The Benefits of Commitment to a Currency Peg: Lessons from the National Banking System

Scott L. Fulford* and Felipe Schwartzman†

September 2015

Abstract

The experience of the U.S. in the late nineteenth century indicates that eliminating speculation about a government’s commitment to a currency peg can have significant effects on bank balance sheets and the real economy. In particular, the resolution of uncertainty about the commitment of the U.S. government to the gold standard was associated with a large and permanent increase in the leverage of National Banks, as well as with a sharp reduction in its volatility. The defeat of the anti-gold candidate in the 1896 presidential election provided a cleanly identified positive shock to commitment to gold, in which gains were most pronounced among banks located in states where agents were more likely to have access to gold denominated assets. We use the election to identify the importance of commitment throughout the period in a structural factor analysis. We find that, in the last decade of the nineteenth century, full commitment to the currency peg could have reduced the volatility of real activity significantly and substantially reduced the depression starting in 1893.

JEL classification: E42, E44, F33, G01

Keywords: Gold Standard; National Banks; Fixed Exchange Rate; Exchange Rate Credibility; Financial Crisis

*Boston College department of economics, scott.fulford@bc.edu (617 552 2425, 140 Commonwealth Ave, Chestnut Hill, MA 02467). We thank John Maney for research assistance and Boston College for research support. We also thank Gary Richardson, Ricardo Reis, Huberto Ennis, Alan Taylor, Christian Mathes, Mark Watson, and members of the audience at UCI, FRB-Richmond and at the 2015 EEA meetings for valuable comments and insights.

†Federal Reserve Bank of Richmond, Felipe.Schwartzman@rich.frb.org (804 697 8000, Post Office Box 27622, Richmond, VA 23261). The views expressed here are those of the authors and do not reflect those of the Federal Reserve Bank of Richmond or the Federal Reserve System.
1 Introduction

Can strengthening the credibility of a currency peg benefit an economy? This possibility underpins the view that fixed exchange rate regimes work best the stronger is the institutional commitment to them, and has been an important part of the rationale behind the creation and expansion of the European Monetary Union (Rehman, 1997, p. 263) In particular, it drives multiple equilibria model of currency crises: Market expectations that a currency will devalue can generate costs that lead policymakers to let the currency devalue, thus becoming self-fulfilling.

Threats to monetary unions and exchange rate pegs continue to be pressing issues. For example, in July 2012 as concerns over the debts of several European countries peaked, 73% of investors predicted at least one country would exit the euro within a year.¹ Interest rates for Greece, Spain, Italy, and Portugal spiked, and it took a speech by the president of the European Central Bank promising to “do whatever it takes” to calm fears² Similarly, following the election of the Syriza government in Greece in January 2015, Greek banks were forced to declare a “banking holiday” and shut down for several weeks in July 2015 as fears of a Greek exit from the euro peaked. The importance of the threat of euro exit in these events is difficult to separate from the particular economic situations of Greece and other periphery nations. Because of these complications, as Eichengreen and Temin (2010) argue, in order to understand the problems in the euro area following the 2008 crisis it is useful to look at other periods of fixed exchange rates.

We examine a period in which the U.S. dollar was pegged to gold to provide evidence that ending speculation about a currency peg can have beneficial effects on bank balance sheets and on real economic activity. In particular, we find that the resolution of uncertainty about the commitment of the United States government to the gold standard following the defeat of the anti-gold candidate

²See, for example, Jeff Black and Jana Randow in Bloomberg, 26 July 2012 “Draghi Says ECB Will Do What’s Needed to Preserve Euro Economy” http://www.bloomberg.com/news/articles/2012-07-26/draghi-says-ecb-to-do-whatever-needed-as-yields-threaten-europe, accessed 14 May 2015. The speech and OMT are widely credited with substantially reducing the risk of a breakup as spreads declined substantially (Martin and Philippon, 2014; Paul De Grauwe, 2013). By July 2013, the fraction of investors predicting an imminent breakup had fallen to 24%.
William Jennings Bryan in the 1896 presidential election was associated with a large and permanent increase in the capacity of the banking system for financial intermediation as measured by its leverage. In fact, as shown in Figure 1, the two features of the aggregate bank leverage time-series stand out: (i) the doubling in aggregate bank leverage in the three years after the 1896 election, and (ii) the stabilization of bank leverage at a higher level after the formal adoption of the Gold Standard after 1900. Furthermore, the growth in bank leverage was most pronounced in states where depositors were most likely to have easier access to gold denominated assets. The Bryan loss reduced the chance of a devaluation and so increased the relative return of dollar denominated assets which, in turn, increased the demand for deposits, particularly in states where bank deposits had to compete with gold denominated assets. The findings are consistent with the emphasis of “third generation” models developed after the Asian crisis on the interaction between exchange rate fluctuations and the financial system.3

Finally, we investigate the impact of the lack of credibility in the exchange rate regime on the economic instability of the period, including the 1893 panic. To this end, we use structural factor analysis to construct an index of relative preference for dollar versus gold denominated assets. We follow Romer and Romer (1989) in combining narrative evidence and formal time-series analysis, but with an application to identification of structural factors. In essence, we use a simple projection to measure the extent to which the cross-sectional variation in bank leverage growth in any given period of time resembles that observed around the 1896 election. Based on the model of market segmentation, and on comparisons with other indicators such as interest spreads, we argue that the index largely captures fluctuations in expected exchange rate devaluation. Changes in the index

3Models of currency attacks are typically categorized in three “generations” (see Jeanne (1999) for a discussion of this and other taxonomies. For canonical examples of first, second and third generation models see Flood and Garber (1983), Obstfeld (1996) and Aghion, Bacchetta, and Banerjee (2001), respectively. Our focus on the balance sheet of the banking sector ties our paper most closely to third generation models. In those models banks and/or firms have liabilities in foreign currency. In the event of a devaluation, their liabilities suddenly increase relative to their assets. Given the costs of being heavily leveraged, this then forces them to either reduce borrowing sharply or default altogether. If the monetary authority does not defend the currency, devaluations can become self-fulfilling as the inability to borrow abroad leads to a sudden stop in capital flows and an ensuing devaluation (Krugman (1999); Aghion, Bacchetta, and Banerjee (2001)). The proposed explanations range from bailout guarantees and other forms of government induced moral hazards (Burnside, Eichenbaum, and Rebelo, 2001) to particular forms of market incompleteness (Caballero and Krishnamurthy, 2001).
suggests that, indeed, the credibility of the gold standard was much in doubt during the height of silver agitation, from the Sherman Silver Purchase Act of 1890 until the presidential election of 1896, and that the strong gyrations in bank leverage were intimately tied to changes in the credibility of the gold standard. Importantly, we find that, as emphasized by narratives of the period (Noyes, 1909), exchange rate uncertainty appears to have been exacerbated in the 1893 panic.

Given the theoretical literature that has associated contractions in bank leverage with output contractions (Gertler and Kiyotaki, 2010), and the fact that the contraction in employment accompanying the 1893 panic was one of the largest in United States history, the evidence of a nexus between fluctuations in the credibility of the exchange rate peg and the health of the banking system suggests large real costs to the economy from exchange rate uncertainty. To evaluate that hypothesis more formally, we perform a structural VAR analysis of the interaction between the index and measures of economic activity. This analysis indicates that under full commitment, fluctuations in economic activity would have been significantly smaller before 1900, including the depression around the 1893 panic. On the other hand, exchange rate instability played no role in the subsequent decade when the narrative evidence suggests there were no concerns about commitment, even though it includes a significant episode of financial turbulence in the 1907 panic.

The National Banking Era is appealing as a laboratory to investigate the relationship between exchange rate credibility and the banking system because, unlike modern economies, there was at the time a large number of banks in the United States which could not branch. This provides us with a panel of states in a currency union all sharing similar regulatory environment with each state populated by a large number of independent financial institutions. Importantly, banks in all states were affected by the same fluctuations in the probability of a currency devaluation, allowing us to examine how the effects of possible devaluation differed with the access that individuals in different states had to gold denominated investment alternatives. Furthermore, the presidential election of 1896, in which William Jennings Bryan famously declared that “mankind shall not be crucified on a cross of gold” (Jones, 1964), offered a particularly clear resolution of uncertainty over the
gold standard. As Hallwood, MacDonald, and Marsh (2000) show, the persistent worries over devaluation until 1896 helps explain why U.S. interest rates were so much higher than British rates. And as the political cartoon in figure 2 illustrates, before the election the threat of devaluation—the “free silver scare”—was blamed for all manner of ills, from the failure of municipal bond issues, to unemployment, to bank closings.\footnote{The claims are perhaps hyperbolic, but show that there was real concern at the time from some in the business community, and that even the threat of silver, “the cry of free silver,” that was considered damaging: “Workman–’If the cry of free silver will cause that, what would not free silver itself do?’”}

The period has also received a great deal of study both for understanding the benefits and costs of imperfect currency pegs (Grilli, 1990; Calomiris, 1992; Hallwood, MacDonald, and Marsh, 2000) and the causes and consequences of banking panics (Noyes, 1909; Sprague, 1910; Wicker, 2000).

More generally, given their relative rarity, the study of changes in exchange rate policy regimes can greatly benefit from historical research. One of the primary sources for understanding the costs of a fixed exchange rate regime comes from the study of the workings of the golds standard during the inter-war period and Great Depression (Eichengreen, 1992). Relative to the inter-war period analyzed by that literature, our paper highlights an example of a success case, in which a country was able to increase its degree of economic stability by reinforcing its commitment to an exchange rate peg.\footnote{Other examples of recent papers that analyze the experience of banking panics in the nineteenth century United States, but do not focus on the foreign exchange aspect are Schularick and Taylor (2012) and Bordo and Haubrich (2012). Also see Carlson (2005), Dupont (2009) and Ramirez (2009) for work on the 1893 panic and Davis, Hanes, and Rhode (2009) for an analysis of nineteenth century United States business cycles.}

Furthermore, our paper contributes to a large empirical literature quantifying the importance of currency mismatches in propagating movements in the exchange rate in modern economies (Calvo and Reinhart, 2002). Much of that literature focuses either on cross-country data (Calvo, Izquierdo, and Mejía, 2004, 2008), or on data from nonfinancial corporations (see Galindo, Panizza, and Schiantarelli (2003) for a review, and also Cowan et al. (2005), Pratap, Lobato, and Somuano (2003), and Gilchrist and Sim (2007)). In contrast, our study focuses exclusively on bank data from within a single country. This is line with theoretical literature and historical narratives which emphasize currency mismatch among financial firms.\footnote{Díaz-Alejandro (1985) provides an early discussion of the role of currency mismatch at the bank level in the Chilean 1981 crisis, and more recently Choi and Cook (2004) introduce a model in which currency mismatch operates by constraining bank’s lending ability.}
2 The U.S. Monetary System at the End of the Nineteenth Century

The monetary system of the United States was a contentious political and economic issue from the Civil War until around 1900, reaching a peak of division during the 1890s. While the United States was technically on a bi-metallic standard until 1900, de facto only gold was in widespread circulation. Since the Coinage Act of 1873 had not made any provision for minting silver—for which it was later dubbed the “Crime of 73” by silver proponents—silver was largely left out of the monetary mix (Friedman and Schwartz, 1963, pp. 114-15). A new political movement, “free silver,” emerged to try to bring silver back into circulation. Whether the federal government would buy silver and at what price were crucial questions that came up again and again.

Silver proponents were most successful with the Sherman Silver Purchase Act of 1890, which committed the Treasury to buying much more silver than it had before (Friedman and Schwartz, 1963, pp. 132-133). The resulting purchase of silver put a large strain on Treasury gold. Friedman and Schwartz (1963, pp. 133) suggest that from 1890 to 1893 the purchase of silver by the Treasury was so large that it would have driven the United States off gold and Sprague (1910, p. 179) argues that the Silver Purchase Act was one of the reasons for the crisis in 1893 and its repeal was helpful in restoring confidence. As the crisis deepened Treasury gold reserves were depleted, so that many took the suspension of gold payments became imminent (Noyes, 1909). The Sherman Silver Purchase Act was repealed in late 1893, and while this was not enough to bring about renewed business activity, it did enable the United States to secure temporary assistance from Europe.

The 1893 crisis did not resolve the question of silver money. The silver producers in the West were joined by a loose coalition of mainly agrarian interests from the Northwest and South in calling for silver. Moreover, the repeal of the Sherman Silver Purchase Act in response to the panic seemed just further evidence to the Populists of what they regarded as a betrayal of agrarian debtors to mortgage holders in the East (Friedman and Schwartz, 1963, p. 116). These factors all came together in the presidential election of 1896.
The selection of William Jennings Bryan as the Democratic and Populist party candidate for the presidential election of 1896 marked the height of the divisions over the silver issue. Bryan’s famous speech at the Democratic National Convention that earned him the nomination set the tone for an election with the gold standard at its heart.\footnote{It is clear from the speech that Bryan stood firmly against the gold standard: “Having behind us the commercial interests and the laboring interests and all the toiling masses, we shall answer their demands for a gold standard by saying to them, you shall not press down upon the brow of labor this crown of thorns. You shall not crucify mankind upon a cross of gold” (Jones, 1964, pp. 228-229).} Although it was sometimes blurred with other demands, the evidence suggests that the Populist demands for silver would have led directly to devaluation. We review the evidence in appendix A.1. Indeed, Frieden (1997) suggests that silver was an important part of Populist demands exactly because it would lead to devaluation. Agricultural commodities were sold on a world market. Devaluation would have increased the price in dollars for agricultural commodities and thus increased the purchasing power of farmers, the biggest supporters of the Populist movement.

Our interpretation of the 1896 election is that it provided a clear and sharp break in the likelihood of dollar devaluation and so can be used as a natural experiment to understand the effect of exchange rate uncertainty on bank balance sheets. This interpretation rests on two assumptions: first, that the election represented a clear break in the expectations about exchange rates at the time; and second, that there were no other important events between the two call dates around the election that would have affected bank balance sheets. We offer a detailed discussion and evidence to support these two claims in appendix A.2. In sum, in support for the first assumption we argue that gold was the central question of the election, and that there was substantial uncertainty over the election. Importantly, there was sufficient uncertainty about the election for many banks and individuals to take costly preparations against a Bryan win including withdrawing gold from banks at a costly premium. As figure 2 illustrates all manner of ills were attributed to “free silver” before the election and the loss of Bryan was met with clear relief by some. For example, “The universal feeling among the advocates of sound money that with the election of McKinley thorough confidence in the large business centers would at once be re-established and that factories long idle
would be run on full time again . . . .”

In support of the second assumption, we examine the historical accounts for other events of importance for monetary questions during the fall of 1896. The most prominent are the large gold finds in Alaska. While the first mentions of possible gold in the “Cloldyke” occurred in the fall of 1896, this came in a context where new gold finds in Alaska were a common occurrence, and there was no specific reason to believe that the new find would be particularly large. It was not until the first shipments of gold arrived in July 1897 that the rest of the world learned of the finds along the Klondike river.

While Bryan would run again in 1900, after 1896 the support for silver was substantially weaker. Of considerable help in strengthening the credibility of the gold standard was the increase in the world supply of gold from discoveries in South Africa, Alaska, and Colorado. The greater supply of gold led to an increase in the monetary supply in the United States starting in 1897 and also substantially reduced the economic reasons for silver agitation (Friedman and Schwartz, 1963, p. 137). The relationship of the dollar to gold was not formally settled until the passage of the Gold Standard Act in March of 1900 set the United States officially on a pure gold standard. The subsequent re-election of McKinley that November by a wide margin was viewed as an endorsement of the gold standard (Hepburn, 1903, p. 405), although silver featured much less prominently than in the campaign of 1896.

3 Market Segmentation, Bank Balance Sheets and Expected Devaluation

In this section we describe a model that illustrates a mechanism where a resolution of exchange rate uncertainty would have an effect on bank balance sheets that would differ across states. The model thus provides the basis for us to use the 1896 election to obtain a description of the impact of shocks to expected exchange rates on the cross-section of states. The model emphasizes the access that

---

prospective depositors had to alternative assets that were denominated in gold. A national event such as the resolution of the gold-to-dollar exchange rate may affect states and banks differently depending on the access to gold within those states. This will be an important element driving our empirical strategy. In essence, given some degree of asset market segmentation, banks with dollar denominated deposits are more vulnerable to fluctuations in expected dollar devaluation the greater the degree of access of prospective depositors to those alternatives. To keep the exposition simple, the description that follows is mostly verbal, with the mathematical details of the model relegated to Appendix B.

Segmentation manifests itself in two ways: First, not all individuals have access to the same investment opportunities outside of the banking system, so that for a given deposit rate a fraction of individuals wish to make deposits and another fraction will not. Second, prospective depositors differ on whether the investment opportunities that they have outside the banking system are denominated in dollars or gold. For analytical convenience, we assume that in each given state $s$ a fraction $\xi_s$ of individuals can only invest in gold denominated assets. This means that changes in devaluation probabilities will have different effects on the banking system depending on the composition of investment opportunities in a given region. We offer evidence that gold played a more important role in the economies of some states in the next section.

The model has two periods. Initially, there is parity between dollars and gold (so that one unit of dollar purchases one unit of gold) with the return on gold denominated assets $R^G$ and dollar denominated bonds $R^D$. Individuals expect the U.S. to abandon the Gold Standard with some probability and establish a new exchange rate $q < 1$ dollars per unit of gold. We focus on the effect of changes in the expected exchange $E[q]$. The relative return of holding dollars versus gold is then

$$F = \frac{E[q]R^D}{R^G}$$

If we interpret $R^G$ as being equal to the return on foreign assets, then $F$ is a measure of the deviation from uncovered interest parity imposed by market segmentation. In appendix B, we

---

9The literature linking foreign exchange rate fluctuations with financial instability emphasizes the role of debt denominated in foreign currency. While contracts with a “gold clause” were common in the U.S., those were not prevalent in the way national banks financed themselves. In fact, the National Banking Act allowed for the constitution of “Gold Banks” that would promise to redeem notes for specie, but there were none in place in the 1890s. To the extent that gold clauses were used by banks, those were not discriminated in the call reports summarized by the Office of the Comptroller of the Currency, which we use as our main data source.
show that in equilibrium the bank deposits $D_s$ in each state is increasing in the expected exchange:

$$\frac{\partial D_s}{\partial E[q]} > 0,$$

where $D_s$ is bank deposits in dollars in state $n$, and the increase is larger in states where gold is more accessible:

$$\frac{\partial D_s}{\partial E[q]\partial \xi_s} > 0.$$

Deposits held by banks increases with $E[q]$, and the more so the higher the share of individuals with alternative investments denominated in gold in the state, $\xi_s$. Furthermore, in the appendix we also show that if the dollar value of government debt is fixed, increases in expected exchange rate are equivalent to increases in the real supply of government bonds. Given that under market segmentation the relative demand for dollar denominated assets is not perfectly elastic, such an increase in the real supply of government bonds leads to an increase in the relative return $F$ so that, in equilibrium, $\frac{\partial F}{\partial E[q]} > 0$. Importantly, changes in the exchange rate only affect bank deposits $D_s$ to the extent that they have an impact on the relative returns $F$. Therefore, changes in bank debt in a period such as the 1896 election when the only important aggregate shock to the economy was a change in the devaluation probability are indicative of how banks in different states react to changes in the interest rate differential. Within the model the debt-to-asset ratio $L_s$ within each state has exactly the same comparative statics as the deposits. We use data on the debt-to-asset ratio in the subsequent sections to control for underlying trends in economy size that could be affecting the overall size of the banking system.

4 Data Source and Descriptive Analysis

Our main data consists of the balance sheets of National Banks between 1880 and 1910 as reported in five call dates distributed over the year, consolidated at the state level. The National Banking Act required National Banks to report several balance sheet items to the Office of the Comptroller of the
Currency (O.C.C.) at five annual call dates, and the O.C.C. would in turn publish the data in annual reports to Congress. Weber (2000) provides these data in electronic form. We have independently checked the call reports during much of the period, and the Weber (2000) data matches the call reports. To our knowledge, our work is the first to explore both the cross-sectional and the time series dimensions of this data.\textsuperscript{10}

We construct our main variables of interest from the individual balance sheet items for individual states. We focus particularly on the behavior of leverage as measured either by the ratio of debt-to-equity or the ratio of debt-to-assets. Leverage provides a useful way of normalizing changes in bank activity across different states with very different sized banking sectors and/or which are growing at different secular trends. It is an exact representation of the model from section 3 as long as equity is slow moving. The emphasis on leverage is in contrast to much of the previous work on the period, which has emphasized bank suspensions as an indicator of bank distress (Wicker, 2000; Carlson, 2005).\textsuperscript{11}

Figure 1 shows that immediately following the 1896 election the overall leverage of national banks increased substantially, and continued to increase over the next three years. The overall change from about 2.5 before the election to 4 is a large increase in a period when banks held substantially more equity than banks today whose leverage often exceed 20. Historians of the period have offered many explanations for the recovery starting in 1897 that are independent from the resolution of uncertainty about the gold standard, including favorable crops and gold inflows from abroad (see Noyes (1909), Sprague (1910), and Friedman and Schwartz (1963), for example). While these probably played a role in the sustained increase in leverage over the course of the year, their timing cannot account for the sharp inflection around the 1896 election. Figure 1 also shows

\textsuperscript{10}See also Champ (2007b) for a discussion of aggregate bank balance sheet data constructed using the OCC aggregate balance sheets and Champ (2007a) for a detailed discussion of the legal and institutional background of the era.

\textsuperscript{11}The use of leverage data as is also in line with recent work by Gertler and Karadi (2011) and Gertler and Kiyotaki (2010) as well as with the model presented in Section 3 above. One further advantage of bank leverage as an indicator of bank distress is that good and bad news have symmetric effects. In contrast, suspensions are only observed in extreme negative states. Therefore, using leverage allows us to investigate the impact of positive as well as negative shocks to the credibility of the gold standard, including periods in which there were few if any bank suspensions in the data.
the ratio of gold to assets held by banks. It is clear that the increased leverage is not coming directly from an increase in the overall gold in the system. Gold had different importance in the economies of different states, however, and we use this variation to help identify the differing effects of changes in the expectations about exchange rates in different states. 12

The change in leverage around the election was particularly pronounced in states where gold was widely available. The model introduced in Section 3 suggests that banks in areas where depositors have more access to gold will be particularly affected by the election. While we do not have any measure of direct holding of gold denominated assets by individuals, we do have some measures of gold held by banks. The scatterplots in Figure 3 show changes in the bank deposits-to-assets ratio around the election in 1896. States whose banks held more specie as a share of assets before 1890 had substantially larger increases in deposits. We focus on the average holding of specie before 1890 to avoid direct endogeneity with the choices in 1896. Due to their special status as central reserve cities where other national banks kept their reserve, we also show New York City, Chicago, and St Louis separately.

As a measure of the availability of gold in different states, the specie-to-assets ratio suffers from an obvious endogeneity problem, since it stems at least in part from a choice made by banks. 13 As an alternative, we combine measures of gold production, gold imports, and customs duties. 14 The federal government received a great deal of its revenues from customs and required that they be paid in gold or gold certificates. Similarly, some states, particularly in the West, mined substantial quantities of gold. Each of these represents a flow associated to an economic agent acquiring

12 The data does not discriminate between gold and other metals, combining all of them in a single “specie” category. However, gold coin and gold certificates (assets payable in gold on demand) accounted for the largest fraction in the value of specie held. For example, in 1891, out of $183 million held by banks in specie, $151 million or about five-sixths were held in gold or gold certificates issued either by the Treasury or by clearinghouses, and the remainder was held in silver coin and Treasury silver certificates.

13 In the case of the City of New York and other central reserve cities, regulations required banks to hold all of their reserves in either gold or silver coins or certificates, or legal-tender notes of the United States (Dunbar and Sprague, 1917, p. 235).

14 We use the following sources: For gold imports in each state we use the average gold imports over 1886-90 for each city recorded in the Statistical Abstract of the United States 1895 pp. 72-82. We aggregate these together by state and New York City and use the five-year average since imports are quite volatile. For gold production we use the average production in 1889 and 1890 by state from the Statistical Abstract of the United States 1895, p. 39. For customs receipts we use the aggregate receipts from each custom district from the Annual Report of the Secretary of the Treasury in 1890 pp. 785-88.
additional gold or making a payment in gold locally but it does not exhaust the uses for gold. Four states had no recorded production, customs, or imports. These states had lower specie holdings in general in 1890.\textsuperscript{15} The second panel in figure 3 shows that the change in the debt-to-assets ratio around the 1896 election is also positively associated with this measure of the local availability of gold.

Overall leverage increased substantially between October and January 1896, the two call dates around the election for banks in states where gold was an important asset. Importantly, this correlation between changes in leverage and gold does not hold in general, but is particularly important around the election. Figure C shows how the change in the debt-to-assets ratio in each state between call dates is related to bank holdings of specie. The first call date after the election is 17 December 1896 and there is a strong positive correlation that states whose banks held more gold before 1890 have larger increases in deposits. The same relationship does not hold in general, nor is it an end of the year effect, as the other panels in figure C demonstrate. In the next section we take this observation that the election had a more pronounced effect on leverage in states where gold was more important and examine its implications more formally.

5 Commitment to the Gold Standard and Economic Fluctuations In the Late Nineteenth Century

The 1896 election was associated with a distinctive pattern of cross-state changes in bank leverage which is plausibly associated to a change in the probability of devaluation on bank balance-sheets. We now ask (i) whether the observation of a similar pattern in other time-periods would be similarly indicative of changes in devaluation probabilities and (ii) to the extent that this is true, what does it tell us about the role of fluctuations in the credibility of the gold standard on key measures of economic activity during that period.

\textsuperscript{15}The four states are Arkansas, Kansas, West Virginia, and Wyoming. They have an average specie/assets ratio on the 17 May 1890 call date of 4.15%, well below the average of 4.87%.
In order to answer question (i), we use structural factor analysis to construct an index of commitment to the Gold Standard. We argue that the index provides a plausible measure of devaluation probabilities for three reasons: First, its larger movements conform to the political narratives of the period. Second, the index correlates well with other variables which are plausibly connected to the probability of devaluation, such as the amount of gold held by the Treasury and interest rate spreads for the dollar versus the pound sterling. The co-movement with interest spreads is especially interesting, since it is strongly positive before 1900 but not afterward. This aligns well with the model prediction, discussed more below, that the co-movement might be positive if the index and the spread are largely driven by fluctuations in devaluation probabilities, but negative if they are driven by other shocks affecting relative return differentials. Third, the index does not appear to react to other salient shocks that occurred in periods when the commitment to the Gold Standard was less in question, such as the 1907 panic, the 1905/06 agricultural boom or the 1888 election. In order to answer question (ii) we then introduce the commitment index in a structural VAR together with indices of economic activity. In particular, we inquire on the role of commitment to the Gold Standard in driving the 1893 depression, which was the primary macroeconomic event of the time.

5.1 Narrative Identification of Factors in a Data-Rich Environment

Previous work, notably Romer and Romer (1989) and Romer and Romer (2004), has relied on historical narratives to identify macroeconomic shocks and then econometrically trace out the impact of those shocks in macroeconomic time-series. From an econometric standpoint, the success of this approach relies on using historical narratives to identify exogenous shocks at different points in time in sufficiently large number to allow for inference. Here, we show how, under certain assumptions, one can instead combine knowledge of a single shock which is well identified by the historical narrative with rich cross-sectional data, to identify a factor corresponding to that shock over the time-series. In econometric terms, the method consists of using the historical narrative to identify a time-varying structural factor.

Let $X_t$ be a $1 \times N$ vector of “informational” variables, i.e., variables who we believe are likely
to contain meaningful information about the factor we are interested in identifying. For any given entry in this vector \( x_{i,t} \), we assume that

\[
x_{i,t} = \sum_{r=1}^{R} \lambda_{i,r} F_{r,t} + \varepsilon_{i,t}, \quad i \in \{1, \ldots, N\}, \quad t \in \{1, \ldots, T\}
\]

where \( R < N \), \( F_{r,t} \) are time-varying factors and \( \lambda_{i,r} \) are factor-loadings that vary across variables but are fixed in time. Under mild conditions on the structure of the error term \( \varepsilon_{i,t} \) (see, for example, Stock and Watson (2003)), one can show that for large \( N \) and \( T \) one can consistently estimate the space spanned by factors 1 through \( R \) using principal component analysis. However, without further assumptions it is impossible to uniquely estimate the values of individual factors and factor loadings.\(^{16}\) Without loss of generality, let \( F_{1,t} \) denote the structural factor of interest. The following two assumptions allow for identification:

**Assumption 1.** There is some \( t^* \) for which \( F_{1,t^*} \neq 0 \) and \( F_{r,t^*} = 0 \) for \( r \neq 1 \).

**Assumption 2.** \( \text{cov}(\lambda_{i,1}, \lambda_{r,1}) = 0 \) for \( r \neq 1 \).

Given Assumptions 1 and 2, the following proposition holds:

**Proposition 1.** Suppose Assumptions 1 and 2 hold and that the sample estimates correspond to population values. Let \( \bar{x}_{i,t} \equiv \sum_{r=1}^{R} \lambda_{i,r} F_{r,t} \) be the part of variable \( x_{i,t} \) explained by the common factors and let \( \bar{x}_t \) be the \( N \times 1 \) vector stacking all values of \( \bar{x}_{i,t} \) for a given time \( t \). Then \( F_{1,t} = \frac{\text{cov}(\bar{x}_{i,t}, \bar{x}_{i,t^*})}{\text{var}(\bar{x}_{i,t^*})} F_{1,t^*} \).

Since a principal components analysis of the covariance matrix for \( x_{i,t} \) provides us with a consistent estimate of the space spanned by the factors, it follows that \( \bar{x}_{i,t} \) can be consistently estimated and, given Assumptions 1 and 2, so can \( F_{1,t} \). The procedure consists at each time \( t \) of regressing \( \bar{x}_{i,t} \) on \( \bar{x}_{i,t^*} \).

---

\(^{16}\)In matrix form, the model can be written as \( X_t = \Lambda F_t + \varepsilon_t \), with \( F_t = \{F_{1,t}, F_{2,t}, \ldots, F_{R,t}\} \) and \( \Lambda \) a \( N \times R \) matrix with entries \( \lambda_{i,r} \). It follows that for any invertible \( R \times R \) matrix \( H \) the model can be alternatively rewritten as \( X_t = \Lambda H^{-1} F_t \) with \( \Lambda \equiv \Lambda H \) and \( F_t \equiv H^{-1} F_t \).
We can relax the assumptions needed for identification of \( F_{1,t} \) if there are dates for which we know that other shocks played an important role but \( F_{1,t} \) was unlikely to be important. For example, the 1907 panic was most likely not associated with a large perceived change in the commitment of the U.S. government to the Gold Standard. Formally, suppose the following assumptions hold:

**Assumption 1’**. There is some \( t^* \) for which \( F_{1,t^*} > 0 \) and \( F_{r,t^*} = 0 \) for \( r > 2 \) and some \( t^{**} \) for which \( F_{1,t^{**}} = 0 \), \( F_{2,t^{**}} > 0 \) and \( F_{r,t^{**}} = 0 \) for \( r > 2 \).

**Assumption 2’**. \( \text{cov}(\lambda_{i,r}, \lambda_{i,1}) = 0 \) and \( \text{cov}(\lambda_{i,r}, \lambda_{i,2}) = 0 \) for all \( r > 2 \).

Given assumptions 1’ and 2’, the following proposition holds:

**Proposition 2.** Suppose Assumptions 1’ and 2’ hold and that the sample estimates correspond to population values. Let \( \bar{x}_{i,t} = \sum_{r=1}^{R} \lambda_{i,r} F_{r,t} \) be the part of variable \( x_{i,t} \) explained by the common factors and let \( \bar{x}_t \) be the \( N \times 1 \) vector stacking all values of \( \bar{x}_{i,t} \) for a given time \( t \) and \( \bar{X}^* = [\bar{x}_{t^*}, \bar{x}_{t^{**}}] \). Let
\[
\begin{bmatrix}
\gamma_1 \\
\gamma_2
\end{bmatrix} = (\bar{X}^* \bar{X}^*)^{-1} \bar{X}^* \bar{x}_t.
\]
Then \( \gamma_1 = \alpha F_{1,t} \) where \( \alpha \) is a proportionality constant.

In what follows, we will construct a relative returns index based on a single date \( t^* \), thus relying Assumptions 1 and 2. We will then use Proposition 2 to evaluate whether results change in an important way if we control for other shocks that we can identify from the historical narrative.

### 5.2 The Relative Return Index: Historical Behavior and Interpretation

We construct our relative returns index by identifying a structural factor using the procedure delineated in Proposition 1, which holds under assumptions 1 and 2. We take 1896/12 as the reference date \( t^* \) which amounts to assuming that the only nation-wide shock of importance around the election was a change in commitment to Gold. In terms of the model in Section 3, since changes in the exchange rate only affect bank liabilities through their impact on the relative return \( F \), strictly speaking the factor loadings we identify correspond to the the derivatives \( \frac{\partial D_s}{\partial F} \), and the time-varying
factor to fluctuations in $F$. Below, we argue that there are good reasons to believe that the larger fluctuations in $F$ during the period were due to fluctuations in the government’s commitment to the exchange rate peg.

To construct the index, we estimate a factor model using log changes in bank debt/assets ratio in 48 states for which continuous time-series are available as our informational variables. Since we extract information from changes in balance sheets, we take the factor to correspond to changes in relative factor over time. The relative returns index is therefore the cumulative sum of the estimated structural factor over time. To choose the number of principal components in the estimate, we calculate the $ICP_1$ and $ICP_2$ indices from Bai and Ng (2002). The number of factors that minimize the two indices are, respectively, 11 and 4. We thus take a conservative stance and calculate the index based on 11 factors for our baseline calculations.\footnote{The number of factors implied by the Bai and Ng criterion is sensitive to whether or not we normalize the individual time-series by their variance, as is common practice in principal component analysis. We decided against normalization since all the time-series refer to the behavior of the same variable in different geographic locations, and are in a common unit.}

Figure 5 depicts the time path of our baseline relative returns index together with a 90% confidence interval constructed through bootstrapping. Each panel of figure 5 compares the index to a different measure from the period. The first noteworthy feature of the time-series for the relative returns index shown in 5 is that it is relatively volatile up to around 1900, after which the relative returns index becomes much more stable. The standard deviation of changes in the index are only 28% as large after February 1900 than before. Given the passage of the Gold Standard Act of 1900, approved in March of that year, this large reduction in volatility provides a strong indication that changes in expected devaluations played a key role in driving the index before 1900. Furthermore, before 1900, the index exhibits strong movements around two episodes that the historical narrative identifies as critical for the credibility of the Gold Standard. The first is the passage of the Sherman Silver-Purchase act in 1890, which was widely regarded as damaging to the credibility of the standard and which is associated with a strong reduction in the index. The second is the election in December 1896. While the change in the index was positive by construction at that date, it remained on an increasing path on the call dates following the election. This continuing increase is
associated with other important events at the time that consolidated the adherence of the U.S. to the gold standard, notably the verification that there were large gold reserves to be exploited in Alaska. Finally, the relative returns index dips around the 1884 and 1893 banking panics suggesting that those panics were associated with a strong decrease in the credibility of the Gold Standard. There is no comparatively large dip around the 1907 panic, by which time the commitment of the U.S. to the Gold Standard was not in question.

The adherence of the broad movements of the series to the historical narrative of the time provides some assurance that it captures an important dimension of the variations in the commitment to the gold standard around the period. As a further measure to inquire the importance of exchange rate fluctuations in driving the index, we compare its behavior with “gold premium” over the next 60 days as calculated by Calomiris (1992) which we extend using the original source (National Monetary Commission, 1910). The gold premium is the forgone interest from holding dollar denominated commercial paper over the next 60 days in New York compared to a pound-sterling denominated bond, and so, assuming uncovered interest parity holds between those two markets, gives the expected appreciation within 60 days. Figure 5 compares the negative of the gold premium with our relative returns index. Like our relative returns index, it drops abruptly around the 1893 panic and right before the 1896 election, after which it switches to a higher and more stable path. The correlation between the two series is 48 percent.

Within the context of the model in Section 3, uncovered interest parity does not hold, so that the relationship between the gold premium and expected depreciation is more nuanced. Since fluctuations in exchange rate devaluation expectations only affect bank leverage through their im-

---

18 The National Monetary Commission (1910) reports the prices of 60-day and sight bills of exchange bought in New York and presentable in London. Calomiris (1992) suggests that it would take about 10 days to travel from New York to London, and so the “sight” rate is really a 10 day rate. The difference between the two rates gives an interest rate for funds in a gold pegged currency (assuming there were no reasons to believe that Britain would abandon exchangeability) over a 50 days starting in 10 days. This rate is then converted to a 60 day rate by multiplying by 6/5. The gold premium is the difference between this “gold” rate and the rate for 60 day top rated commercial paper in New York. Under the assumption that participants in the two markets can move funds freely between them, uncovered interest parity holds and the gold premium measures the expected devaluation of the dollar within 60 days. The gold premium is not itself a clean measure of expected devaluation, however, as transaction costs preventing arbitrage between gold and dollars were substantial, so that gold premia would not necessarily vary smoothly with changes in devaluation expectations (see Coleman (2012) for recent a detailed discussion of the failures of uncovered interest parity at the time).
pact on the relative return of gold versus dollar denominated assets, the index is, strictly speaking, capturing the impact of any shocks that have an impact on that differential. The theoretical relationship between our index and observed interest rate differentials are easiest to see in a log-linear version of the model presented in Section 3. Given that model, the 1896 election affected bank balance-sheets solely by changing the return differential between gold and dollar denominated assets available to bank depositors. Therefore up to a scaling constant our index captures variation in this differential:

$$\alpha F_t = -(r_{G,t} - r_{D,t}) + E_t[\Delta q]$$

where $F_t$ is the relative returns index at any given time $t$, $E_t[\Delta q]$ is the expected exchange rate devaluation, $r_{G,t} - r_{D,t}$ is the difference between local-currency interest rates on gold and dollar denominated assets. The parameter $\alpha$ captures the fact that the indicator has arbitrary scale as well as the possibility that participants in the markets for commercial paper and London exchange are relatively better equipped to arbitrage interest rate differentials. As one can immediately see from the equation any other factor that leads to an increase in $r_{G,t} - r_{D,t}$ without affecting $E_t[\Delta q]$ would lead to a negative co-movement with $F_t$. At the same time, around the 1896 election both $r_{G,t} - r_{D,t}$ and $F_t$ increased, suggesting that an increase in $E_t[\Delta q]$ has the power to affect both variables in the same direction. More generally, any positive co-movement between $r_{G,t} - r_{D,t}$ and $F_t$ has to be associated to fluctuations in $E_t[\Delta q]$. Accordingly, we find that before formal commitment to gold in 1900, changes in the index are dominated by changes in expectations of devaluation and the correlation between the two series is 56%. Conversely, after 1900, the two series are slightly negatively correlated (-1%) and the clear spike in the gold premium around the crisis of 1907 at the same time as the index becomes more negative suggests that it is no longer primarily capturing fluctuations in exchange rate devaluation expectations.

Finally, we compare the index with the amount of gold held by the Treasury, depicted in Figure 5. The amount of gold held by the Treasury might be correlated with commitment to the gold standard for two reasons. First, as emphasized by Grilli (1990), higher gold reserves give the
Treasury more “fire power” to defend the gold standard in the event of a speculative attack. Second, an increase in the probability of an exit from the gold standard would be an incentive for agents to redeem gold from the Treasury in exchange for dollars, depleting gold reserves. As Figure 5 shows, the correlation between the two measures is very high, with both series peaking together in the beginning of 1889, bottoming around the 1893 panic, and rising again after the 1896 election. The correlation between the two series is 66 percent. Furthermore, the correlation is not restricted to low-frequency fluctuations. If converted to year-on-year changes the correlation is a smaller but still high 56 percent.

Lastly, in order to more formally control for the possibility that Assumptions 1 and/or 2 do not hold, we recalculate the index using the procedure laid out in Proposition 2, taking the cross-sectional pattern of behavior of the informational variables in periods when other shocks were likely to have been particularly important as controls. In particular, Assumption 1 assumes that the change in perceived commitment of the U.S. government to the Gold Standard was the only important aggregate shock in December 1896. One could worry about two additional possibilities: The first is that other, relatively less prominent policies that depended on the election outcome might have affected the informational variables. To control for that possibility, we re-estimate the relative returns index taking the 1888 and 1900 elections as controls. These elections took place in periods in which the commitment to the gold standard was relatively less at stake. The 1900 election was a rematch of the 1896 election, with now incumbent president McKinley running against William J. Bryan. The 1888 election provides an interesting point of comparison because, like the 1896 election, it was fairly close. Another possibility that would invalidate the method is that the behavior of the informational variables are simply depicting a typical rebound from a banking panic, since October 1896 was marked by a spike in bank failures. To control for that possibility, we add a control for the December 1907, capturing the period in which the 1907 panic was at its worst. We also experiment with controls for agricultural shocks by taking changes around the fall call-date for 1905 as a control. Finally, for the 1907 panic and the 1905 agricultural shock, we also evaluate the robustness of our index to a control for a five call-date window around these
Table 1 depicts the results of the robustness exercise. The first three rows show, respectively, statistics referring to the baseline index, and for indices calculated using 5 and 20 factors instead of 11. The six subsequent rows correspond to results obtained using different sets of control. The first column shows the correlation between the relative returns index calculated under different assumptions and our baseline (90% confidence intervals based on a bootstrap are presented below each statistic, in parenthesis). The correlation is uniformly high, above 95% in most cases, and reaching its lowest value at 88% when we control for a five call-dates window around the 1905 commodity shock. The second column shows the ratio between the volatility of changes in the relative returns index after and before 1900. In all cases, the ratio is close to 25%, implying that the relative returns index varied four times as much before the formal adoption of the Gold Standard than before. Columns 3 through 5 show the change in the index following the three main historical events that we highlighted above: the year after the passing of the Sherman Silver Purchase Act in 1890, the year after the 1896 election and the trough of the 1893 crisis. The ability of the index to capture these key episodes is robust to changing the number of factors or to the addition controls. Together, these robustness exercises lend some credence that Assumptions 1 and 2 provide a close enough basis for the construction of a meaningful index of relative returns.

5.3 The Economic Impact of Imperfect Commitment

The last panel of figure 5 shows the time series for the credibility index, overlaid with the time series for log leverage of national banks, aggregated across all states. The two are highly correlated. There is no noticeable reduction in leverage following the Sherman Silver Purchase Act, but otherwise the two series share similar peaks and troughs. This correlation suggests that even if changes in commitment to gold did not explain all fluctuations in leverage over the period, they played a key role in the increase in bank leverage after 1896 and the reduction in volatility after 1900. Importantly, this close relationship is not just by construction. Rather, the relative returns index is identified by how the cross-section across states varies around the election of 1896, not by
the aggregate time series.

How important was the lack of commitment to the gold standard for real economic activity? The close relationship with leverage suggests a potentially large effect and as figure 2 illustrates people at the time did as well. To assess the impact of fluctuations in commitment on economic activity we estimate the effect of changing commitment on four measures of real activity, for which high-frequency (monthly or quarterly) data is available: (i) the number of business failures tabulated by Dun and Bradstreet’s, (ii) pig iron production as tabulated by Macaulay (1938) from weekly capacity of furnaces in blast, (iii) industrial production as calculated by Miron and Romer (1990) and (iv) Factory Employment as calculated by Jerome (1926). All of these time-series are available in the NBER Macro History Database. Of these, the number of business failures is only one which is a direct depiction of a single uninterrupted data-series calculated from primary sources. For that reason, we take that as our baseline.

For each measure, we first estimate a two variable vector autoregression (VAR) including log-changes in the measures of economic activity and changes in the relative return index. We include five lags covering one year of data. To identify the effects of shocks to relative returns we take two extreme identification approaches. In one case, we assume that exogenous shocks to the commitment to the gold standard have no immediate impact on the measures of economic activity but that the converse is true. This is a plausible assumption if we take the relevant economic variables to be relatively slow moving. In the other case, we assume that shocks to the different measures of economic activity do not have any immediate impact on relative returns. This assumption amounts to viewing fluctuations in relative returns as largely exogenous over the short run.

Given the identification of shocks, we then construct counter-factual time-series for the measure of economic activity under perfect commitment to the gold standard using two alternative sets of assumptions: First, based on the discussion in Section 5.2 pointing out that much of the fluctuations in the relative-returns index were driven by changes in commitment to the gold standard, we assume that all fluctuations in the relative returns index before 1900 were driven by fluctuations in the commitment to the gold-standard, and obtain the counter-factual by calculating an
alternative sequence of structural shocks to the relative returns index that ensure that it remains constant throughout the period, while keeping other structural shocks at their historic path. This provides us with an upper bound to the role of those changes. Second, we alternatively assume that none of the shocks to the returns index came from fluctuations in commitment to the gold standard and that the only effect of increased commitment is to change the impact of structural shocks on measured economic variables. Thus, we calculate the counter-factual sequences for output and for the relative-returns index before 1900 by feeding the historical sequence of shocks identified for that period through the structural parameters identified for the post 1900. Under this assumption, there would still be a positive shock to the relative returns around the 1896 election, even though under perfect commitment to the Gold Standard, such a question would not have arisen. From that perspective, the exercise puts a lower bound on the role of changes in the commitment to the gold standard. Both of these counter-factual exercises are vulnerable to the Lucas critique, since greater commitment to the gold standard could change the propagation of shocks. Thus, as an additional measure of robustness we also calculate the counter-factual using VAR coefficients estimated using the post 1900 sub-sample.

Table 2 shows summary statistics for the results of these exercises under the first set of assumptions by setting variation in the relative returns index to zero. For each measure of economic activity, we present results with the two alternative identification schemes. We label “fast” the identification scheme in which the index of relative returns reacts immediately to shocks affecting economic activity and “slow” where it does not. The first two columns show the volatility of changes in the counter-factual measure of economic activity relative to the actual historical experience before and after the formal adoption of the Gold Standard in 1900. Before 1900 the volatility of changes in business failures would be 19% lower for the “fast” identification scheme (10% in the “slow” one. Numbers for the volatility of change in pig-iron production, factory employment and industrial production are progressively smaller, at 14% (9%), 17% (13%), and 3% (3%), re-

---

19 The exercise does assume that perfect commitment to the gold standard would affect the direct transmission of all shocks to output. This, however, is not a very stringent assumption, given that the volatility of shocks to measures of economic activity change very little before and after 1900.
pectively. In all cases but that of industrial production, the results imply that full commitment to the gold standard would yield a statistically significant reduction in the volatility of economic activity. In contrast, after 1900 in none of the cases is the effect of eliminating shocks to relative returns statistically significant. The post 1900 periods acts as a placebo test since there was, by all accounts, full commitment to the gold standard after 1900 and eliminating shocks to relative returns should not have any effect during this period.

The last two columns of Table 2 present the implication of the counter-factual calculations for the 1893 depression, which was the prominent macroeconomic event of the period. In the “fast” identification scheme, the point estimates imply that fluctuations in the commitment to the gold standard account for close to 70% of the rise in business failures between March and October 1893, 43% of the reduction in pig iron, 60% of the change in employment, and 70% of the change in industrial production. Under the slow identification scheme, the lack of commitment to the gold standard accounts for smaller, but still substantial, fractions of the drop in economic activity in that period, ranging from 23% of the change in pig iron production to 50% of the change in business failures.

Table 3 inquires whether the results are robust to the Lucas Critique by calculating the counter-factual using parameters estimated using post 1900 data only. The trade-off as compared to the baseline estimates is that those calculations rely on a much smaller sample, and are therefore less precise. The point estimates change relatively little, confirming the results in Table 2. Given the less precise estimates for the VAR parameters, the confidence intervals broaden, so that now the ratio of variances pre 1900 is significantly different from 1 for not only some of the variables and identifications. The use of VAR coefficients estimated using post 1900 data to calculate the counter-factual for the 1893 depressions imply larger contributions in 1893 due to volatility from gold, although the estimates become less precise. The evidence suggests that the lack of commitment to the gold standard during the period had significant and large effects on real output.

Table 4 shows the results under the second set of assumptions. Given those assumptions commitment to the Gold Standard only would only have reduced the relative volatility fluctuations in
business failures and would have increased the volatility of other measures of economic activity. It would have uniformly reduced the size of the output loss during the 1893 panic in all measure, although the reduction would only have been statistically significant for the case of business failures. The higher volatility of some of the measures of aggregate activity in the counter-factual economy is at odds with the reduction in volatility in the relative returns index. Table 5 shows that the increased volatility is a consequence of more volatile shocks to measures of economic activity in the post 1900 period. Table 5 is calculated under the assumption that the volatility of shocks to output was unaffected by the policy regime. Under those assumptions, commitment to the gold standard reduces the volatility of economic activity in all cases, and the reduction is statistically significant for a wider set of possibilities.

6 Conclusion

The modern view of exchange rate pegs is that they work best the more credible they are. When analyzing the costs of abandoning a peg, the negative impact of a devaluation on the balance sheets of financial institutions appears as a major source of problems. The evidence we show informs both views. We find that, in the gold standard era, the prospect of a devaluation was costly, and that the cost was exactly on the balance sheet of banks whose depositors had the greatest access to other currencies. We show that concern over devaluation had large impacts on volatility and the 1893 depression. The more general lesson from our findings is that, whether or not a devaluation is good policy, uncertainty and imperfect commitment to that policy can be costly.

---

20 As before, counter-factual values calculated using only coefficients estimated only after 1900 imply similar point estimates but larger confidence intervals.

21 Specifically, for the “fast” identification scheme, in which shocks to relative returns have an immediate impact on economic activity, we assume that the policy regime only affects the shock having an impact on relative returns within the period. In the “slow” identification scheme, in which shocks to relative returns only affect output with a lag, we assume that the policy regime does not affect the shock affecting economic activity with in the period.
References


A Historical narrative around 1896

A.1 Evidence for “free silver” as leading to devaluation

How United States notes would have been redeemed in the event of a change in the gold standard is not certain since Bryan lost the election, but the evidence supports the view at the time that it would have resulted in a devaluation of the dollar. Such a devaluation was an important part of the demands of Populist agricultural interests (Frieden, 1997). Populist monetary strategists were mostly in favor of fully fiat money (Frieden, 1997) and viewed bi-metalism mostly as political compromise to achieve the support of mining interests.

Since in both the panic of 1893 and in the 1896 election the monetary status of silver was a central issue, it seems likely that any change in the currency standard would involve making payments of some debts in silver. This might have included dollar notes as well as Treasury bonds. For example, in April 1893 the suggestion by Treasury Secretary Carlisle that, due to diminishing gold reserves, it might be necessary to redeem Treasury notes in silver rather than gold (Wicker, 2000, p. 58) prompted an immediate sell-off in the stock market. The market settled somewhat only after President Cleveland issued an emergency statement that notes would be paid in gold.

Bryan’s speeches are probably the best guide as to what would have happened had the Populists won the presidency and managed through legislation or executive power to change the monetary system, although it is not entirely clear that he understood the consequences. Bryan was committed to buying substantial quantities of silver to raise the price and called for the “free and unlimited coinage” of silver (Bryan, 1909, p. 274). The claim was that the government would by the “law of supply and demand” raise the price of silver bullion enough to fix the ratio between them since they are both in “limited” supply (p. 275).

“At the present time and under present laws a silver dollar when melted loses nearly half its value but that will not be true when we again establish a mint price for silver and leave no surplus silver upon the market to drag down the price of bullion. Under bimetallism silver bullion will be worth as much as silver coin just as gold bullion...
is now worth as much as gold coin and we believe that a silver dollar will be worth as much as a gold dollar”” (Bryan, 1909, pp. 280-81, from speech given in Madison Square Garden, New York, August 10, 1896).

Yet it is unclear where the revenues to do so would have come from and the experience from the Sherman Silver Purchase Act suggests that the federal government could not have persisted in substantial silver purchases for long without depleting gold reserves. Since dollar note holders could anticipate the devaluation, a run on gold reserves, as had happened in 1893, would have been a likely outcome.

A.2 Evidence for the election as a natural experiment

Who would win in 1896 was in doubt all the way to the end. Bryan lost the election, but the election was close and a few hundred votes in close states might have swung the election the other way (Jones, 1964, p. 341). Moreover the lack of systematic polling would have left everyone uncertain. The possibility of a Bryan win had bankers and financial interests very concerned and buying gold (Jones, 1964, pp. 339-40) and in the fall of 1896 a small banking panic ensued.

For many at the time, it is clear that gold was the central question of the election and there was substantial uncertainty and worry over the outcome. In the days after the election, for example, *The New York Tribune* interviewed a number of business and political interests with a similar conclusion: “The one thing of prime importance that I see in this election is that it settles with definiteness and for good and all the money question” according to Brayton Ives who had been a member of the electoral college in 1892.22 It seems at the time there was sufficient uncertainty about the election for many banks and individuals to take costly preparations against a Bryan win. Moreover, at least in New York, there were production orders contingent on a McKinley win that sparked an apparent boom in business after the election. Just before the election there were minor

---

runs on the regional offices of the Treasury to obtain gold in exchange for greenbacks and treasury certificates. Some had been hoarding gold for weeks and after the election tried to sell it. For example, after the election results became clear, the cashier of New York Sub-Treasury said: “Yes, hoarders are trying to unload their gold on us. They want bills for what they were so anxious to posses before the elections . . . .” Withdrawals from banks before the election were often costly. One Philadelphia bank reported that it received a substantial deposit of gold from a customer who had purchased the gold in the weeks before the election at a premium of between 0.25 and 1 percent. Figure 2 illustrates that at least some at the time attributed substantial real economic costs to just the possibility of free silver.

After the election there was a clear sense of relief among financial interests across the country and reports that banks would start lending again. For example, in New York “The universal feeling among the advocates of sound money that with the election of McKinley thorough confidence in the large business centers would at once be re-established and that factories long idle would be run on full time again . . . .” A similar sentiment was apparent in both Chicago and San Francisco, where at least a part of the reason came because banks seemed increasingly willing to lend: “Today banks are willing to lend, merchants are seeking to borrow, and customers are placing their orders where a week ago there was no lending nor borrowing and little buying.”

---


25 “Gold Set Free in Philadelphia,” The New York Times, Nov. 10, 1896, p. 13. In ProQuest Historical Newspapers: The New York Times (1851-2010). The relation to the election is clear: “Philadelphia, Nov. 9—Heavy deposits of gold have been made in this city the last few days . . . . Most of the gold recently deposited was withdrawn and hoarded to await the outcome of the election.”

26 The text reads: “FREE SILVER SCARE. Prevents SALE of New York City and Brooklyn City BONDS. 65 other MUNICIPALITIES had the same experience. BANKS and BUSINESS HOUSES CLOSING. RAILROADS and BUSINESS HOUSES CLOSING. RAILROADS have ABANDONED PROJECTED IMPROVEMENTS. FACTORIES and MANUFACTURERS all over the country CLOSE their DOORS. COKE OVENS, SILK MILLS, and ROLLING MILLS CLOSE DOWN. Thousands thrown out of employment. Workman—‘If the cry of free silver will cause that, what would not free silver itself do?’


28 “Prosperity’s Return to California,” The San Francisco Chronicle, Nov. 10, 1896, p. 9; in ProQuest Historical Newspapers: San Francisco Chronicle (1865-1922). The Chronicle interviewed Henry Wadsworth, cashier of Wells,
No other factors were important during the period from the last call date before the election (October 6) to the first call date after (December 17). While there seems to have been a minor financial disturbance in October 1896, Calomiris and Gorton (1991, p. 114) leave it as a question whether it is actually a panic and Wicker (2000, p. xii) dismisses it, noting that it was not a banking panic and was entirely confined to Chicago and Minneapolis-St. Paul. In any case, increasing stringency for banks is consistent with our interpretation of the potential for devaluation.

The first major gold shipments from the Klondike and surrounding areas arrived in July 16, 1897 and that is the generally accepted date when the world outside of Alaska learned of the rich deposits there (Wharton, 1979, p. 86). News had seeped out earlier about a new find of gold as some of the prospectors corresponded with family or returned from Alaska. While the first public mention of a new find on the “Cloldyke” seems to have appeared in October 1896 in the San Francisco Chronicle, it was important only in retrospect. That announcement would hardly have stood out as particularly important at the time. It had been well known that there was gold in Alaska for a number of years, with the first rich strike in 1880 (Wharton, 1979, p. 3). In the summer of 1895 a number of reports of rich gold finds seem even more promising than the “Cloldyke” find. Against a backdrop of continuing gold discoveries, no news of particular import occurred around the election.

The production of agricultural commodities in 1896 was generally larger than in 1895 (Olm-
stead and Rhode, 2006a,b), so there does not appear to be any evidence of an agricultural fall. In any case, knowledge about the harvest for most crops would have already arrived by the election, so there could not have been a large change in expectations or information.

B The Banking Model

Following the model introduced in section 3, this section develops the conclusions of the model formally. There are two periods, \{1, 2\}, and two assets, gold and dollar \{G, B\}. Gold assets pay an exogenous rate of return \( R^G \). Dollar assets are issued by the government in period 1 and exchanged for goods against a promise for repayment in period 2. We assume that the government issues a fixed dollar face value \( B \) of this asset. This reflects the slow moving nature of the stock of nominal government debt. In fact, in the context of the time, most nominal bond issues required authorization of congress. The prospect of abandonment of the gold standard changes the real face value of government debt. In the status quo in which the U.S. remains in the gold standard, the real face value of debt is also equal to \( B \). In the event of an exit from the gold standard, a dollar will afford fewer goods, so that the real face value of debt is equal to \( qD \), with \( q < 1 \). In period 1, the government sells its debt for \( \frac{B}{R^B} \) units of gold. Thus, \( R^B \) is the dollar return on dollar assets, and the expected real return is equal to \( E[q] R^B \).

In each state (indexed \( s \)) there is a representative bank that behaves competitively. The bank is endowed with equity \( E_s \) and takes deposits \( D_s \) from individuals, offering them a dollar deposit rate \( R^D \). We assume that banks can only purchase dollar assets. This is an extreme assumption that simplifies the exposition. We can relax it so long as (i) at the margin, return on bank assets vary with the return on dollar bonds, and (ii) so long as this dependence is relatively stable across states. Hence, for example, an extension of the model where banks face decreasing returns in the issuance of loans or the purchase of foreign assets but not in the purchase of domestic assets would imply identical results. Competitive behavior by banks implies that interest rates on deposits are identical to the returns on dollar assets: \( R^B = R^D \).
In the model, each state is populated by a measure 1 of prospective depositors indexed $i_s \in [0, 1]$, each endowed with $x_s$ units of a consumption good in $t = 1$, and with an investment opportunity. Individuals can invest in either dollar denominated bonds, with nominal rate of return $R^D$ dollars for each dollar invested, or in gold denominated bonds, with real rate of return $R^G$ units of gold for each dollar invested. Each individual faces a transaction cost of $1 - \tau^B (i_s)$ per unit invested in dollar denominated assets and $1 - \tau^G (i_s)$ in gold assets. Individuals also have the option to deposit their goods with the bank, at a cost $1 - \tau^D (i_s)$ per unit deposited. The transaction cost implies that, after paying the cost, a fraction $\tau^G (i_s)$ of the asset is left. Depositors only consume in period 2 so they invest their endowments fully and have risk neutral utility functions and so maximize returns. For analytical convenience, we assume that in each given state $s$ a fraction $\xi_s$ of individuals (indexed $i_s \in [1, \xi_s]$) can only invest in gold denominated assets (so that $\tau^B (i_n) = 0$ for $i_s \in [0, \xi_s]$) and the remaining can only invest in dollar denominated assets (so that $\tau^G (i_n) = 0$ for $i_n \in [\xi_n, 1]$). We also assume that individual values for $\tau^B (i)$ for agents with dollar denominated investment opportunities and $\tau^G (i)$ for agents with gold denominated opportunities are independent and identically distributed draws from the continuous and differentiable cumulative distribution function $H(\cdot)$.

Agent $i_s$ invests in dollar denominated bonds if:

$$\tau^B (i) E[q] R^B \geq \max \{ \tau^D (i) E[q] R^D, \tau^G (i) R^G \}.$$ 

Analogously, she invests in gold denominated bonds if:

$$\tau^G (i) R^G \geq \max \{ \tau^D (i) E[q] R^D, \tau^B (i) E[q] R^B \}.$$ 

Finally, she acquires deposits with the bank if:

$$\tau^D (i) E[q] R^D \geq \max \{ \tau^G (i) R^G, \tau^B (i) E[q] R^B \}.$$ 

---

30In reality a large fraction of government bonds were held by banks who then used them to back the issuance of bank notes. So we can alternatively interpret household holdings of government bonds as holdings of bank notes.
For given interest rates $R^G$, $R^D$ and $R^B$ the demand for deposits with banks is:

$$D_s = \xi_s H \left( \frac{E [q] R^D}{R^G} \right) x_s + (1 - \xi_s) H \left( \frac{R^D}{R^B} \right) x_s,$$

which, given that in any equilibrium in which deposits are large enough that banks will wish to hold some bonds $R^D = R^B$, we have that:

$$D_s = \xi_s H \left( \frac{E [q] R^B}{R^G} \right) x_s + (1 - \xi_s) H (1) x_s. \quad (1)$$

To close the model, we need to pin down the interest rate differential $\frac{E [q] R^B}{R^G}$. For that purpose, we assume that $R^G$ is pinned exogenously in the international money market. At the same time, in the first period the government issues an amount of the dollar denominated debt $B$ whose face value is pre-determined. It exchanges for the goods held by households, which it then consumes. The government pays the debt through lump-sum taxation of households in the final period. The equilibrium condition in the debt market is:

$$B = \sum_{s=1}^{S} B^I_s + \sum_{s=1}^{S} B^B_s,$$

where $B^I_n$ is dollar denominated debt held directly by individuals in state $n$, which is equal to $(1 - \xi_s) (1 - H (1)) x_s$, and $B^B_s$ is the amount held by banks in that state, given by:

$$B^B_s = E_s + D_s$$

It follows that:

$$\frac{B}{R^B} = \sum_{s=1}^{S} \left[ E_s + (1 - \xi_s) x_s + \xi_s H \left( \frac{E [q] R^B}{R^G} \right) x_s \right].$$

Applying the implicit function theorem, we can check that $F = \frac{E [q] R^B}{R^G}$ increases as $E [q]$ increases. As the probability of devaluation declines (which is equivalent to an increase in $E [q]$), the rate of return on dollar denominated bonds has to fall in order for the gold rate of return to
remain constant. However, a fall in the rate of return on dollars implies an increase in the price of dollar denominated debt. It follows that the return differential \( F = \frac{E[q] R^B}{R^G} \) has to increase in order to attract a larger number buyers.

Finally, differentiating equation 1 it follows that

\[
\frac{\partial D_s}{\partial E[q]} = \xi_s H'(F) x_s \frac{\partial F}{\partial E[q]} > 0,
\]

and

\[
\frac{\partial D_s}{\partial E[q] \partial \xi_s} = H'(F) x_s \frac{\partial F}{\partial E[q]} > 0
\]

Thus deposits held by banks increase with the expected face value of dollar denominated assets, and is more sensitive the higher the share of individuals with alternative investments denominated in gold in the state, \( \xi_s \). Defining the debt-to-assets ratio \( L_s = \frac{D_s}{D_s + E_s} \), the same comparative statics hold normalizing by bank size: \( \frac{\partial L_s}{\partial E[q]} > 0 \) and \( \frac{\partial L_s}{\partial E[q] \partial \xi_s} \).

Note that we can alternatively write the domestic bond market equilibrium as:

\[
\frac{E[q] B}{R^G} = \frac{E[q] R^B}{R^G} \sum_{s=1}^{S} [E_s + (1 - \xi_s + \xi_s H(F)) x_s],
\]

so that, given endowments \( \{x_s, E_s\}_{s=1}^{S} \) and the parameters \( \{\xi_s\}_{s=1}^{S} \), the real supply of dollar assets in the economy \( \frac{E[q] B}{R^G} \) is a sufficient statistic for the determination of relative real returns \( \frac{E[q] R^B}{R^G} \).

Thus, changes in \( R^G \) and \( B \) have similar impact on bank deposits as changes in \( E[q] \).

**C Narrative Factor Identification: Proofs**

The proofs take as given that the sample moments are consistent estimators of the population moments, and that the data is large enough that they have converged.

**Proof of Proposition 1**

The proof follows from direct calculation. In particular, note that
Given Assumption 1, all the terms with \( r' \neq 1 \) drop out, so that

\[
\text{cov} (\bar{x}_{t^*}, \bar{x}_t) = \sum_{r=1}^{R} \sum_{r'=1}^{R} \text{cov} (\lambda_{i,r}, \lambda_{i,r'}) F_{r',t^*} F_{r,t}
\]

Given Assumption 2, all the terms with \( r \neq 1 \) also drop out, so that

\[
\text{cov} (\bar{x}_{t^*}, \bar{x}_t) = \sum_{r=1}^{R} \text{cov} (\lambda_{i,r}, \lambda_{i,r'}) F_{1,t^*} F_{r,t}
\]

Finally, note that, from the particular case with \( t = t^* \) we get \( \text{var} (\bar{x}_{t^*}) \),

\[
\text{var} (\bar{x}_{t^*}) = \text{cov} (\bar{x}_{t^*}, \bar{x}_t) = \text{var} (\lambda_{i,1}) F_{1,t^*}^2
\]

It follows that

\[
\frac{\text{cov} (\bar{x}_{t^*}, \bar{x}_t)}{\text{var} (\bar{x}_{t^*})} = \frac{F_{1,t}}{F_{1,t^*}}
\]

**Proof of Proposition 2**

We can similarly prove proposition 2 from direct calculations following similar steps. The algebra is tedious, but straightforward.
Table 1: The Credibility Index - Robustness

<table>
<thead>
<tr>
<th>Factor Version</th>
<th>Correlation with baseline std( &gt; 1900)/std(&lt; 1900)</th>
<th>Change 1890/5 - 1891/7</th>
<th>Change 1896/10 - 1896/12</th>
<th>Change 1893/5 - 1893/7</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 factors</td>
<td>(1,1) (0.242,0.281)</td>
<td>(-1.9,-1.37)</td>
<td>(2.73,3.29)</td>
<td>(-2.21,-1.68)</td>
</tr>
<tr>
<td></td>
<td>(0.904,0.993) (0.268,0.374)</td>
<td>(-2.49,-1.72)</td>
<td>(2.72,3.96)</td>
<td>(-2.95,-2.01)</td>
</tr>
<tr>
<td>20 factors</td>
<td>0.994 0.28</td>
<td>-2.16</td>
<td>3.46</td>
<td>-2.54</td>
</tr>
<tr>
<td></td>
<td>(0.988,0.996) (0.232,0.263)</td>
<td>(-1.83,-1.57)</td>
<td>(2.71,2.97)</td>
<td>(-1.92,-1.7)</td>
</tr>
<tr>
<td>Dec-07</td>
<td>0.987 0.286</td>
<td>-1.39</td>
<td>2.79</td>
<td>-1.77</td>
</tr>
<tr>
<td></td>
<td>(0.942,0.999) (0.254,0.35)</td>
<td>(-1.79,-1.14)</td>
<td>(2.54,3.03)</td>
<td>(-1.96,-1.58)</td>
</tr>
<tr>
<td>Dec-88</td>
<td>0.988 0.231</td>
<td>-1.77</td>
<td>3.39</td>
<td>-2.11</td>
</tr>
<tr>
<td></td>
<td>(0.975,0.995) (0.226,0.267)</td>
<td>(-1.99,-1.35)</td>
<td>(2.91,3.56)</td>
<td>(-2.27,-1.78)</td>
</tr>
<tr>
<td>Dec-00</td>
<td>0.994 0.225</td>
<td>-1.87</td>
<td>3.32</td>
<td>-2.1</td>
</tr>
<tr>
<td></td>
<td>(0.981,1) (0.218,0.273)</td>
<td>(-2.13,-1.54)</td>
<td>(2.88,3.5)</td>
<td>(-2.28,-1.79)</td>
</tr>
<tr>
<td>Aug-05</td>
<td>0.912 0.255</td>
<td>-2.01</td>
<td>3.33</td>
<td>-1.86</td>
</tr>
<tr>
<td></td>
<td>(0.861,0.957) (0.239,0.314)</td>
<td>(-2.47,-1.51)</td>
<td>(2.95,3.66)</td>
<td>(-2.22,-1.66)</td>
</tr>
<tr>
<td></td>
<td>0.984 0.256</td>
<td>-1.5</td>
<td>3.1</td>
<td>-1.86</td>
</tr>
<tr>
<td></td>
<td>(0.946,0.991) (0.236,0.308)</td>
<td>(-1.91,-1.21)</td>
<td>(2.84,3.38)</td>
<td>(-2.15,-1.6)</td>
</tr>
<tr>
<td>Dec-1907 (window)</td>
<td>0.973 0.273</td>
<td>-1.51</td>
<td>2.94</td>
<td>-1.83</td>
</tr>
<tr>
<td></td>
<td>(0.807,0.98) (0.257,0.378)</td>
<td>(-2.19,-1.1)</td>
<td>(2.28,3.2)</td>
<td>(-2.2,-1.54)</td>
</tr>
<tr>
<td>Aug-05 (window)</td>
<td>0.882 0.259</td>
<td>-2.09</td>
<td>3.22</td>
<td>-1.91</td>
</tr>
<tr>
<td></td>
<td>(0.795,0.945) (0.224,0.353)</td>
<td>(-3.2,-1.67)</td>
<td>(2.72,3.65)</td>
<td>(-2.4,-1.64)</td>
</tr>
</tbody>
</table>

Notes: 90% confidence intervals in parentheses calculated using bootstrapping.
Table 2: Macroeconomic implications based on a fixed factor

<table>
<thead>
<tr>
<th>Real Activity Measure</th>
<th>Speed of response of economic var.</th>
<th>Rel. vol. (&lt;1900)</th>
<th>Rel. vol. (&gt;1900)</th>
<th>Total change Mar - Oct 1893</th>
<th>Change full commitment</th>
</tr>
</thead>
<tbody>
<tr>
<td>business failures</td>
<td>fast</td>
<td>0.807</td>
<td>1.01</td>
<td>1.01</td>
<td>0.307</td>
</tr>
<tr>
<td></td>
<td>slow</td>
<td>0.903</td>
<td>1.02</td>
<td>1.01</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.791,0.863)</td>
<td>(0.959,1.11)</td>
<td>(0.21,0.406)</td>
<td>(0.308,0.693)</td>
</tr>
<tr>
<td>pig iron</td>
<td>fast</td>
<td>0.856</td>
<td>0.966</td>
<td>-0.578</td>
<td>-0.329</td>
</tr>
<tr>
<td></td>
<td>slow</td>
<td>0.907</td>
<td>0.967</td>
<td>-0.578</td>
<td>-0.445</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.834,0.92)</td>
<td>(0.948,1.03)</td>
<td>(-0.366,-0.286)</td>
<td>(-0.479,-0.406)</td>
</tr>
<tr>
<td>factory employment</td>
<td>fast</td>
<td>0.833</td>
<td>0.98</td>
<td>-0.155</td>
<td>-0.0616</td>
</tr>
<tr>
<td></td>
<td>slow</td>
<td>0.86</td>
<td>0.994</td>
<td>-0.155</td>
<td>-0.0938</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.812,0.9)</td>
<td>(0.961,1.06)</td>
<td>(-0.0746,-0.0482)</td>
<td>(-0.108,-0.0767)</td>
</tr>
<tr>
<td>industrial production</td>
<td>fast</td>
<td>0.971</td>
<td>0.976</td>
<td>-0.196</td>
<td>-0.0581</td>
</tr>
<tr>
<td></td>
<td>slow</td>
<td>0.969</td>
<td>0.988</td>
<td>-0.196</td>
<td>-0.0893</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.912,1.09)</td>
<td>(0.959,1.05)</td>
<td>(-0.0851,-0.0336)</td>
<td>(-0.118,-0.0631)</td>
</tr>
</tbody>
</table>

Notes: 90% Confidence intervals calculated using bootstrapping.
### Table 3: Macroeconomic implications based on a fixed factor and post 1900 VAR

<table>
<thead>
<tr>
<th>Real Activity Measure</th>
<th>Speed of response of economic var.</th>
<th>Rel. vol. (&lt;1900)</th>
<th>Rel. vol. (&gt;1900)</th>
<th>Total change Mar - Oct 1893</th>
<th>Change full commitment</th>
</tr>
</thead>
<tbody>
<tr>
<td>business failures</td>
<td>fast</td>
<td>0.84</td>
<td>1.24</td>
<td>1.01</td>
<td>0.27</td>
</tr>
<tr>
<td></td>
<td>slow</td>
<td>0.94</td>
<td>1.32</td>
<td>1.01</td>
<td>0.36</td>
</tr>
<tr>
<td>pig iron</td>
<td>fast</td>
<td>0.84</td>
<td>0.96</td>
<td>-0.58</td>
<td>(-0.31)</td>
</tr>
<tr>
<td></td>
<td>slow</td>
<td>0.89</td>
<td>0.96</td>
<td>-0.58</td>
<td>(-0.42)</td>
</tr>
<tr>
<td>factory employment</td>
<td>fast</td>
<td>0.82</td>
<td>1.06</td>
<td>-0.16</td>
<td>(-0.05)</td>
</tr>
<tr>
<td></td>
<td>slow</td>
<td>0.86</td>
<td>1.06</td>
<td>-0.16</td>
<td>(-0.08)</td>
</tr>
<tr>
<td>industrial production</td>
<td>fast</td>
<td>0.87</td>
<td>1.03</td>
<td>-0.20</td>
<td>(-0.04)</td>
</tr>
<tr>
<td></td>
<td>slow</td>
<td>0.88</td>
<td>1.04</td>
<td>-0.20</td>
<td>(-0.08)</td>
</tr>
</tbody>
</table>

Notes: 90% Confidence intervals calculated using bootstrapping.

### Table 4: Macroeconomic implications based on post 1900 Choleski

<table>
<thead>
<tr>
<th>Real Activity Measure</th>
<th>Speed of response of economic var.</th>
<th>Rel. vol. (&lt;1900)</th>
<th>Rel. vol. (&gt;1900)</th>
<th>Total change Mar - Oct 1893</th>
<th>Change full commitment</th>
</tr>
</thead>
<tbody>
<tr>
<td>business failures</td>
<td>fast</td>
<td>0.90</td>
<td>1.00</td>
<td>1.01</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>slow</td>
<td>0.89</td>
<td>1.00</td>
<td>1.01</td>
<td>0.70</td>
</tr>
<tr>
<td>pig iron</td>
<td>fast</td>
<td>1.19</td>
<td>1.00</td>
<td>-0.58</td>
<td>(-0.50)</td>
</tr>
<tr>
<td></td>
<td>slow</td>
<td>1.19</td>
<td>1.00</td>
<td>-0.58</td>
<td>(-0.56)</td>
</tr>
<tr>
<td>factory employment</td>
<td>fast</td>
<td>1.33</td>
<td>1.00</td>
<td>-0.16</td>
<td>(-0.15)</td>
</tr>
<tr>
<td></td>
<td>slow</td>
<td>1.33</td>
<td>1.00</td>
<td>-0.16</td>
<td>(-0.16)</td>
</tr>
<tr>
<td>industrial production</td>
<td>fast</td>
<td>1.15</td>
<td>1.00</td>
<td>-0.20</td>
<td>(-0.13)</td>
</tr>
<tr>
<td></td>
<td>slow</td>
<td>1.15</td>
<td>1.00</td>
<td>-0.20</td>
<td>(-0.14)</td>
</tr>
</tbody>
</table>

Notes: 90% Confidence intervals calculated using bootstrapping.
<table>
<thead>
<tr>
<th>Real Activity Measure</th>
<th>Speed of response of economic var.</th>
<th>Rel. vol. (&lt;1900)</th>
<th>Rel. vol. (&gt;1900)</th>
<th>Total change Mar - Oct 1893</th>
<th>Change full commitment</th>
</tr>
</thead>
<tbody>
<tr>
<td>business failures</td>
<td>fast</td>
<td>0.86 (0.839,0.939)</td>
<td>1.00 (0.996,1.01)</td>
<td>1.01 (0.511,0.848)</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td>slow</td>
<td>0.90 (0.883,0.959)</td>
<td>1.00 (0.995,1.01)</td>
<td>1.01 (0.560,0.884)</td>
<td>0.71</td>
</tr>
<tr>
<td>pig iron</td>
<td>fast</td>
<td>0.88 (0.877,0.948)</td>
<td>1.00 (0.991,1)</td>
<td>-0.58 (-0.494,-0.333)</td>
<td>-0.41</td>
</tr>
<tr>
<td></td>
<td>slow</td>
<td>0.93 (0.921,0.991)</td>
<td>1.00 (0.991,1)</td>
<td>-0.58 (-0.546,-0.421)</td>
<td>-0.48</td>
</tr>
<tr>
<td>factory employment</td>
<td>fast</td>
<td>0.90 (0.876,1.07)</td>
<td>1.00 (0.998,1)</td>
<td>-0.16 (-0.152,-0.0779)</td>
<td>-0.11</td>
</tr>
<tr>
<td></td>
<td>slow</td>
<td>0.89 (0.878,1.03)</td>
<td>1.00 (0.999,1)</td>
<td>-0.16 (-0.144,-0.0783)</td>
<td>-0.11</td>
</tr>
<tr>
<td>industrial production</td>
<td>fast</td>
<td>0.97 (0.961,1.01)</td>
<td>1.00 (0.992,1)</td>
<td>-0.20 (-0.179,-0.0548)</td>
<td>-0.12</td>
</tr>
<tr>
<td></td>
<td>slow</td>
<td>0.97 (0.964,1.01)</td>
<td>1.00 (0.992,1)</td>
<td>-0.20 (-0.171,-0.0617)</td>
<td>-0.12</td>
</tr>
</tbody>
</table>

Notes: 90% Confidence intervals calculated using bootstrapping.
Figure 1: National Bank Leverage

Figure 2: The costs of “free silver”

Figure 3: Changes in bank deposits in gold states around the 1896 election

Figure 4: Leverage and specie holding around 1896

Change in log debt/assets from previous call date

Dates surrounding Nov 1896 defeat of Bryan

Source: National bank assets are based on Weber (2000) and author calculations.
Figure 5: The Relative return index, the gold premium, and gold in Treasury

Source: y-o-y refers to the correlation between year-on-year changes. The gold premium axis is flipped and is calculated from National Monetary Commission (1910, pp. 188-208) following Calomiris (1992). It is the difference between the exchange in New York for Sterling immediately and in 60 days. Gold in Treasury is from the Annual Report of the Secretary of the Treasury in 1900 and 1908. Shaded area shows two standard deviations of the changes in the relative return index.