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The postbellum deflation and its lessons for today

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Abstract

A number of recent studies examining historical experiences with deflation have called into question the widely-held view that maintains deflation is economically harmful. These studies contend that a broad, historical perspective reveals a more nuanced view of deflation, one that requires taking seriously both malign and benign deflation. This paper builds on these findings by taking an in-depth look at the U.S. experience with deflation during the postbellum period and considers whether it supports the claim that deflation can be benign. This paper also considers the lessons of this deflation experience for monetary policy today.

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1. Introduction

A number of recent studies examining historical cross-country experience with deflation have called into question the widely-held view that holds deflation is economically harmful (Atkeson & Kehoe, 2004; Bordo & Filardo, 2005; Bordo, Lane, & Redish, 2004; Bordo & Redish, 2004; Borio & Filardo, 2004). These studies find that incidents of deflation weakening the economy have been more the exception than the rule during past periods of deflation and that the deflationary experiences that shape the modern economic psyche, the Great Depression in the 1930s and Japan in the 1990s, are far from representative of most deflation outcomes. These studies contend that a broader, historical perspective reveals a more nuanced view of deflation, one that requires monetary policy taking seriously not only deflation that results from a collapse in aggregate demand and

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is harmful, but also deflation that arises from a surge in aggregate supply and is consistent with robust economic growth. Deflation, therefore, can come in both malign and benign forms.

This paper builds on these findings by examining the U.S. experience with deflation during the postbellum period and considers whether it supports the claim that deflation can be benign. This period of deflation persisted for about thirty years while the economy grew and has been cited by some observers as evidence for benign deflation (Bordo & Redish, 2004; Bordo et al., 2004). Others observers contend, however, that although there was economic growth during this time the deflation was still mildly malign and a drag on the economy (Bernanke, 2003; IMF, 2003). This paper makes two contributions to this debate. First, it applies a broader set of economic data than used in previous studies in assessing the nature of the postbellum deflation. Second, it evaluates whether this deflation experience was subject to sufficient nominal rigidities to make it relevant for monetary policymakers today. This paper finds that most of the empirical evidence points toward this period as being one of benign deflation with nominal rigidities being meaningful enough to make aggregate demand shocks matter to economic activity. The findings of this paper, therefore, support the view that there is merit in acknowledging both malign and benign deflation in the conduct of monetary policy.

The remainder of the paper proceeds as follows. First, the paper reviews the conventional view of deflation and contrasts it with the more nuanced view of deflation that distinguishes between malign and benign deflation. Second, the paper examines the empirical evidence for the postbellum deflation and considers whether the standard deflation concerns of experiencing weak to negative economic growth, reaching the lower bound of zero on the nominal interest rate, and increasing financial disintermediation were binding during this time. Third, the paper empirically assesses in a vector autoregression whether there were nontrivial nominal rigidities during the postbellum period deflation. Finally, the paper concludes by considering the lessons of the postbellum deflation experience for monetary policy today.

2. Views on deflation

Most observers view deflationary pressures as a threat to macroeconomic stability (Stern, 2003). This understanding of deflation is often justified on theoretical grounds by noting several important channels through which deflation can adversely affect an economy. First, given relatively rigid nominal input prices, an unexpected decline in the price level will increase real input prices, lower firms' profit margins, and as a result reduce production and employment levels (Akerlof, Dickens, & Perry, 1996). Second, the nominal interest rate may be pulled down by deflation to its lower bound of zero and thereby eliminate the possibility of additional monetary stimulus through the policy rate (Svensson, 2003). Third, the financial system will become beset with unplanned increases in real debt burdens as the price level falls as well as unanticipated decreases in collateral values as the economy deteriorates. As a result, delinquencies and defaults will increase and the balance sheets of financial institutions will weaken. In turn, financial intermediation will suffer and create an additional drag on the economy (IMF, 2003). Collectively, these events may reinforce each other in a 'deflationary spiral' where expectations of more deflation and additional economic weakness lead to a further fall in aggregate demand that pushes the economy into a prolonged economic slump. Deflation of any form, therefore, should be feared and "avoided at all costs" (De Long, 1999, p. 231).

This conventional view of deflation, however, assumes deflation is the result of negative shocks to aggregate demand and fails to consider that deflation may also arise from positive shocks to aggregate supply that are not accommodated by monetary policy easing. This benign form of

deflation occurs as the result of productivity advances that lower per unit costs of production and in conjunction with competitive forces, put downward pressure on output prices.¹ Profit margins are likely to remain stable under this form of deflation even if relatively rigid nominal input prices, such as wages, are present since the decline in output prices is matched by the decline in per unit costs of production (Selgin, 1997).

The productivity gains also mean an increase in the natural rate of output and the real interest rate. In turn, the higher real interest rate should counter the downward pressure on the nominal interest rate arising from the deflationary pressures and minimize the chance of hitting the lower nominal interest rate bound. Financial intermediation should not be adversely affected either, since the burden of any unanticipated increase in the stock of real debt arising from benign deflation should be offset by a corresponding unanticipated increase in real income. Collateral values, meanwhile, should not decline but increase given expectations of higher future earnings from the productivity growth (Selgin, 1997). Deflation, therefore, can be consistent with economic growth and should not always be feared.

A spate of recent studies examining historical cross-country experience with deflation have adopted this more nuanced approach and find benign deflation to be a real phenomenon far more common than the malign form of deflation (Atkeson & Kehoe, 2004; Bordo & Filardo, 2005; Bordo & Redish, 2004; Bordo et al., 2004; Borio & Filardo, 2004). One experience often cited in these studies as evidence that deflation can be benign is the sustained decline in the price level that occurred during the postbellum period in the United States. This paper provides further evidence on the nature of this postbellum deflation and assesses whether it supports the view that there can be both malign and benign forms of deflation. Unlike previous studies, however, which typically use the standard macroeconomic variables of output, inflation, a monetary aggregate and an interest rate to draw their conclusions about this period's deflation, this paper takes a broader look by also examining other economic indicators such as wages, productivity, measures of financial intermediation, multiple measures of output and money, and the agrarian sector. This broader approach provides a more complete picture of the postbellum deflation and, given the uncertain reliability of nineteenth century data, it also provides a better sense of the robustness of any conclusions drawn from this period.

3. The postbellum period of deflation in the United States

3.1. Introduction

Between 1866 and 1914 productivity and total factor input growth accelerated leading to rapid gains in the U.S. economy. This postbellum period was one of substantial capital investments, a growing labor force, increased financial deepening, improvements in communication and transportation technology, and institutional developments like the emergence of big business. These developments all contributed to the robust economic growth of this time and helped push the United States ahead of Great Britain to become the leading industrial power (Gallman, 2000).

The first three decades of the postbellum period were especially remarkable since the rapid economic growth was accompanied by a steady decline in the price level as seen in Fig. 1. Between 1866 and 1897, this secular deflation averaged just over 2 percent a year while real GNP

¹ Aggregate supply induced-deflation can also arise as a result of positive factor input shocks with many of the same implications as noted above. See Beckworth (2006) for a discussion on productivity-induced versus factor input-induced benign deflation.

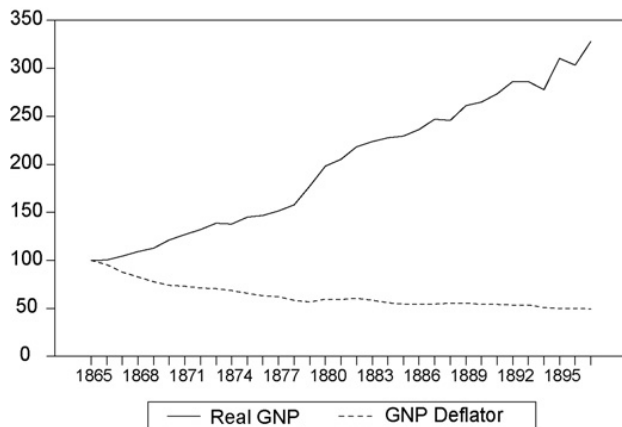


Fig. 1. Secular deflation and economic growth (1865 = 100). Sources: Balke and Gordon (1989) and Johnston and Williamson (2003).

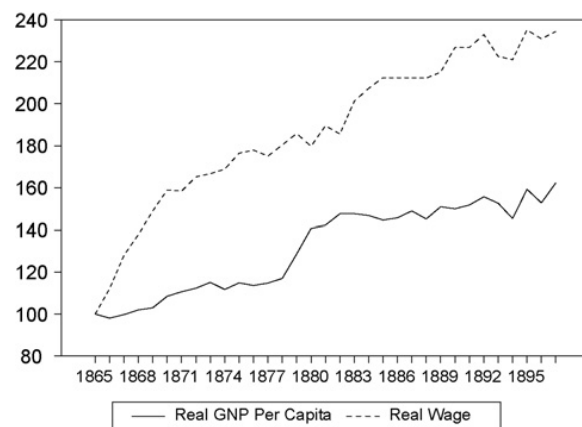


Fig. 2. Real per capita income and the real wage (1865 = 100). Sources: Balke and Gordon (1989), Johnston and Williamson (2003) and NBER composite wage index (2006).

grew almost 4 percent a year (Balke & Gordon, 1989; Johnston & Williamson, 2003). Fig. 2 shows these economic gains were realized on the individual level as the real wage and real GNP per capita also advanced. Robust economic growth, therefore, coincided with persistent but mild deflation for about 30 years. The postbellum period up through 1897, therefore, appears to provide a good example of benign deflation.

The postbellum period of deflation, however, was not completely free of economic distress. First, there were several episodes of acute financial crises and economic weakness in the 1870s and 1890s. Second, although the U.S. economy was undergoing a rapid expansion, this period was also one of social unrest, much of it attributed to the perceived economic harm to farmers caused by the ongoing deflation. These developments have led some observers to question whether the deflation of this period was truly benign. The IMF (2003) contends that with deflation “there was significant volatility in growth” during the postbellum period and that the “periods of inflation . . . had generally higher growth than periods of sustained deflation” (p. 16). Bernanke (2003) similarly concludes the postbellum deflation was “probably a drag on net” for the economy. These concerns about the economic distress and its relationship with the deflation do make analysis of the postbellum period more complicated, but they do not create a damning indictment of the secular deflation as these and other observers contend. Rather, the economic distress can be largely explained by structural and other real factors that plagued the postbellum economy. A look at the standard deflation concerns of experiencing weak to negative economic growth, reaching the lower bound of zero on the nominal interest rate, and increasing financial disintermediation as they applied to this time leave little doubt that postbellum deflation was generally benign.

3.2. Deflation and economic growth

The first concern of the standard deflation view is that a falling price level will result in weak to negative economic growth. It has already been shown that there was solid economic growth during the postbellum deflation. Therefore, the only question with regard to this first concern is whether the economic growth during the deflation years was less robust and more volatile than the inflation years of the postbellum period as some have claimed.

Before evaluating this claim it useful to consider why deflation emerged during the postbellum period. Table 1 provides a simple but complete accounting of the factors driving the changes in

Table 1

Equation of exchange decomposition of postbellum deflation

	ΔP_t	=	$-\Delta Y_t$	+ ΔM_t	+ ΔV_t		+ ΔB_t	+ Δm_t
1866-1879	-4.06%	=	-4.09%	1.75%	-1.72%		-2.01%	3.76%
1880-1897	-0.76%	=	-3.42%	5.69%	-3.03%		3.64%	2.05%
1866-1897	-2.22%	=	-3.71%	3.97%	-2.46%		1.17%	2.80%
1898-1914	0.23%	=	-3.35%	7.42%	-3.84%		4.84%	2.58%

Notes: This table is based on the equation of exchange in growth rate form, $\Delta M_t + \Delta V_t = \Delta P_t + \Delta Y_t$, where M_t , V_t , P_t , and Y_t are the money supply, velocity, the price level, and output in log levels. The money supply growth rate is the sum of the monetary base growth rate, ΔB_t , and the money multiplier growth rate, Δm_t , or $\Delta M_t = \Delta B_t + \Delta m_t$. Isolating the price level growth rate in this equation gives the decomposition shown above in the table. Some of the components due not fully add to price level growth because of rounding. Sources: Balke and Gordon (1986, 1989).

the postbellum price level. This table uses data from Balke and Gordon (1986, 1989) presented in annual average growth rate form and is based on the equation of exchange. This accounting framework shows that deflation can occur because either output is increasing relative to the money supply or velocity is declining.² Table 1 breaks the postbellum deflation period into two periods based on two distinct phases of monetary policy: (i) the 1866–1879 period where effectively there was a tight monetary policy so that by 1879 the gold standard could be resumed at the pre-Civil War exchange rate between the dollar and gold; and (ii) the 1880–1897 period after the resumption of the gold standard where monetary policy was determined by the change in the stock of gold. Table 1 completes the coverage of the postbellum period by also including data for the years of inflation: 1898–1914. This table shows that between 1866 and 1879 real output on average grew over twice as fast as the M2 money supply putting significant downward pressure on prices. During the 1880–1897 period, however, the M2 money supply growth exceeded output growth increasing the importance of declining velocity as a source of deflation as seen both in Table 1 and in Fig. 3.³ Deflation emerged, therefore, because of both strong economic growth relative to the money supply and a declining velocity.

Table 2 provides evidence to evaluate the claim that inflation was more conducive to economic growth than deflation during the postbellum period. As far as possible, Table 2 breaks the data into the same time periods as in Table 1 and provides along with the annual average growth rates a standard deviation in parenthesis as a measure of volatility. The Balke and Gordon (1989) GNP estimates are adopted for use as a measure of output and, in addition, the Davis (2004) Industrial Production Index is provided as a robustness check.⁴ The first section of the table provides evidence on output and output per capita growth rates and show that these two series were as much as 61 and 26 basis points higher, respectively, during the deflation period with about

² The Balke and Gordon GNP series (1989) begin in 1869 and therefore the output and price level estimates of Johnston and Williamson (2003) are used for the years 1865–1868.

³ Bordo and Jonung (1987) show that the declining velocity of the postbellum period was largely the result of that increasing monetization of the economy taking place at this time, as the economy grew both in size and sophistication.

⁴ Although the Balke and Gordon series is probably one of the better estimates of real GNP for this period, it may suffer from not having consistent underlying components over the entirety of the series. The Davis series, however, is based on the same underlying components throughout and in that sense may be more reliable measure of real economic activity.

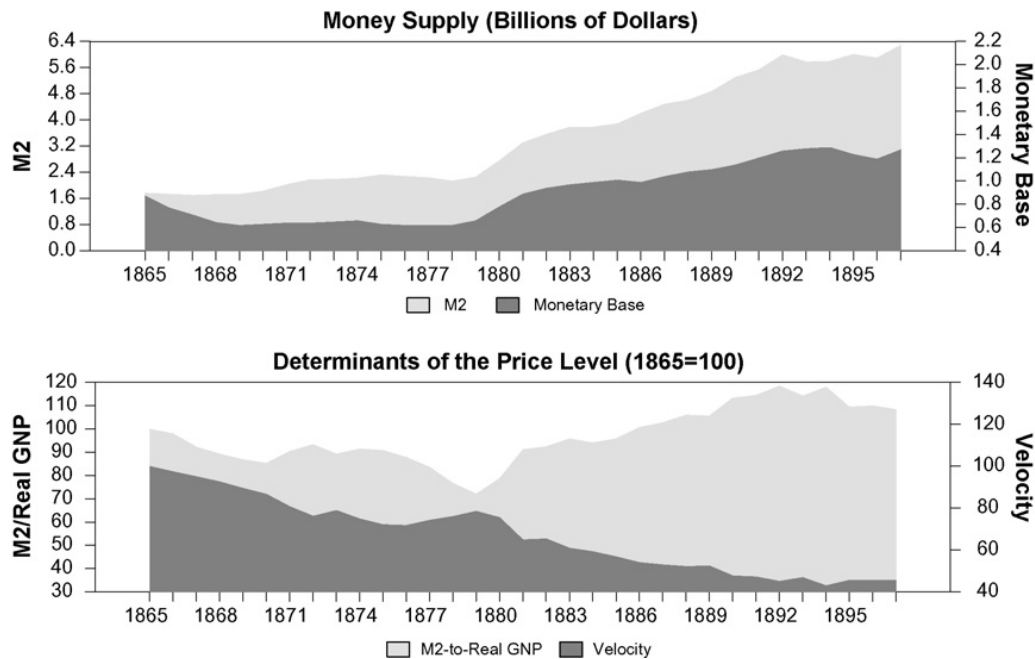


Fig. 3. The money stock. Sources: Balke and Gordon (1986, 1989), Johnston and Williamson (2003) and Mitchell (2003).

200 basis points less in volatility. A similar pattern emerges with real wages during the postbellum period. The real wage reported in the table is created using the ratio of the NBER's composite wage index (2006) to the Balke and Gordon GNP deflator and, as a robustness check, the ratio is also constructed using the Johnston and Williamson GNP deflator (2003). These measures show the real wage growth during the deflation period clearly exceeds the real wage growth during the inflation period, particularly during the 1866–1879 period. These real wage gains are consistent with the productivity growth rates of Kendrick (1961a) shown in Table 2 which indicate greater productivity gains during the deflation period. Table 2 also shows the growth rates of the capital stock, the capital stock per capita, and the capital stock per worker for the postbellum period as reported in Kendrick (1961b). Since firms under normal market conditions will only take on additional investment expenditures if they expect a positive rate of return, the growth of the capital stock can be viewed as a proxy for firms' expectation of current and future profitability. Using this metric, firms apparently did not view deflation as a threat to their profit margin. All of this evidence, therefore, undermines the claim that inflation was more conducive to economic growth than deflation during the postbellum period.

Although economic gains overall were robust, the NBER reports several severe economic downturns during the postbellum deflation including one of the longest in U.S. history, the recession of 1873–1879, as well as the 'Great Depression' of the 1890s. Some observers cite these economic downturns as evidence that the deflation was not so benign (Mishkin, 1991). Davis (2004, 2006), however, has called into question the reliability of these measures by showing that the NBER's business cycle dating methods for the postbellum period relied heavily on nominal measures and qualitative information that bias the results to overstate the severity of recessions.⁵ Table 3 indicates the economic downturn in the 1870s appears to be one such case. This table

⁵ Davis (2004, 2006) shows the qualitative information was biased since it is based on observations from contemporary sources of the postbellum which tended to notice downturns more than upturns. The use of nominal measures also are distorting since many early NBER researchers assumed a decline in nominal terms necessarily meant a decline in real economic activity.

Table 2
The postbellum economy under different price level regimes

	Balke & Gordon GNP	Davis industrial production	Average	
Output growth rates				
1866–1879	4.09% (2.88%)	4.49% (4.40%)	4.29% (3.64%)	
1880–1897	3.42% (3.87%)	4.99% (7.72%)	4.21% (5.80%)	
1866–1897	3.71% (3.48%)	4.77% (6.57%)	4.24% (5.03%)	
1898–1914	3.35% (5.23%)	4.16% (8.75%)	3.75% (6.70%)	
Output per capita growth rates				
1866–1879	1.80% (2.92%)	2.17% (4.41%)	1.98% (3.67%)	
1880–1897	1.29% (3.88%)	2.84% (7.68%)	2.07% (5.78%)	
1866–1897	1.51% (3.50%)	2.54% (6.46%)	2.03% (4.98%)	
1898–1914	1.48% (5.24%)	2.28% (8.57%)	1.88% (6.88%)	
	Balke & Gordon deflator	Johnston & Williams deflator	Average	
Real wage growth rates				
1866–1879	4.43% (4.22%)	4.39% (4.33%)	4.41% (4.27%)	
1880–1897	1.29% (3.30%)	1.28% (2.96%)	1.29% (3.13%)	
1866–1897	2.66% (4.04%)	2.64% (3.94%)	2.65% (3.99%)	
1898–1914	2.27% (4.64%)	0.46% (1.85%)	1.37% (3.25%)	
	Capital stock	Capital stock/capita	Capital stock/worker	
Capital stock growth rate				
1869–1879	4.67%	2.40%	1.68%	
1880–1899	5.04%	2.93%	2.38%	
1869–1899	4.92%	2.75%	2.15%	
1900–1909	4.53%	2.54%	1.72%	
1910–1919	3.80%	2.25%	2.71%	
1900–1919	4.17%	2.39%	2.21%	
	Labor productivity		Total factor productivity	
	Private domestic economy	Manufacturing	Private domestic economy	Manufacturing
Productivity growth rates				
1869–1879	2.01%	1.00%	4.02%	0.87%
1880–1899	0.83%	1.91%	0.64%	1.54%
1869–1899	1.22%	1.60%	1.75%	1.32%
1900–1909	0.80%	1.15%	1.16%	0.71%
1910–1919	0.82%	0.81%	0.70%	0.30%
1900–1919	0.81%	0.98%	0.93%	0.50%

Notes: Each value is the annual average growth rate while the parentheses contain one standard deviation as a measure of volatility. The capital and productivity measures are derived from decadal values and so standard deviation cannot be computed for these series. Sources: The output and output per capita data come from Balke and Gordon (1989), Davis (2004) and Johnston and Williamson (2003). The real wage uses the nominal wage from the NBER's composite wage index (2006) and the deflators from the output sources. The productivity data all come from Kendrick (1961a) in the following tables: Table A-XXIV, Table A-XVII, Table D-I. The capital stock data come from Table 3 in Kendrick (1961b).

reports the peak-to-trough, the largest annual output loss, and the cumulative output loss for each business cycle of the postbellum period using the same data sources as before. The cumulative output loss is calculated as the sum of the absolute decline in real economic activity as long as output is below its previous peak level. Both loss measures are calculated by taking the differences

Table 3
Postbellum recessions

Peak	Trough	Largest annual loss	Cumulative loss
Balke & Gordon GNP			
1866–1897 recessions			
1873	1874	0.63	0.63
1883	1885	<i>nr</i>	<i>nr</i>
1887	1888	0.47	0.47
1892	1894	2.96	3.06
1895	1896	2.30	2.30
1898–1914 recessions			
1903	1904	<i>nr</i>	<i>nr</i>
1906	1908	5.62	8.75
1910	1911	<i>nr</i>	<i>nr</i>
1913	1914	7.88	7.88
Davis industrial production			
1866–1897 recessions			
1873	1875	5.67	10.83
1883	1885	3.63	10.13
1887	1888	<i>nr</i>	<i>nr</i>
1892	1894	9.07	25.63
1895	1896	3.1	3.1
1898–1914 recessions			
1903	1904	4.85	4.85
1907	1908	16.93	16.93
1910	1911	3.77	3.77
1913	1914	10.73	10.73

Notes: The numbers are in percent form. The cumulative loss is calculated as the sum of the absolute decline in output as long as output is below its previous peak level. *nr* = no recession.

in logarithms and therefore can be viewed as percentage points. Table 3 shows a far shorter downturn during the 1870s than the six-year contraction portrayed by the NBER. Table 3 does show, however, a protracted economic downturn in the early-to-mid 1890s. Even in this case, though, the economic downturn was not always marked by deflation—the recessions in 1893 and 1896 were accompanied by inflation according to the Balke and Gordon (1989) GNP deflator—and underscores the fact that severe output fluctuations were not limited to a particular price level regime during the postbellum period.⁶ Bordo et al. (2004) furthermore show that the output fluctuations of this time were largely the result of real shocks, not changes in the price level. Taken as whole, then, the evidence for the postbellum period indicates deflation was just as consistent with robust economic growth as was inflation.

3.3. Deflation and the zero bound on the nominal interest rate

The second concern of the standard deflation view is that deflation may lower the nominal interest rate to its zero bound and prevent monetary authorities from providing additional monetary stimulus through the policy interest rate. Fig. 4 plots a long-term nominal interest rate, the average

⁶ The sharpest one-year economic declines during the postbellum period actually occurred under inflation.

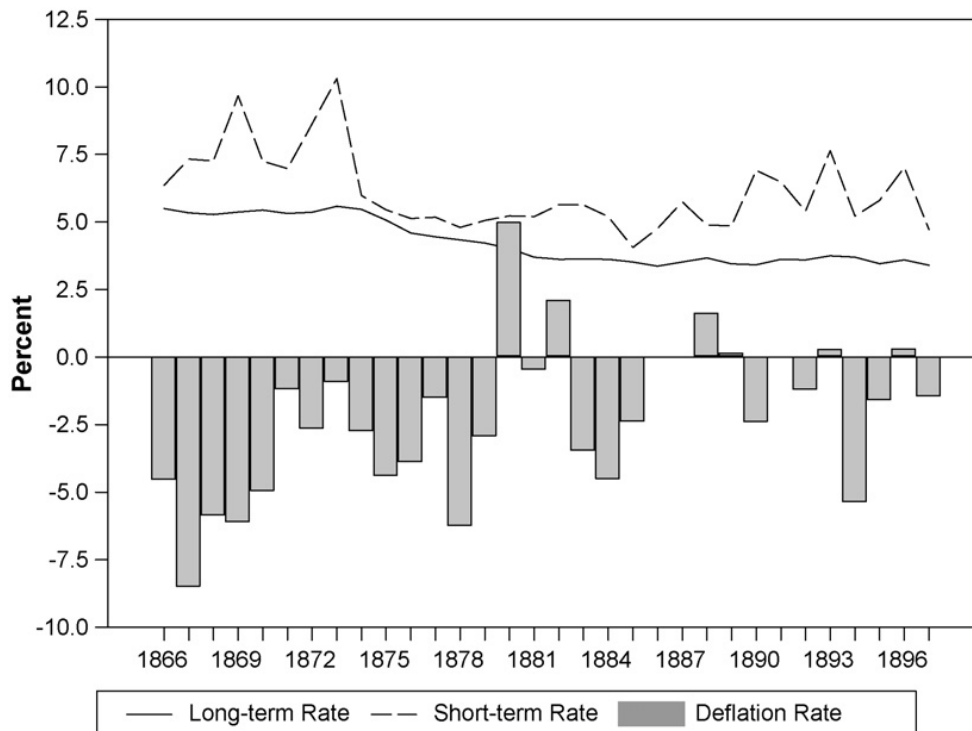


Fig. 4. Deflation and interest rates. Sources: Homer (1977), Balke and Gordon (1989) and Officer (2003).

yield on New England municipal bonds, and a short-term nominal interest rate, the commercial paper rate, against deflation for the postbellum period of deflation. The yield on New England municipal bonds is regarded as probably the best representative of a long-term nominal interest rate during this time while the commercial paper rate provides an example of a short-term interest rate that could have been targeted had there been discretionary monetary policy (Homer, 1977).⁷ Fig. 4 reveals that despite the three decades of deflation the lower bound on the nominal interest rate was never reached during this time.

One explanation for this outcome is that most of the secular deflation was of the benign form—it was driven by the rapid economic growth which should have propped up real interest rates. The higher real interest rates in turn would have offset the downward deflationary pressure on the nominal interest rate. This explanation is consistent with the fact that nominal interest rates were generally higher during the 1866–1879 period of the postbellum deflation, the time when the productivity and economic growth was the strongest.

Other forces, however, may have been influencing interest rates at this time and therefore complicate the interpretation of interest rate movements. Homer (1977) shows that the bond market was depressed until the mid 1870s, but subsequently became a bull market that lasted through the end of the century. He also states that the United States' growing economic clout and its increasing financial sophistication during this time meant an increasingly lower premium to attract foreign capital. Both of these factors imply higher interest rates early on followed by a decline. Another complication is that some studies have shown, and been puzzled by the fact,

⁷ Homer (1977) believes New England municipal bond yields are a good indicator of long rates for two reasons. First, federal securities yields were distorted by their use as collateral in the National Banking system and by the retirement of the debt by the government. Second, railroad bond yields did not become a good representative security of long rates until the 1880s.

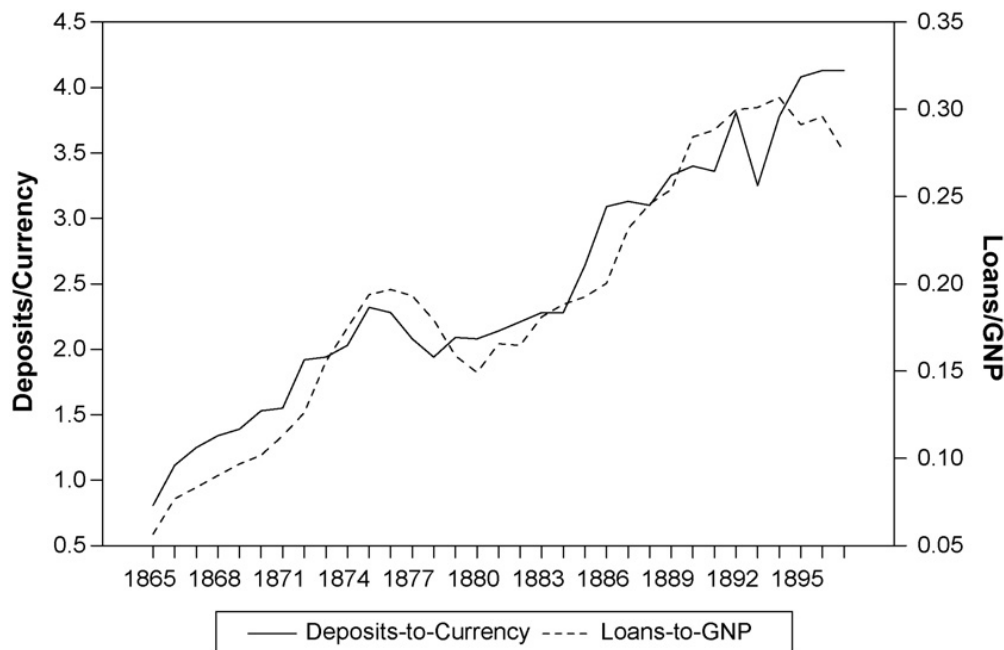


Fig. 5. Financial intermediation. Sources: U.S. Bureau of the Census (1949), Friedman and Schwartz (1963), Balke and Gordon (1989), Johnston and Williamson (2003) and Mitchell (2003).

that nominal interest rates during the postbellum period more closely tracked the price level than the rate of change in the price level (Barky, 1987; Barsky & De Long, 1991; Shiller & Siegel, 1977). These findings have been explained by both sluggish updating of expectations in an information-poor environment and a mean-reverting process of inflation expectations owing to the gold standard (Bordo & Filardo, 2005). This alleged breakdown of the Fisher relationship, called the Gibson paradox, has been challenged recently by Siegler and Perez (2003). Even with the possibility of the Gibson paradox, the treat of hitting the zero bound would not have been eliminated. The nominal interest rate was allegedly tracking the price level, which in principle could have fallen far enough to have caused the nominal interest rate to hit the zero bound. That the zero bound was not reached can be explained again by invoking argument that the robust productivity and economic growth kept real rates high enough to serve as a check against reaching the zero bound.

Although not conclusive, the postbellum period of deflation does provide evidence consistent with the idea that deflation does not necessarily mean the lower bound on the nominal interest rate will be reached. These findings show that the second concern of the standard deflation view was not an issue during the postbellum period of deflation.

3.4. Deflation and financial disintermediation

The third concern of the standard deflation view is that deflation will lead to financial disintermediation. Fig. 5 provides evidence on financial intermediation for the postbellum period of deflation. This figure plots two indicators of financial intermediation, the Friedman and Schwartz (1963) deposits-to-currency ratio and a loans-to-GNP ratio constructed using the loans of all national banks and other state and private banks reporting to the comptroller of the currency (U.S. Bureau of the Census, 1949) divided by GNP (Balke & Gordon, 1989). Fig. 5 shows both of these measures to be increasing overall during this period. The deposits-to currency ratio, which reveals the proportion of funds being put into the financial system versus being held as currency, grew on

average 5.7 percent annually while the loans-to-GNP ratio, which indicates what percent of the economy is being financially intermediated, grew on average 5.4 percent a year. The long decline in prices, therefore, was typically associated with increasing financial intermediation.

Fig. 5 does reveal, though, that in spite of upward trend in both series there was some financial instability, particularly around the mid-1870s and early to mid-1890s following the financial panics of 1873 and 1893 (Mishkin, 1991).⁸ These financial crises, however, have been shown by Calomiris and Gorton (1991) to be the result of the weak institutional structure underlying the postbellum financial system, not the deflation itself. One key institutional weakness was the poor design of the National Banking System that emerged during the Civil War. The National Banking System consisted of a tiered system of banks across the country that effectively kept most of their reserves in New York City banks. The New York City banks, in turn, invested the reserves in the call loan market at the New York stock exchange. Call loans were made to parties who bought securities on margin—the securities served as collateral—and were payable on demand. Since most of the reserves were tied up in the stock market, the liquidity of the National Banking System was made susceptible to external shocks that created volatility in stock prices.⁹ The frailty of the National Banking System was especially consequential since the state banking system, the alternative venue for chartering a bank, declined after the Civil War and would not fully recover until the late 1800s (Atack & Passell, 1994; Sylla, 1972; Wilson, Sylla, & Jones, 1990).¹⁰ The second key institutional weakness was the absence of interstate, and in some cases intrastate, branch banking during the postbellum period. Branch banking was not allowed under the emerging National Banking system and state banks where they did exist at this time also were typically constrained by unit banking laws. This lack of bank asset diversification effectively forced upon banks poorly diversified portfolios that made them more susceptible to external shocks. As a result, this absence of branch banking further weakened the U.S. financial system (Calomiris, 2000).

These institutional weaknesses made the postbellum financial system susceptible to economic shocks. In 1873 and 1893 shocks to the railroad sector sent the stock market tumbling and precipitated major banking panics that resulted in the suspension of bank deposit convertibility (Mishkin, 1991). The most virulent financial crisis of the postbellum period occurred in 1907 after the collapse of the stock market led to a major banking panic. This financial crisis, however, occurred under inflation and suggests it was the institutional structure not the price level regime that was important in explaining the financial instability of the postbellum period. The evidence thus point to the postbellum period of deflation being a time of overall increasing financial intermediation in spite of an institutionally-weak financial structure that was susceptible to external shocks.

3.5. *The agrarian protest*

The evidence presented so far points to the deflation of the postbellum period as being benign. This evidence, however, is based on aggregate data and does not capture a major sectoral devel-

⁸ There were also several less severe bouts of financial stringency in 1884 and 1890. These events, however, had a much lower rate of bank suspension and did not result in a general suspension of specie convertibility (Mishkin, 1991).

⁹ The periodic draining of reserves to the interior of the country in the fall to pay for crops and the initial limit on the total amount of national bank notes issued was another weakness of the National Banking System.

¹⁰ The legislation creating the National Banking System had imposed a tax on state bank notes that made banking under a state charter unprofitable. Only when checking emerged as popular alternative to bank notes did state banking reemerge (Atack & Passell, 1994).

opment during this time: the social upheaval in the agricultural sector attributed in part to the postbellum deflation. From the end of the Civil War down to the turn of the century, there was political agitation by farmers who complained that the deflation harmed them by disproportionately lowering the price of their farm products and by increasing the real burden of their farm mortgages. Research on the agrarian protest has revealed, however, that the farmers' terms of trade actually increased during the postbellum period of deflation and that the majority of farmers did not have onerous mortgages (Atack & Passell, 1994). What then were the causes of the farmers' discontent? One reason was the economic uncertainty the farmers faced. Even though the overall terms of trade for farmers increased, there was significant volatility in their purchasing power over the short run. The economic uncertainty was the result of the increasing integration of U.S. agricultural sector into the world economy and the growing commercialization of farming. The increasingly global nature of the agricultural market meant a narrowing of price differentials on similar farm goods from around the world and a decline of pricing power for U.S. farmers. The growing commercialization of farming meant that larger capital and land expenditures, often financed by borrowing, were necessary to stay competitive. U.S. farmers, therefore, became both increasingly exposed to external price shocks and more susceptible to these shocks as they took on increased financial leverage to stay commercially viable (Atack, Bateman, & Parker, 2000). A second reason for the agrarian unrest is that the income-inelastic nature of agricultural products and the shift from an agricultural-based to an industrial-based economy both meant that farmers, contrary to their expectations, would not benefit proportionally from the nation's rapid economic growth during the postbellum period. Farmers, use to being the dominant economic sector, simply failed to understand and accept this outcome. As a result, there was a delayed exit of labor from and prolonged agitation in the agricultural sector (Atack et al., 2000).

An inflationary regime would not have reversed this structural change in the U.S. economy or the increasingly globalized nature of the agricultural market. Neither would have an inflationary regime increased just agricultural prices while leaving other prices intact, an outcome necessary to improve the farmers' terms of trade. Inflation, therefore, would not have been the panacea farmers believed it to be during the postbellum period of deflation. The evidence, then, for the deflation of the postbellum period indicates it was benign: economic growth was generally strong, the lower bound on the nominal interest rate was never reached, financial intermediation typically was growing, and the agrarian protest was ultimately about structural change.

4. Nominal rigidities and the postbellum period

4.1. Deflation and nominal rigidities

Although the deflation of postbellum period has been shown to be benign, this outcome may be the result of an economy with little-to-no nominal rigidities that easily could have handled any price level regime. If so, then the postbellum experience with deflation becomes little more than a historical curiosity with no relevance for understanding deflation in the modern world where nominal rigidities are considered important. To what extent then were there meaningful nominal rigidities during this time? Hanes (1993) finds a progressively weakening relationship between nominal wages and output over the period 1870–1907 and interprets this as a significant decline in nominal wage flexibility. Hanes concludes from these findings that binding nominal rigidities only emerged in the late 19th century. His results, however, only show a relative decline in nominal wage flexibility and do not indicate nominal wages were ever highly flexible, a result consistent

with his later findings that nominal wages were probably countercyclical throughout this period (Hanes, 1996). One limit of these studies is that they are based on reduced-form wage regressions that do not disentangle demand shocks from supply shocks and therefore create some ambiguity in their interpretation. This deficiency is to some extent addressed in Bordo and Redish (2004) and Bordo et al. (2004) who reveal indirectly the presence of nominal rigidities by identifying aggregate supply and aggregate demand shocks and their influence on output. These papers find that while aggregate supply shocks explain most of the fluctuations in output during this time, the effect of aggregate demand shocks were nontrivial. Consequently, nominal rigidities must have been meaningful enough for aggregate demand shocks to matter. Their analysis, however, only provides indirect evidence on nominal rigidities. What is needed is an empirical test that identifies both the effect of demand shocks on output and the role nominal rigidities played in the transmission of the shocks. This task is undertaken in the next section.

4.2. Testing for nominal rigidities

A number of studies have used vector autoregressions (VARs) to identify economic shocks and their influence on economic activity during the postbellum period. A common identification strategy used in these studies is to impose the Blanchard and Quah (1989) decomposition of VAR shocks into permanent and temporary components. Among other things, this approach allows for the identification of nominal shocks and their effect on the real economy. For example, Robertson and Wickens (1997), Keating and Nye (1998), and Bordo and Filardo (2005) adopt this approach using annual data in a two variable VAR of real GNP and the price level for the postbellum and other historical periods. They make the identifying restriction that a price level shock has no long-run effect on real output, but can permanently affect itself. A shock to GNP, however, is allowed to permanently affect the price level and itself. In addition to just identifying the model, this specification allows a shock to the price level to be interpreted as an aggregate demand shock, while permitting the shock to real GNP to be interpreted as an aggregate supply shock. The long-run identifying restriction, therefore, transforms the two-variable VAR of real output and the price level into a standard aggregate demand-aggregate supply model. Bordo and Redish (2004) and Bordo et al. (2004) use the same identification strategy with annual data but also include the money supply as a variable and therefore decompose the aggregate demand shock into a money supply shock and an other demand shock.

As noted above, however, this approach can only reveal indirectly if nominal rigidities are binding. Directly observing the behavior of nominal rigidities following an aggregate demand shock requires extending the VAR. The approach adopted here is to expand the VAR to include real output, the price level, and the real wage, w_t , as variables in a model of the postbellum period. If nominal wages are sticky then real wages should be countercyclical and serve as a conduit through which an aggregate demand shock affects real output. This real wage countercyclicity should be evident in an impulse response function following an aggregate demand shock if indeed the nominal wage rigidity were binding during this time.

The key identification issue now is to identify the aggregate demand shocks. This paper follows the partial identification strategy outlined by Keating (1996) and Christiano, Eichenbaum, and Evans (1999) where certain shocks can be identified without identifying the entire system. This approach is followed by imposing the restriction that a price level shock has no long-run effect on real output and real wages, but can permanently affect itself. No other identifying restrictions are imposed. This identification strategy fully identifies the shock to the price level, but does not identify the other shocks which are inconsequential to the analysis. As in the above studies, the

long-run restriction imposed on the price level allows its shock to be interpreted as an aggregate demand shock.

Formally, this approach starts with an autoregressive structural model of the form

$$A_0 y_t = A_1 y_{t-1} + \dots + A_p y_{t-p} + u_t, \tag{1}$$

where

$$y_t = \begin{pmatrix} \text{GNP}_t \\ w_t \\ P_t \end{pmatrix}$$

is the vector of endogenous variables, A_0, \dots, A_p are 3×3 structural parameters matrices and u_t is a 3×1 vector of uncorrelated structural shocks that are assume to be multivariate normal with mean zero and unit variance. The structural autoregressive model can be transformed into a structural moving average form so that the relationship between the endogenous variables and the structural shocks can be defined. The structural moving average model can be shown to be

$$y_t = (D_0 + D_1 L + D_2 L^2 + \dots) u_t = D(L) u_t, \tag{2}$$

where $D_0 = A_0^{-1}$, $D_i = (A_0^{-1} A_i)^i A_0^{-1}$ and L denotes the lag operator. The coefficient matrices in $D(L)$ represent the dynamic multipliers of the structural shocks. As it stands, (2) is still a structural model and cannot be estimated directly. Rather, a reduced form version must be estimated and then identifying restrictions imposed to recover the structural model. The reduced form moving average can be expressed as follows:

$$y_t = (I + C_1 L + C_2 L^2 + \dots) \varepsilon_t, \quad y_t = C(L) \varepsilon_t. \tag{3}$$

There is a mapping between the reduced-form parameters in (3) and the structural parameters in (2) since $\varepsilon_t = D_0 u_t$, $C(L) = D(L) D_0^{-1}$ and $E \varepsilon_t \varepsilon_t' = \Sigma = D_0 D_0'$. However, this mapping is not unique as an infinite number of values of D_0 can satisfy $\Sigma = D_0 D_0'$. Consequently, even though the reduced form parameters $C(L)$ and Σ are directly estimable, identifying restrictions need to be imposed to recover the structural shocks.

As noted above, the identification scheme adopted here is to identify the aggregate demand shock by imposing long-run restrictions on the price level. The long-run restrictions are imposed on $D(1)$, the infinite horizon sum of $D(L)$ as follows:

$$D(1) = \begin{pmatrix} d_{11} & d_{12} & 0 \\ d_{21} & d_{22} & 0 \\ d_{31} & d_{32} & d_{33} \end{pmatrix}. \tag{4}$$

Setting $d_{13} = d_{23} = 0$ restricts the sum impact of a price level shock on real output and the real wage to zero. Again, this approach leaves the model under-identified since it requires $(n^2 - n)/2$ or three restrictions to just identify the model. However, this identification strategy does fully identify the structural shock to the price level and is invariant to the ordering of the other two variables (Keating, 1996).

This VAR model is estimated using the log of the Balke and Gordon (1989) real GNP and GNP deflator series, and the log of the NBER's composite wage index (2006) to the Balke and Gordon

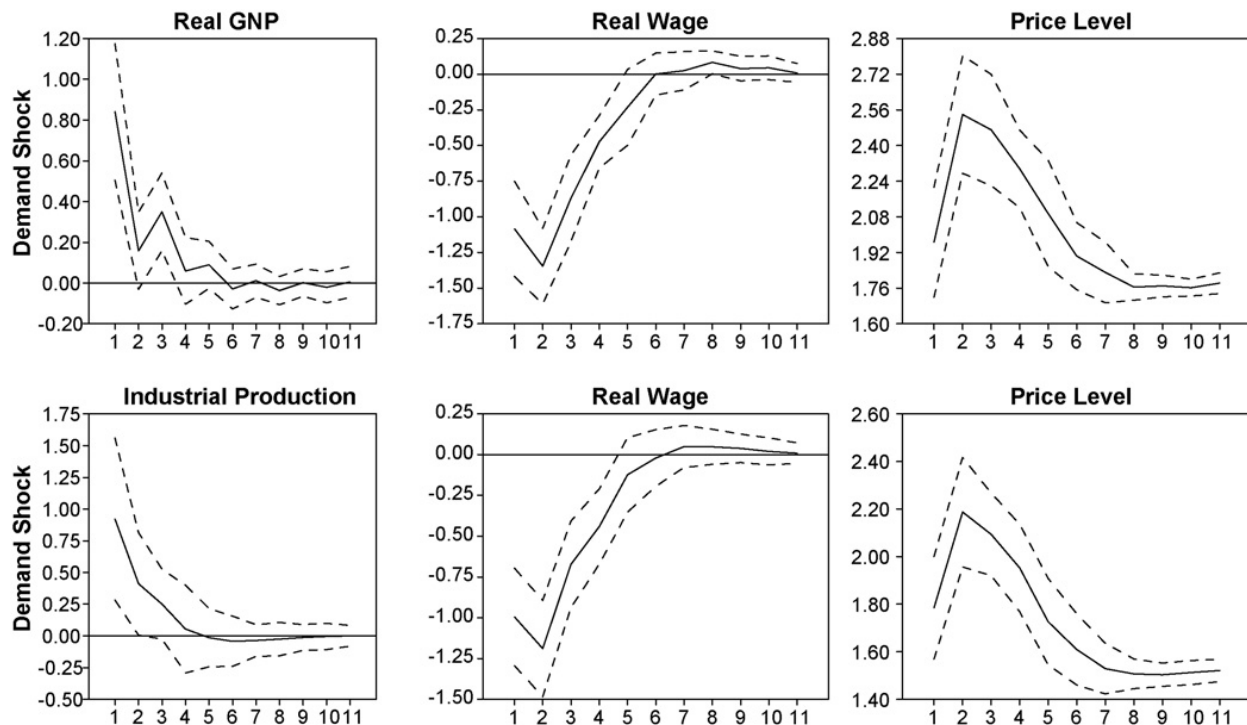


Fig. 6. Response to shocks. *Notes:* Figures show the accumulated impulse response of each variable to a one standard deviation shock of approximately 2 percent to aggregate demand. The vertical axes are in percent form. One standard error bands are indicated by the dashed lines.

(1989) GNP deflator ratio.¹¹ Consistent with the earlier analysis in the paper, the model is also re-estimated using the log of the Davis (2004) industrial production series as a measure of output. First differencing of all three variables is used because there was evidence of nonstationary using standard unit root tests in the levels. Since the data is limited to an annual frequency and VAR lags use up observations, additional years are included up front to offset the lags and increase the degrees of freedom. The Ljung-Box Q statistic indicates at least two lags are needed to eliminate serial correlation and whiten the residuals in both versions of the VAR. Consequently, the VARs are estimated using two lags for the years 1864–1897.¹²

Fig. 6 shows the accumulated impulse response functions (AIRFs) of the three endogenous variables over an eleven year response to a one standard deviation aggregate demand shock of about 2 percent. The top panel in this figure shows the VAR estimated with real GNP and the bottom panel shows the VAR estimated with industrial production. One standard error bands generated by Monte Carlo methods are indicated by the dashed lines. The top panel reveals a one standard deviation shock to aggregate demand increases output by 0.84 percent upon impact, while the bottom panel indicates output increases to 0.92 percent. Stated differently, a one percent shock to aggregate demand would be followed by an initial increase in output of 0.42–0.46 percent. This effect gradually unwinds and by year four is not significantly different than zero. This same one standard deviation shock causes the real wage upon impact to fall 1.08 percent in the top panel and

¹¹ As before, the Johnston and Williamson (2003) real GNP and GNP deflator series are used for years before 1869.

¹² Since 1864–1865 were war years, the VAR was also estimated with dummies for these observations. The VAR was also estimated using dummies to capture any effect the return to the gold convertibility in 1879 may have created. Neither of these applications of dummies significantly altered the impulse response function of the endogenous variables to the aggregate demand shock. Consequently, the VAR was estimated without them to increase the degrees of freedom.

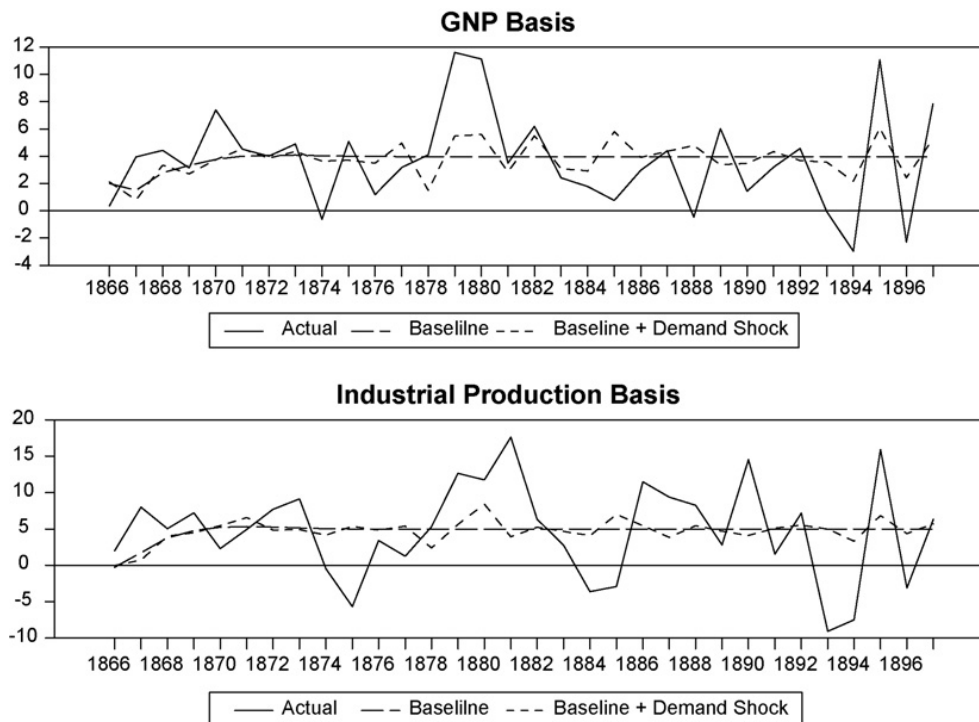


Fig. 7. Historical decomposition of output growth. *Notes:* The solid line shows the actual growth rate of output, the larger dashed line shows baseline forecast of output, and the smaller dashed line shows the baseline forecast plus the effect of aggregate demand shocks on output. The closer this last line is to the actual output series, the more aggregate demand shocks explain the deviation of the output growth rate from its forecasted value.

1.00 percent in the bottom panel. The real wage, therefore, would initially fall by about a half a percent following a one percent shock to aggregate demand. The real wage would continue to fall for a second year after the shock, but then return to its original value by year six. The aggregate demand shock, therefore, has a short run effect on output and the real wage, but permanently increases the price level. This contemporaneous increase in the price level and decline in the real wage indicates nominal wages were relatively slow to adjust to the aggregate demand shock during this time. Moreover, these AIRFs imply nominal wage rigidities were nontrivial during the postbellum period of deflation since there was a decline in the real wage accompanied by an increase in output.

Further evidence on the consequences of nominal rigidities in the postbellum period is provided in Fig. 7. This figure reports the VAR's historical decomposition of the output growth rate into an actual path series, a baseline forecast series, and a baseline forecast plus the aggregate demand shock series. The second series is a projection of the growth rate of output that does not include any of the structural shocks in the period being forecasted. The third series makes the same projection but incorporates the effect of the aggregate demand shocks. The closer the third series is to the actual path series the more the aggregate demand shock accounts for the non-forecasted variation in the growth rate of output. Fig. 7 reveals that although far less important than aggregate supply shocks—the difference between the baseline plus aggregate demand series and the actual path series—the aggregate demand shocks still were consequential to economic activity. The historical decomposition under both output series shows aggregate demand shocks increased output by as much as 3.4 percent and decreased output by as much as 2.6 percent. Aggregate demand shocks mattered to the postbellum economy.

These findings suggest that even though nominal rigidities may have been comparatively less binding during the postbellum period, they were still meaningful enough to influence real economic activity. Nominal rigidities in the postbellum period probably were driven more by imperfect information constraints than are nominal rigidities today, but they still were consequential and indicate that deflation can be benign even in the presence of nominal rigidities.

5. Conclusions and lessons for today

This paper has shown that the postbellum period of deflation was one of robust economic growth, growing financial intermediation, a nominal interest rate that never reached the zero bound, and binding nominal rigidities that had real economic consequences. The postbellum period, therefore, provides strong evidence that there is a difference between benign and malign deflation. Although caution must be exercised in generalizing from these findings which are based on annual data to the present where monetary policy is driven by higher frequency data, there are at least two lessons from this deflation experience for monetary authorities today.

The first lesson is that the appropriate monetary policy response to deflation should be based on the form it takes: malign deflation should be countered with aggressive monetary easing while benign deflation should be allowed to proceed without any special monetary accommodation. The postbellum period shows that an economy with deflationary pressures can grow unimpeded without special monetary accommodation if the deflation originates from aggregate supply innovations. As discussed in section two and demonstrated by the postbellum experience, aggregate supply shocks that lead to deflationary pressures are consistent with stable profit margins, increasing real wages, financial stability, and avoiding the zero bound on the nominal interest rate even in the presence of nominal rigidities. One difficulty, though, in applying this understanding is distinguishing between positive aggregate supply shocks and negative aggregate demand shocks. For example, during the deflation scare of 2003 in the United States there appeared to be signs of positive aggregate supply shocks—robust productivity growth—as well as negative aggregate demand shocks—low capacity utilization. If, however, the distinction can be made then monetary authorities should only monetarily accommodate malign deflationary pressures.

Taking this logic one step further, there may be other monetary policy goals than targeting some low rate of inflation. [Bordo and Filardo \(2005\)](#) explore this possibility and conclude that a low but stable deflation rate could increase economic welfare in a growing economy by spreading the benefits of the economic growth widely through lower output prices. However, they also argue that such a monetary policy would only work if there were a credible nominal anchor and monetary authorities were able to distinguish between aggregate demand and aggregate supply shocks. [Selgin \(1997\)](#) also believes mild deflation can be consistent with economic growth and could be a monetary policy target, but only if productivity is increasing. Productivity gains imply lower per unit costs of production and given competitive pressures lower output prices. The price level then, an average of output prices, should be declining as well if the productivity gains are widespread. Conversely, declines in productivity should lead to a higher price level. Selgin, therefore, calls for a 'Productivity Norm' rule that would allow the price level to inversely reflect changes in productivity. He specifically calls for a nominal income targeting rule that would target a nominal income growth rate equal to the expected growth rate of real factor inputs. Such a nominal income target would monetarily accommodate the real output effect of factor input growth, but not productivity growth and therefore allow the price level to inversely reflect changes in productivity. Like other nominal income targeting rules, the Productivity Norm rule would also provide a natural offset against aggregate demand shocks. Selgin maintains that such a monetary

policy rule would not only widely spread the benefits of economic progress, but relative to a price stability rule it would also improve macroeconomic stability in the presence of productivity shocks. Selgin believes that if monetary policy eases to counter the benign deflationary pressures created by the productivity gains, then it may create an unsustainable aggregate demand stimulus that temporarily pushes output beyond its natural rate. Monetary authorities, therefore, may actually increase macroeconomic volatility in their attempt to stabilize the price level.

The second lesson from the postbellum experience with deflation is that a deflationary regime, even if benign, is highly controversial. The evidence presented in this paper indicates that most people during the postbellum period of deflation benefited from the rapid economic growth and lower prices, but some observers nonetheless believed they were being harmed by the deflation and acted to prevent it. There is no reason to believe that benign deflation today would be any less controversial. Letting the price level fall in response to aggregate supply shocks today should similarly spread the benefits of economic progress widely through lower prices as it did during the postbellum period and it may even serve to improve macroeconomic stability. But, as evidenced by the deflation scares of 1998 and 2003 in the United States, deflation may also mobilize to active opposition those individuals who see only its costs and fail to appreciate its benefits, a potentially large group of individuals given the preeminence of the conventional view of deflation. Benign deflation, therefore, is a policy option unlikely to be exercised any time soon. It remains, however, an interesting outcome of the postbellum period that deserves to be taken seriously both as an historical event and as a tool for better understanding monetary policy today.

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