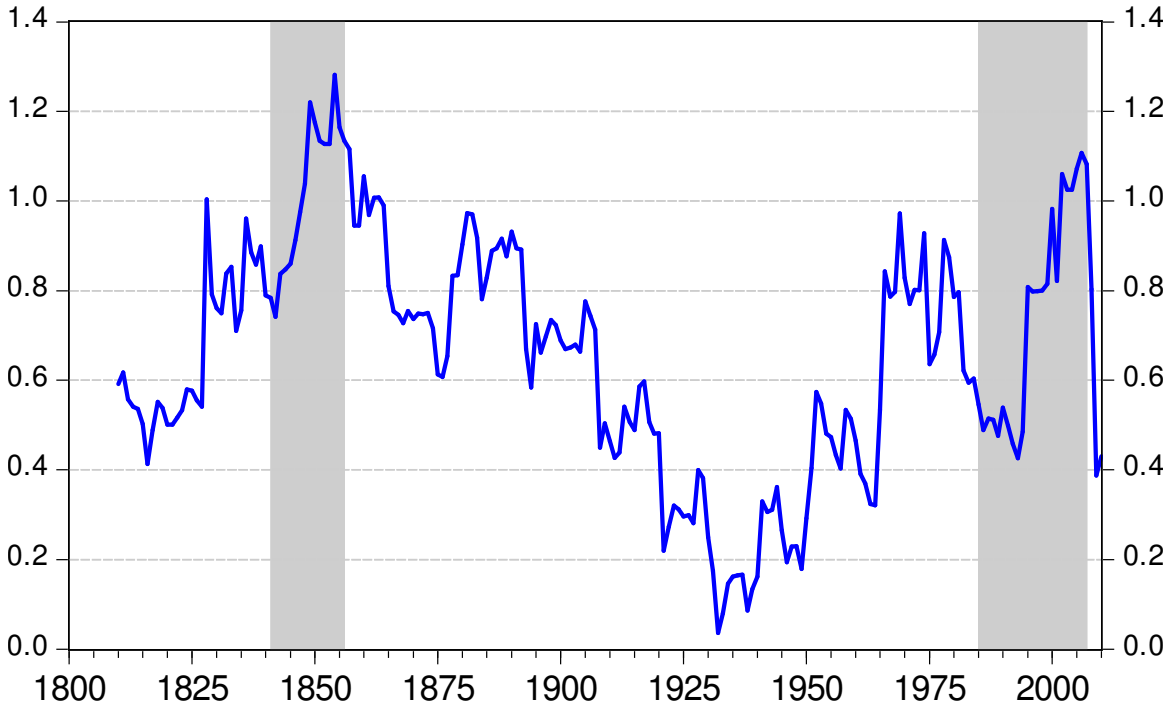
Figure 1: Growth rates in annual Davis IP index, 1791-2010



Gray areas represent negative growth rates in the Davis IP index, which I associate here with recessions. See also Joseph Davis. "An Improved Annual Chronology of U.S. Business Cycles," *Journal of Economic History*, Vol. 66 (2006), pp. 103–121, and see Table 2. The yellow area represents the First Great Moderation.

Sources: Joseph Davis, "A Quantity-Based Annual Index of US Industrial Production, 1790-1915: An Empirical Appraisal of Historical Business-Cycle Fluctuations," Ph.D. dissertation, Duke University, 2002; Joseph Davis, "An Annual Index of US Industrial Production, 1790-1915," *The Quarterly Journal of Economics*, Vol. 119, No. 4 (Nov. 2004), pp. 1177-1215; Davis, "Improved Annual Chronology"; author's calculations.

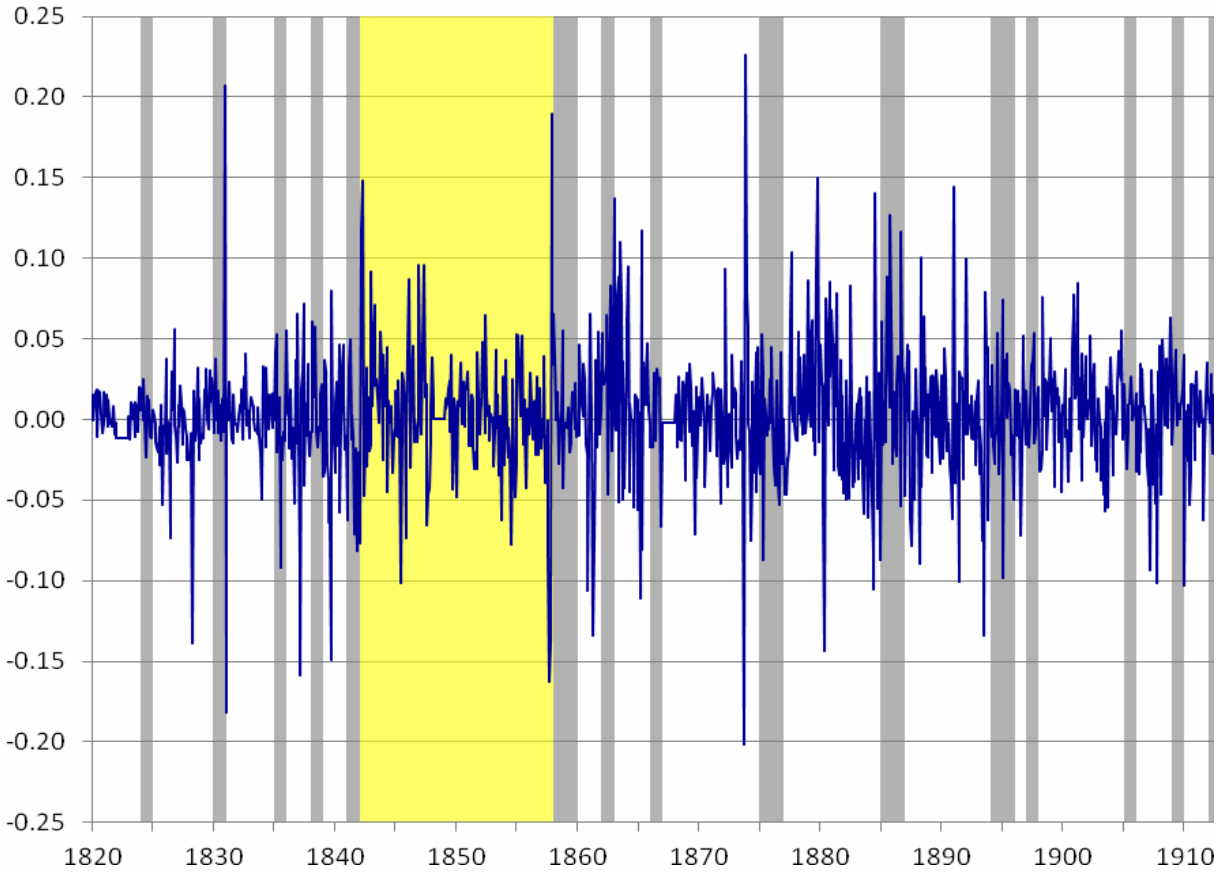
Figure 2: Growth-to-Volatility Ratio (20 Year Average) in Industrial Production, 1810-2010



Growth-to-volatility ratios are the inverse of coefficients of variation; thus, a high growth-to-volatility ratio indicates high economic stability. Gray areas represent the first and second Great Moderations.

Sources: Davis, "A Quantity-Based Annual Index"; Davis, "US Industrial Production". Figure taken from Davis, Shaffer, and Weidenmier, "America's First Great Moderation", forthcoming.

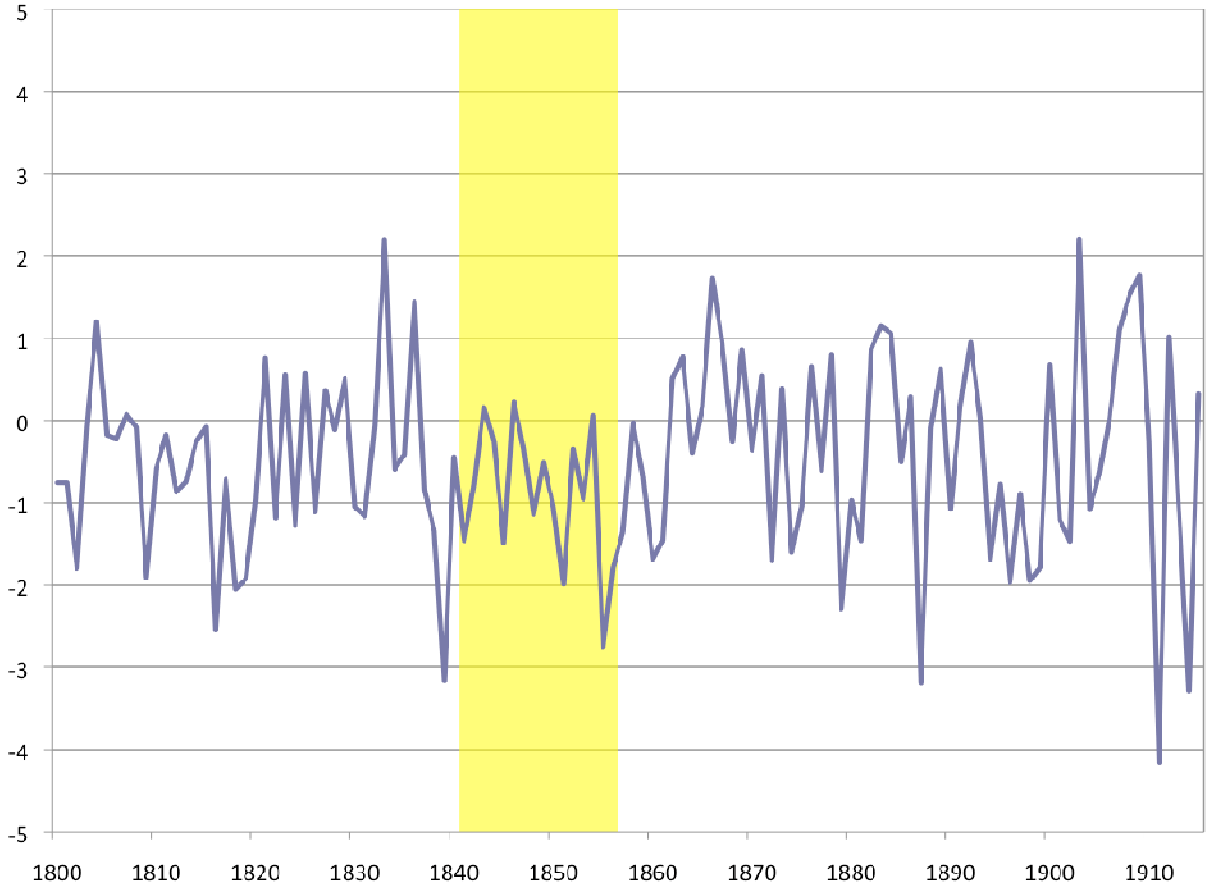
Figure 3: Monthly percent returns in NYSE index, 1820-1915



Gray areas represent annual recession years. The yellow area represents the First Great Moderation.

Sources: William N. Goetzmann, Roger G. Ibbotson, and Liang Peng, "A New Historical Database for the NYSE 1815 to 1925: Performance and Predictability," *Journal of Financial Markets* Vol. 4 (2001) pp. 1-32; Davis, "Improved Annual Chronology"; author's calculations.

Figure 4: Average Palmer Drought Severity Index (PDSI) for the Southeast, 1800-1915



PDSI values are on a scale from -6 (representing extreme drought) to +6 (representing extremely wet conditions). For the years shown, I obtained PDSI values for sample regions representing the states of NC, SC, TN, AK, LA, AL, MI, and GA (grid points #193-5, 202-4, 211-3, 220-2, 229-31, 238-41, 248-50, and 257), which produced a large majority of American cotton during the antebellum, and averaged these values to produce the index above. Yellow period represents the First Great Moderation.

Sources: E.R. Cook et al, "North American Summer PDSI Reconstructions, Version 2a," 2008, National Oceanic and Atmospheric Agency Satellite and Information Service, www.ncdc.noaa.gov/paleo/pdsi08_ts.html; author's calculations.

Table 1: Period Average Growth, Standard Deviation, and Coefficient of Variation for Various Macroeconomic Indices

Average Period Growth	Pre-1841	Great Moderation (1841-1856)	1866-1915
Davis IP Index	0.050	0.081	0.050
NYSE Monthly Index	-0.001	0.003	0.002
Davis IP - Durables	0.055	0.095	0.057
Davis IP - Nondurables	0.069	0.069	0.049
Wages (monthly)	0.026	0.013	0.033
Wholesale Prices (monthly)	0.000	0.001	-0.001
Cotton Prices (monthly)	0.001	0.003	0.000
Wheat Prices (monthly)	n/a	0.009	0.005
Corn Prices (monthly)	0.005	0.006	0.000
Railroad Construction (monthly)	0.070	0.008	0.006

Periodic Std. Dev.	Pre-1841	Great Moderation (1841-1856)	1866-1915
Davis IP Index	0.068	0.054	0.076
NYSE Monthly Index	0.045	0.035	0.039
Davis IP - Durables	0.107	0.068	0.109
Davis IP - Nondurables	0.098	0.067	0.050
Wages (monthly)	0.169	0.060	0.028
Wholesale Prices (monthly)	0.019	0.019	0.017
Cotton Prices (monthly)	0.077	0.059	0.062
Wheat Prices (monthly)	n/a	0.122	0.107
Corn Prices (monthly)	0.099	0.096	0.078
Railroad Construction (monthly)	0.157	0.005	0.003

Coefficients of Variation	Pre-1841	Great Moderation (1841-1856)	1866-1915
Davis IP Index	1.365	0.669	1.508
NYSE Monthly Index	68.773	11.445	21.390
Davis IP - Durables	1.924	0.721	1.901
Davis IP - Nondurables	1.417	0.971	1.020
Wages (monthly)	6.551	4.421	0.865
Wholesale Prices (monthly)	201.994	19.917	22.498
Cotton Prices (monthly)	62.076	19.499	171.243
Wheat Prices (monthly)	n/a	13.662	22.424
Corn Prices (monthly)	20.250	15.152	189.072
Railroad Construction (monthly)	2.241	0.676	0.512

Sources: NYSE monthly index: Goetzmann, Ibbotson, Peng, "Historical Database for the NYSE". Davis IP Index and Durable-Nondurable Production: Davis, "A Quantity-Based Annual Index"; Davis, "US Industrial Production". Wages: "Table Ba4128 – Index of money wages for unskilled labor: 1774-1974," *Historical Statistics of the United States*, Cambridge University Press. 2000. Wholesale, Cotton, Wheat, Corn: "United States Producer Price Index – All Commodities – Annualized," "Cotton Spot Price (Cents/Pound)," "Wheat #2 Cash Price (US Dollars/Bushel)," and "Pennsylvania Corn Prices (US$/bushel)," *Global Financial Data*, Los Angeles: Global Financial Data, Inc, 2011. Railroad: Davis, "A Quantity-Based Annual Index." Author's 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***

"No recession" reflects a period of growth in the Davis IP index where the NBER chronology lists a recession.
Source: Davis, "Improved Annual Chronology," p. 106.

Table 3: Regression on the Relationship Between Durable and Nondurable 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)***

Regression dependent variable is growth rate of durable goods production. Asterisks denote significance at the *10%, **5%, and ***1% levels.
Sources: Davis, "Improved Annual Chronology"; author's calculations

Table 4: Interest Rates in Major Cities, 1836-1856 – Periodic Mean Rate, Standard Deviation, and Coefficient of Variation

		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: Howard Bodenhorn, "Capital Mobility and Financial Integration in Antebellum America," *The Journal of Economic History*, Vol. 52 No. 3 (Sep. 1992), pp. 603-608; author's calculations

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