

Deep Recessions, Fast Recoveries, and Financial Crises: Evidence from the American Record

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Do steep recoveries follow deep recessions? Does it matter if a credit crunch or banking panic accompanies the recession? Moreover does it matter if the recession is associated with a housing bust? We look at the American historical experience in an attempt to answer these questions. The answers depend on the definition of a financial crisis and on how much of the recovery is considered. But in general recessions associated with financial crises are generally followed by rapid recoveries. We find three exceptions to this pattern: the recovery from the Great Contraction in the 1930s; the recovery after the recession of the early 1990s, and the present recovery. The present recovery is strikingly more tepid than the 1990s. One factor we consider that may explain some of the slowness of this recovery is the moribund nature of residential investment, a variable that is usually a key predictor of recessions and recoveries.

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I. Introduction

The recovery from the recent recession has now been proceeding for over six years. Many argue that this recovery is unusually sluggish and that this reflects the severity of the financial crisis of 2007-2008 (Roubini 2009; Reinhart and Rogoff 2009). Yet if this is the case, it seems to fly in the face of the record of U.S. business cycles in the past century and a half. Indeed, Milton Friedman noted as far back as 1964 that in the American historical record “A large contraction in output tends to be followed on the average by a large business expansion; a mild contraction, by a mild expansion.” (Friedman 1969, p. 273). Much work since then has confirmed this stylized fact but has also begun to make distinctions between cycles, particularly between those that include a financial crisis. Zarnowitz (1992) documented that pre-World War II recessions accompanied by banking panics tended to be more severe than average recessions and that they tended to be followed by rapid recoveries.

In this paper we revisit the issue of whether business cycles with financial crises are different. We use the evidence we gather to shed some light on the recent recovery. A full exploration of this question benefits from an historical perspective, not only to provide a statistically valid number of crises but also to gain perspective from the differing regulatory and monetary regimes in place. We restrict ourselves to the U.S., where we have a better grasp and can take a closer focus on the monetary regimes and institutional

environment. This also avoids comparability problems with other countries, which often have very different stochastic structures of output (Cogley 1990), but of course this means that our data contains many fewer crises and business cycles than is the case with studies based on multicountry panels. We look at 27 cycles starting in 1882 and use several measures of financial crises. We compare the change in real output (real GDP) over the contraction with the growth in real output in the recovery, and test for differences between cycles with and without a financial crisis. We check for robustness to various definitions of financial crises, output, and business cycles. Finally, we introduce residential investment as a possible explanation for a slow recovery after a recession that involves a housing bust, as the U.S. is currently experiencing.

Our analysis of the data shows that steep expansions tend to follow deep contractions, though this depends heavily on how the recovery is measured. In contrast to much conventional wisdom, the stylized fact that deep contractions breed strong recoveries is particularly true when there is a financial crisis. In fact, on average, it is cycles without a financial crisis that show the weakest relation between contraction depth and recovery strength. This is our key finding. For many configurations, the evidence for a robust bounce-back is stronger for cycles with financial crises than those without. The results depend somewhat on the time period, with cycles before the Federal Reserve looking different from cycles after the Second World War. Our results also suggest that a sizeable fraction of the shortfall of the present recovery from the average experience of recoveries after deep recessions is due to the collapse of residential investment.

Until quite recently, the extensive literature on business cycle dynamics rarely combined a long data series with a focus on financial crises. Friedman (1969, 1993) has a long series but does not consider the effect of financial crises, in addition to using data and empirical techniques that are somewhat different than ours. In contrast to most subsequent work, Friedman looks at growth over the entire expansion. Wynne and Balke (1992, 1993) include only cycles since 1919 and do not consider the effect of financial crises. They measure growth 4 quarters into the expansion. Kahn and Rich (2007) have a neoclassical growth model with regime shifts in permanent and transitory components, but their focus is on identifying post-WWII productivity trends, not business cycles or financial crises. Among more recent papers, the first major split is between papers like ours that focus on one country, and those that use international data. Lopez-Salido and Nelson (2010) explicitly look at the connection between financial crises and recovery strength but look only at post-World War II cycles in the U.S. Bordo and Haubrich (2010) find that contractions associated with a financial crisis tend to be more severe but do not gauge the speed of the resulting recovery. Stock and Watson (2012) use a 198-variable dynamic factor model on data since the Second World War, attributing recent slow recoveries to demographic factors in the labor market. Gali, Smets, and Wouters (2012) estimate a structural new Keynesian model and attribute the current slow recovery to adverse demand shocks stemming from the zero lower bound and wage markups. Hall (2011) defines a related concept of slump, when employment is below 95.5 percent of the labor force. On the international side, Howard, Martin, and Wilson (2011) look at the relationship between recoveries and crises

for 59 countries since 1970 and reach conclusions similar to ours. Benati (2012), in a paper that originated as a conference discussion of our paper, looks at impulse response functions for five countries and the euro area since 1970 and does not find different dynamics after crises. A recent paper by Romer and Romer (2014) looks at the impact of financial distress on advanced countries in the post-World War II period and find results similar to ours.

The second major split is over the definition of recovery. Most of the literature follows Friedman and considers a recovery or expansion as starting at the cyclical trough. Several important papers, however, measure a recovery from peak to peak, that is, how long it takes the economy to return to the cyclical peak. These are important differences, and seemingly divergent results often stem from differing formulations of the question. Reinhart and Rogoff (2008, 2009) concentrate on major international financial crises and document long and severe recessions but make few direct comparisons of the recovery speed with noncrisis cycles. They also measure speed by how long it takes to get back to the previous business cycle peak and not how fast the economy grows once the recovery has started. Jordà, Schularick, and Taylor (2011) find slow growth after a credit boom but say little about the patterns after a recovery has started, again making peak-to-peak comparisons. Cerra and Saxena (2008) look at data for 190 countries and find that output losses in disasters are in general not recovered, in the sense of returning to the pre-crisis trend line. Gourio (2008) finds strong recoveries after disasters, in the sense of exceptionally high growth rates.

The remainder of the paper is as follows. Section 2 presents an historical narrative on U.S. recoveries. Section 3 examines the amplitude, duration, and shape of business cycles since 1882, testing whether strong recoveries follow deep contractions, and whether financial crises alter that pattern. Section 4 examines the connection between weak recoveries and slow residential investment. It incorporates the long-standing importance of housing in the transmission mechanism. Section 5 concludes.

II. Narrative

The relation between a contraction, a recovery, and an associated financial crisis can in principle depend on the monetary regime, banking system, and macroeconomic environment. To provide some context for the econometric results, and offer some justification (and skepticism) for treating over a century of business cycles in a coherent fashion, we present some descriptive evidence and historical narratives on U.S. business cycle recoveries from 1880 to the present. For example, financial crises before the advent of the FDIC in 1934 were banking panics reflecting a scramble for liquidity, fast-moving events that lasted at most a matter of months. Since 1934, financial crises have been mostly insolvency events not liquidity events, resolved by fiscal rescues by the FDIC and Treasury. They often lasted for years. We do not aim to establish causality, particularly about the extent to which contractions and crises influence each other, but rather to foster a broader appreciation of the idiosyncracies of the timing, policy, and environment that surround each cycle and crisis. At some level, even very basic questions about cycles and output remain unresolved: Cole and Ohanian (2004) start out their paper with “The recovery from the Great Depression was weak,” while Friedman and Schwartz (1963, p. 493) insist that “severe contractions

tend to be succeeded by vigorous rebounds. The 1929-1933 contraction was no exception.”

Table 1 shows some metrics on the salient characteristics of the recessions and recoveries. Columns 1 and 2 report the date of the cyclical peak and trough, as determined by the NBER. Column 3 lists the date of the onset of the financial crisis, if any, associated with the cycle. Column 4 shows the total change (usually a drop) in GDP during the contraction, and column 5 shows the total change (usually an increase) during the recovery going out the same number of quarters as the contraction lasted (so if the contraction lasted five quarters, five quarters of the recovery will be counted). Columns 6 and 7 show the percentage changes.

A. 1880-1920: The Pre-Federal Reserve Period

During this era the U.S. was on the gold standard and did not have a central bank. The NBER demarcates 11 business cycles, of which two, 1893(I) to 1894(II) and 1907(II) to 1908(II), had major recessions. There were also 4 banking panics and 6 stock market crashes. Most of the recessions were followed by recoveries at least as rapid as the downturns with the exception of the cycle following World War I. Foreign shocks were particularly prominent in the pre-WW I era, e.g., Bank of England tightening, European banking instability, the state of harvests in the U.S. relative to Europe, and foreign investment in railroads. Fels (1959) and Friedman and Schwartz (1963) have useful narratives of business cycles in this era.

The recession of 1882-85 featured a banking panic in May 1884 following the collapse of the brokerage firm, Grant and Ward, and a stock market crash (Wicker 2000, p. 35). The banking panic ended with the issuance of clearinghouse loan certificates and U.S. Treasury quasicentral banking operations. The recovery of 1885(II) to 1887(II) was driven by capital and gold inflows. The recovery was interrupted by a brief one-year mild contraction.

The recovery from 1888(I) to 1890(III) was driven by good harvests in the U.S. and bad ones in Europe (Fels 1959). Two big shocks ended the recovery: the passage of the Sherman Silver Purchase Act in July 1890, which led to serious capital flight based on fears that the U.S. would be forced off gold; and the November 1890 Baring crisis in London, which led to a sudden stop of capital flows to all emerging markets, including the U.S. These events culminated in a banking panic in New York in November, which was ended by the issuance of clearinghouse loan certificates (Wicker 2000, chapter 3). The recession ended in May 1891 and recovery from 1891(II) to 1893(I) was fostered by a series of good U.S. harvests, which generated gold inflows.

The decade of the 1890s was shadowed by silver uncertainty and falling global gold prices, which produced persistent deflationary pressure. The recovery ended early in the first quarter of 1893. A stock market crash on May 3 was followed by a banking panic which spread from New York to the interior and back. The panic, which ran in waves from May to July led to many bank failures across the country (Friedman and Schwartz 1963 chapter 3; Wicker 2000, chapter 4). The resulting monetary contraction contributed to a serious recession. The issuance of clearinghouse loan certificates and the suspension of convertibility of deposits into currency eventually ended the panic by the fall of 1893.

The subsequent recovery from 1894(II) to 1895(III) was aided by the Belmont Morgan syndicate, which was created in early 1895 to rescue the U.S. Treasury's gold reserves from a silver-induced run. Silver uncertainty contributed to capital flight and led to another recession from late 1895 to 1897. The election of 1896 was fought over the issue of free silver, and once the silver advocate William Jennings Bryan was defeated, the pressure eased.

The recovery from 1897(II) to 1899(II) began a long boom interrupted by a few minor recessions. The key drivers of the boom were important gold discoveries in Alaska and South Africa which increased the global monetary gold stock and ended the Great Deflation of the late nineteenth century. Increased gold output stimulated the real economy. A very mild recession in 1899-1900, associated with the outbreak of the Boer War, interrupted the expansion. Gold inflows and good harvests drove the recovery from 1900(I) to 1902(IV), which ended with the "rich man's panic" of 1902 and a mild recession from 1902 to 1904. The following recovery from 1904(II) to 1907(IV) was driven by heavy capital inflows from London, in part reflecting insurance claims resulting from the San Francisco earthquake (Odell and Weidenmier 2004). The Bank of England reacted to declining gold reserves by raising its discount rate and rationed lending based on U.S. securities. This created a serious shock to U.S. financial markets, triggering a stock market crash and a major banking panic in October 1907. The banking panic led to many bank failures, a steep drop in the money supply, and a serious recession, which ended in May 1908. The panic and recession of 1907-08 led to the monetary reform that created the Federal Reserve in 1913.

The recession of 1907-1908 was followed by a vigorous recovery from 1908(II) to 1910(I). Friedman and Schwartz attribute this to gold inflows reflecting a decline in U.S. prices relative to those in Britain stemming from the crisis. A mild recession from 1910 to 1912 triggered by capital outflows was followed by a brief recovery in 1912-1913. The onset of World War I in 1914 led to a recession and a banking crisis. The recession was then followed by a major boom, driven by the demand for U.S. goods by the European belligerents and then by the U.S. as it prepared for war.

The wartime recovery ended with a recession from 1918(III) to 1919(I), following the cessation of hostilities and the conversion from war to peace. The vigorous recovery thereafter involved a major restocking boom and rapid commodity inflation in the U.S. The Federal Reserve, which had opened its doors in 1914 and had become an engine of inflation subservient to the Treasury, was reluctant to raise its discount rate to fight inflation in 1919 because of concern over the balance sheets of member banks that had absorbed Liberty Bonds at high prices (Meltzer 2003, chapter 3). In the face of a declining gold reserve, the Fed reluctantly tightened sharply at the end of 1919 prior to a serious recession in 1920.

B. The Interwar Period: 1920-1945

The Federal Reserve was established in 1914 in part to solve the problem of the absence of a lender of last resort in the crises of the pre-1914 national banking era. In the Fed's first 25 years there were three very severe business cycle downturns and several minor cycles. In addition to exogenous shocks such as wars, Fed policy actions were key in both

precipitating and mitigating cycles. Most of the recoveries in this period were at least as rapid as the downturns that preceded them with one important exception: the recovery from the Great Contraction of 1929 to 1933.

Recovery 1921(III) to 1923(II): The recession that followed Fed tightening in December 1920 was severe but short: industrial production fell 23%, wholesale prices fell 37%, and unemployment increased from 4% to 12%. No banking panic occurred but the stock market crashed in the fall of 1920¹. In the face of mounting political pressure the Fed reversed course in November 1920 and the real economy began recovering in August 1921. By March 1922 industrial production had increased 20% above the previous year's level.

Recoveries 1924(II) - 1926(III) and 1927(IV) - 1929(III): Two mild recessions in the mid-1920s reflected Fed preemptory tightening in the face of incipient inflation. In each case the recessions were followed by healthy recoveries. There were no banking crises or stock market crashes in these episodes, but there was a housing bust in 1926 (White 2010).

Recovery 1933(I) - 1937(II): The Fed tightened beginning in late 1926 to stem the stock market boom that had begun that year. This tightening led to a recession in August 1929 and a major stock market crash in October. A series of banking panics beginning in October 1930 ensued. The Fed did little to offset them, turning a recession into the Great Contraction. The recovery began after Roosevelt's inauguration in March 1933 with the Banking Holiday. Other key events in spurring recoveries included the U.S. leaving the gold standard in April, gold and silver purchases by the Treasury, and the devaluation of the dollar by close to 60% in January 1934. These policies produced a big reflationary impulse from gold inflows, which were unsterilized and so passed directly into the money supply. They also helped convert deflationary expectations into inflationary ones (Eggertsson 2008). Expansionary monetary policy largely explains the rapid growth from 1933 to 1937 (Romer 1992). The recovery, although rapid (output grew by 33%), was not sufficient to completely reverse the preceding downturn. The recovery may have been impeded somewhat by New Deal cartelization policies like the National Industrial Recovery Act, which, in an attempt to raise wages and prices, artificially reduced labor supply and aggregate supply (Cole and Ohanian 2004).

Recovery 1938(II) - 1945(I): The 1937-38 recession, which cut short the rapid recovery from the Great Contraction of 1929-1933, was the fifth-worst recession of the twentieth century, as real GDP fell by 7% and unemployment, which had declined considerably after 1933, increased to 20%. The recession was produced by a major Fed policy error. Policy-makers doubled reserve requirements in 1936 to sop up excess reserves and prevent future inflation. The Fed's contractionary policy action was complemented by the Treasury's decision in late June 1936 to sterilize gold inflows in order to reduce excess reserves. These policies led to a collapse in the money supply and a return to a severe recession (Friedman and Schwartz 1963; Meltzer 2003). Fiscal policy hardly helped, with the Social Security payroll tax debuting in 1937 on top of the tax increase mandated by the Revenue Act of 1935 (Hall and Ferguson 1998).

¹According to Rotemberg (2013), this was because the public believed that the Federal Reserve would serve as a lender of last resort.

The recession ended after FDR in April 1938 pressured the Fed to roll back reserve requirements, the Treasury stopped sterilizing gold inflows and desterilized all remaining gold sterilized since December 1936, and the Administration began pursuing expansionary fiscal policy. The recovery from 1938 to 1942 was spectacular: output grew by 49%, fueled by gold inflows from Europe and a major defense buildup.

C. Post-World War II: 1945 -2014

In the post-World War II era, with only two exceptions, recoveries were at least as rapid as the downturns. In general, recessions were shorter and recoveries longer than before World War II (Zarnowitz 1992). There also were fewer stock market crashes. The key exceptions to this pattern were the initial part of the expansion following 1991(I) and the recent recovery that started in 2009(II). The 2007 recession was the only one with a banking crisis, stock market, crash and housing bust.

1945(IV) -1948(IV). The conversion from a wartime to a peacetime economy led to a very sharp, quick recession followed by a very rapid recovery. The recovery ended in 1948 with the Fed tightening by raising reserve requirements in the spring of 1948. The Treasury also allowed the Fed to raise the discount rate by 25 basis points in July (Meltzer 2003, pp. 658-659) to fight inflation. This led to a mild recession from 1948 to 1949.

1949(IV) -1953(II). According to Meltzer (2003, chapter 7) the rapid recovery from the 1948-49 recession was aided by deflation, which encouraged gold inflows and increased the real value of the monetary base, though Gordon (1974) credits fiscal stabilizers.

1954(III)- 1953(II). After the Federal Reserve Treasury Accord of March 1951, the Fed was free again to use its policy rates to pursue its policy aims. At the end of the Korean War, it tightened policy to stem inflation, leading to a recession beginning in July. The Fed then began easing policy well before the business cycle trough in May 1954, leading to a rapid recovery. Again in the face of incipient inflation the Fed began a tightening cycle at the end of 1954, which led to a recession beginning in August 1957(II) (Friedman and Schwartz 1963, chapter 11; Meltzer 2010, chapter 2).

1958(II) - 1960(II). The recession of 1957-58 was one of the most severe recessions of the postwar period but it was very short-lived. It ended in April 1958 following expansionary policy that began in November 1957. The subsequent recovery was vigorous. The Fed, again worrying about rising inflation and gold outflows, began tightening in August 1958. The tightening cycle ended with a recession beginning in April 1960 (Friedman and Schwartz 1963, chapter 11; Meltzer 2010, chapter 2).

1961(I) - 1969(IV). By early 1960 the FOMC recognized that the economy had slowed and began to ease two months before the April business cycle peak. The recession of 1960-61 was mild and brief, lasting 10 months. Fed policy continued to be loose throughout the downturn, evidenced by a cut in the discount rate and expansion of the monetary base (Meltzer 2000, pp. 303-315). The recession ended in February 1961, and the subsequent recovery exhibited very rapid growth with low inflation.

1970(IV) - 1973(IV). In face of rising inflation after 1965, the Fed began tightening. This was not enough to stem the buildup of inflation, although it led to the credit crunch of 1966

and a growth slowdown (Bordo and Haubrich 2010). Fed tightening in the summer of 1969 led to a mild recession beginning in December 1969. Policy began to ease after January 1970. In April 1970 Chairman Arthur Burns abandoned the anti-inflationary policy that had been pursued by his predecessor William McChesney Martin, because of the slowing economy. The easy policies continued until after the business cycle trough. Recovery in real GDP was relatively sluggish, and unemployment didn't peak until the summer of 1971.

1975(II) - 1980(I). In the face of rising inflation in 1972, the Fed tightened but not enough (Meltzer 2010 chapter 6). Further tightening occurred in the summer of 1973. The recession that began in November was one of the worst in the postwar period. Real GDP fell by 3.4% and unemployment increased to 8.6%. The recession was greatly aggravated by the first oil price shock, which quadrupled the price of oil, and by wage price controls which prevented the necessary adjustment. During this episode the U.S. experienced a minor banking crisis with the failure of Franklin National and other significant banks (Lopez-Salido and Nelson 2010). Faced with inflation and rising unemployment the FOMC sought moderate growth in monetary aggregates (Roesch 1975). The recovery began in April 1975. As in most of the postwar recessions, the pace of the recovery exceeded the pace of the downturn.

1980(III) - 1981(III). By 1979 inflation had reached double-digit levels. In August, Paul Volcker was appointed chairman of the Federal Reserve. In October, he announced a major shift in policy aimed at lowering inflation. The announcement was followed by a series of sizable hikes in the federal funds rate. The roughly 7 percentage point rise in the nominal funds rate between October 1979 and April 1980 was the largest increase over a six-month period in the history of the Federal Reserve. The tight monetary stance was temporarily abandoned in mid-1980 as interest rates spiked and economic activity fell sharply. The FOMC, on the Carter Administration's request, then imposed credit controls (March to July 1980) and let the funds rate decline. The controls led to a marked decline in consumer credit, personal consumption, and a very sharp decline in economic activity. The recession ended in July 1980 and was followed by a very rapid recovery.

1981(IV) - 1990(III). Fed policy began to tighten again in May 1981 in the face of a jump in inflation. It raised the federal funds rate from 14.7% in March to 19.1% in June. This second and more durable round of tightening succeeded in reducing the inflation rate from 10% in early 1981 to 4% in 1983 but at the cost of a sharp and very prolonged recession. Real GDP fell by close to 3% and unemployment increased from 7.2% to 10.8%. During this period there were two banking crises. The first, between 1982-1984, involved the failure and bail-out of Penn Square Bank in 1982 and Continental Illinois in 1984. Both banks were hit hard by the collapse in global oil prices. The money center banks were hard hit by the Latin American debt crisis in 1982, and the Volcker Fed eased policy as part of a complicated plan to avoid extensive defaults (Meltzer 2010, book 2). The second was the Savings and Loan Crisis from 1988-1991 (Lopez-Salido and Nelson 2010). There also was a stock market crash in the fall of 1987.

The Fed shifted to a looser policy in August 1982. After the trough, real output rose rapidly, and the pace of the recovery greatly exceeded that of the downturn. The recession of 1991 was preceded by Fed policy tightening beginning in December 1988 (Romer and

Romer 1994). The FOMC wanted to reduce inflation from the 4% to 4.5% range. The federal funds rate was raised from 6% to 9 7/8% between March and May. The recession began in July 1990 and was aggravated by an oil price shock after Iraq invaded Kuwait in August 1990. The recession was mild. Real GDP fell by only 1.1%.

1991(I) to 2001(I). The FOMC only began cutting the funds rate in November 1990 because its primary concern was to reduce inflation, which had reached 6.1% in the first half of 1990 (Hetzel 2008, chapter 15). The recovery from the trough in March 1991 was considered tepid, and it was referred to as a jobless recovery. Unemployment peaked at 7.75% in June 1992. The recession was also viewed as a credit crunch (Bordo and Haubrich 2010), and real housing prices declined by 13%, suggesting a minor housing bust. This is the first recovery in the postwar era where the pace of expansion was less than that in the downturn. The recovery continued into a lengthy expansion, however.

2001(IV) - 2007(IV). Between June 1999 and May 2000, the FOMC raised rates six times. The tech boom, which had elevated the NASDAQ to unsustainable levels, peaked in March and led to a bust and a decline in wealth and consumption. The FOMC didn't forecast a recession and was slow to respond because of tightness in the labor market (Hetzel 2008, page 241). Although real growth began decelerating in mid-2000, the FOMC began reducing the funds rate in January 2001, from 6.5% to 1% by June. After the trough in November, although real growth had picked up, employment had not and like the previous recession there was talk about a jobless recovery. By March 2004 the unemployment rate was at 5.7%, still near its cyclical peak. Moreover, since 2003 the Fed had worried about deflation and the zero lower bound problem. Consequently the federal funds rate was maintained at its recession low until June 2004 when, alarmed by an increase in inflationary expectations, the Fed began raising it in 0.25% increments until late summer 2007.

2009(II) - ?. The recent recession which began in December 2007 was preceded by a crisis in the shadow banking sector after the collapse of the housing market reduced the value of mortgage-backed securities. This later affected the balance sheets of the banking system. The fact that the Fed had supported the insolvent investment bank Bear Stearns in March, but to prevent moral hazard did not do so for Lehman Brothers in September, even though it was in similar shape, many believe triggered a global liquidity panic (Bordo 2013). According to Hetzel (2012), the recession was not caused by the financial crisis but by the Fed following tight monetary policy in the fall of 2007 and early 2008. The recession was the most severe in the postwar period (real GDP fell by more than 5% and unemployment increased to 10.8%). The financial crisis in the fall of 2008 was without doubt the most serious event since the Great Contraction.

Both the crisis and the recession were dealt with by vigorous policy responses: on the monetary policy side, the Federal Reserve cut the funds rate from 5.25% in early fall 2007 to close to zero by January 2009 and introduced quantitative easing via the purchase of mortgage-backed securities and long-term Treasuries in a series of programs starting in January 2009. The Federal Reserve also implemented an extensive network of facilities created to support the credit markets directly and reduce spread. These programs involved a tripling of the Federal Reserve's balance sheet, on top of a massive fiscal stimulus package.

The recovery since 2009 has been tepid, with real growth expanding at slightly above 2%. The pace of recovery is well below the pace of the decline in output.

III. The Relationship between Recessions and Recoveries

In this section we take a more statistical view of the relationship between the depth of the contraction and the strength of the following expansion. We make no claims about causality: we do not consider here whether financial crises contribute to recessions or recessions create financial crises. That is, we examine recoveries that occur against the backdrop of a recent financial crisis; the analysis does not require attributing the preceding recession to the crisis.

Our data is based on Bordo and Haubrich (2010), where we provide a more detailed description. Business cycle turning points (in quarters) come from the NBER. Real Gross Domestic Product, again at a quarterly frequency, is based on Balke and Gordon (1986) and Gordon and Krenn (2010), extended via the NIPA accounts. This gives us quarterly RGDP for 27 business cycles, starting with the peak in 1882 and ending with the recovery from the 2007 recession.

We measure the amplitude of the contraction by the percentage drop (from the peak to the trough) of quarterly RGDP. We measure the recovery strength as the percentage change from the trough at two horizons: four quarters after the cyclical trough and after a time equal to the duration of the contraction. Figure 1 plots the strength of the recovery against the depth of the contraction, for both recovery conventions. Going out the length of the contraction, while it appeals to symmetry, appears to be new, as most papers restrict their attention to 4 quarters (or 12 months if they use monthly data). Friedman (1993) is the exception, looking at growth to the next cyclical peak. Morley and Piger (2012) in their discussion of bounceback models, consider recoveries of up to six quarters after a trough, while Howard, Martin, and Wilson (2011) look out three years after a trough. Papell and Prodam (2011) look at when growth rates return to trend and when both levels and growth return to trend.

Exactly what constitutes a financial crisis depends on how it is defined, and the question has been answered several ways. In this section, for the pre-World War II years we use the chronology from Eichengreen and Bordo (2002) and also add 1914, a year in which the bond markets closed. For the postwar period, we use the chronology of Lopez-Salido and Nelson. This gives us crisis periods of 1884-85, 1892-93, 1895, 1904, 1907, 1914, 1930-33, 1973-75, 1982-84, 1988-91 and 2007. See Table 1.

Consequently, the recessions we associate with a financial crisis are those that start in 1882, 1893, 1907, 1913, 1929, 1973, 1981, 1990, and 2007. (We drop the 1945 recession from our sample. This is reasonable, but it matters, as it was the deepest recession of the century outside the Great Depression, with an extremely weak recovery.) It is perhaps interesting to note that the five GDP “disasters” picked out by Barro and Jin (2011) correspond to the cycles with troughs in 1908, 1914, 1921, 1933, and 1947, with three of those five being associated with a financial crisis. (With our data, we would add 1894 as a disaster where RGDP fell by 10 percent or more.) Interestingly, of our 27 business cycles, only 4 did

not have some form of financial crises, according to the reckoning of Reinhart and Rogoff² (1899, 1923, 1953, and 1960).

A. *Are Deep Recessions Followed by Steep Recoveries?*

The visual evidence (Figure 1) strongly suggests that deep recessions are followed by strong recoveries, though a few outliers, particularly the Great Depression, may have a disproportionate impact. Regressing growth 4 quarters after the trough against contraction amplitude shows a positive but small and statistically insignificant relationship. The relationship is tighter, and stronger, if we examine more of the recovery, measuring growth out to the duration of the contraction after the trough. Looking out only 4 quarters can give a misleading picture, particularly for longer recessions. Much of the difference is in fact driven by the Great Depression, and it should not be surprising that the drop in output from 1929 to 1933 was not fully reversed by 1934, since monetary policy (using M2) only became expansionary in early 1934 with the devaluation of the dollar and resulting gold inflows (Friedman and Schwartz 1963, chapter 8). By 1936 though, output was much closer to its pre-crisis level.

Do financial crises affect the bounceback? Or more precisely, since we cannot assess causality without a carefully identified model, do the recoveries from recessions with a financial crisis look different than those without? Figure 2 plots the strength of the recovery against the depth of the recession, separately identifying crisis and noncrisis cycles. The scatterplot strongly suggests a difference, but for reasons contrary to the conventional wisdom. In crisis times, strong recoveries follow deep recessions, but outside of a crisis, they do not. The relation is in fact negative, though not statistically significant.

To get a more formal view of the difference, we run a set of regressions based on the following specification:

$$(1) \quad \% \Delta Y_{T+k} = \alpha_1 + \alpha_2 D_F + \beta_1 [\% \Delta Y_{P-T}] + \beta_2 D_F [\% \Delta Y_{P-T}].$$

Here, $\% \Delta Y_{T+k}$ is the percentage increase in real GDP from the cyclical trough (T) to quarter $T+k$; as mentioned above, k is either 4 or equals the number of quarters in the recession. D_F is a dummy for financial crises, $\% \Delta Y_{P-T}$ is the percentage change in real GDP from peak to trough (peak minus trough over trough, so in typical contractions this will be a positive number). Thus the strength of the expansion is regressed against a constant, a dummy for financial crises, a measure of the depth of the contraction and an interaction between the financial crisis dummy and the depth of the contraction, in effect

²Reinhart and Rogoff have a more liberal definition of financial crisis than do Eichengreen and Bordo (2002), whose chronology we follow. See Bordo and Meissner (2015) for a comparison of the dating of financial crises across databases. There is likewise considerable debate over measuring crisis severity. On the one hand, the Friedman and Schwartz view is that the banking panics pre-1934 had serious consequences because they led to bank failures and declines in the money supply. On the other hand, Calomiris and others measure the capitalized losses of the banking sector in the earlier period, adding bailout costs in the later period. The IMF (Laeven and Valeria 2010) measure losses by the decline in real output from the crisis to the recovery. See Bordo and Meissner, 2015. And of course there is the tradition stemming from Bernanke (1983) which looks at increases in the cost of credit intermediation.

a slope dummy. An F-test then determines the significance of excluding the dummy and the interaction term. This specification is meant to capture two separate ways that a crisis may affect the bounceback. On average, such contractions may have a slower recovery, but the relationship between contraction depth and recovery strength may also be affected.

It may not be proper to lump all crises and all cycles together, given the very different monetary standards and regulatory regimes in place over time. We split the data several ways, dropping the Great Depression, and separately examine the years after the founding of the Federal Reserve and after the Second World War. Table 2 reports the results out to the first four quarters of the expansion, and Table 3 looks at the expansion going out the duration of the contraction.

Looking only at 4 quarters of the recovery, there is little evidence that recoveries following financial crises are much different. At a formal level, the F-test does not show a significant difference. Informally, the coefficient on the financial dummy is uniformly negative, indicating that recoveries following financial crises are on average somewhat smaller, though the coefficient is significant in only one case. The interaction term, also insignificant, is split between negative and positive values: in the one significant case the depth of the recession has a greater impact on the strength of recoveries when there is a crisis.

The differences are more striking once more of the recovery is considered, as Table 3 shows (Figure 2 plots the data). The interaction term and the F-test are significant in all but the post-World War II samples. The dummy for financial crises is always negative, but it is significant only half the time. The post-World War II sample shows no significant difference between crisis and noncrisis recoveries (perhaps because crises were less severe, a point we return to later), but for the other samples a clear pattern emerges: the dummy for financial crises is negative, but the interaction term is positive. This means that relatively mild recessions with a crisis have slower-than-average recoveries, but the deeper the recession, the stronger the recovery. For the entire sample, the crossover point is about 3.25%, met by most crisis contractions except 1882, 1973, 1981 and 1990, which perhaps contributes to the impression that the crisis recoveries are weaker. The numbers have economic heft: a one percent deeper recession with a crisis will lead to greater than an extra one and one half percent of growth in the quarters following the trough.

As a check on the robustness of the results, we look at alternative measures of crises. Bordo and Landon-Lane (2010) find the world has had five global financial crises since 1880 (1890-91, 1907-08, 1913-14, 1930-33, and 2007-2008). Figure 3 plots recovery amplitude (4 quarters) against contraction amplitude for these crises and all post-World War II contractions, including 2007-2008. The appendix conducts further robustness tests with alternate measures of output and of business cycles.

Like the previous figures, figure 3 shows a positive relationship between contraction amplitude and recovery strength, though the coefficient is relatively small. In part, this arises from the three most recent cycles, which seem different, with both a lower intercept and a lower slope. Some speculation suggests that this results from changes in labor market behavior since the 1980s. (Beauchemin 2010; Jaimovich and Siu 2014).

Another classification of financial crises comes from Reinhart and Rogoff (2009), and

using their measure also lets us make distinctions between financial crises based on their severity. Replacing the crisis dummy in the interaction term with the Reinhart and Rogoff index of crisis severity (which essentially adds up the number of different crises occurring during particular years, which we sum over contractions), provides yet another robustness check. The results looking out either four quarters from the trough or the duration of the contraction into the expansion were quite similar, so in Table 4 we report only the results for duration. Again the results are somewhat mixed. The financial crisis dummy is usually positive, but insignificant. The interaction term is significant in all four cases, and positive except for the post-World War II period. Thus, for most of the sample, a more severe crisis means a stronger recovery.

IV. The Effect of Housing

Housing deserves separate attention, if only because it played such a prominent role in the 2007-2008 crisis. In fact, housing has been important in many cycles (Leamer 2007) and a stylized fact noticed even by Burns and Mitchell is that household investment (which is predominantly housing) leads the business cycle (Fisher 2007). A standard story for the transmission of monetary policy was that the Federal Reserve would raise rates, which in the days of Regulation Q would lead to disintermediation, cutting off funds needed for construction (Jaffee and Rosen 1979). Home builders famously sent Paul Volcker hundreds of two-by-fours to protest his raising of rates (Greider 1987, p. 462). Other work has suggested that a shock to the housing market can account for much of the output decline in the recent recession (Henly and Wolman 2011) and that mortgage lending strongly influences business cycles (Jordà, Schularick, and Taylor, 2014). More recently, former Chairman Bernanke (2011) has remarked that

Notably, the housing sector has been a significant driver of recovery from most recessions in the United States since World War II, but this time—with an overhang of distressed and foreclosed properties, tight credit conditions for builders and potential homebuyers, and ongoing concerns by both potential borrowers and lenders about continued house price declines—the rate of new home construction has remained at less than one-third of its pre-crisis level.

The obvious question is to what extent the problems in the housing market can account for the slow recovery so far. Clearly, questions of precedence, causality, and influence are difficult to sort out. Our approach is to ask a counterfactual: What would the current recovery look like if it followed the historical pattern based on the depth of the contraction? Since the recovery is in fact much slower than predicted by just the recession depth, that is, the bounceback is weaker than expected, we see if the effects of the financial crisis or problems in the housing market can account for the difference.

In essence, the first step is to look for outliers in the relationship between recession depth and recovery. If we can identify which recoveries look different, can we start to understand why? We do this in a three-step process. First, as mentioned already, we compare actual with fitted values in a regression of RGDP growth in the recovery against contraction

depth, again also measured by the drop in RGDP. We then add a measure of financial distress, the risk spread used in Bordo and Haubrich (2010), Moody's Seasoned Baa less Long-term Treasury Composite,³ and again compare fitted with actual values. Finally, we add a third term, Residential Investment, as our measure of the housing market, comparing actual to fitted values. Using the measures of financial distress and the housing market unfortunately restricts the data to the post-World War I era, though unlike Leamer, we are able to consider the interwar years.

Figure 4 graphically reports the results. (Table 5 reports the regressions.) The first panel compares actual change in real GDP for the recovery (as before, length of the contraction after the trough) with the fitted value from the regression against contraction depth. The most recent three cycles stand out as having particularly weak recoveries given the size of the recessions. Their bounce back is abnormally slow.

The second panel shows how much of the shortfall we attribute to problems in the financial sector. This might be expected to be large, as the 1990 cycle is famous for its financial "headwinds," and the problems of the current crisis need no further recapitulation. Does financial stringency explain the slow recovery? To the measures of loan growth and stock appreciation from the previous section we add the interest rate risk spread. This does improve the fit overall, though for the current crisis the fit worsens. Adding these financial variables also reverses the trend of the last three recessions, which no longer look weaker than predicted. So, as noted before, there is some evidence in the most recent cycles that financial crises lead to weaker recoveries.

The third panel shows the effect of adding Residential Investment, an obvious measure of the housing market and a key component of Leamer's (2007) contention that "Housing is the business cycle." This panel shows the actual and fitted values using contraction depth, loan growth, stock appreciation, risk spread, and residential investment. Residential investment is not a large component of national expenditure, but it is closely linked to the purchases of consumer durables and other housing-sensitive sectors, which together give it a bigger impact. The improvement is particularly noticeable for the current recovery. This was also the case in the last five recessions, which show noticeable improvement in fit—a Wald test rejects excluding the extra variables at well above the one percent level. Nevertheless, the orders of magnitude are strikingly greater in the current recovery.

In the absence of a model, of course, this finding points to the need for further analysis, to determine if weakness in housing was directly to blame for the weak recovery, or if it merely reflected or transmitted other problems, such as weakness in the intermediary sector. Nonetheless, the role of housing does stand out as a marker for weakness in the current recovery.

³A very recent paper by Krishnamurthy and Muir (2015) emphasizes the impact of credit spreads on contractions and recoveries.

V. Prospects for the Current Recovery

Recessions that accompany a financial crisis tend to be long and severe (Bordo and Haubrich 2010; Reinhart and Rogoff 2009). What that portends for economic growth once a recovery has started is less certain, however. On the one hand, there is the feeling that “growth is sometimes quite modest in the aftermath as the financial system resets” (Reinhart and Rogoff, p. 235). On the other hand, there is the stylized fact behind Friedman’s plucking model, that “A large contraction in output tends to be followed on the average by a large business expansion” (Friedman 1969, p. 273). One popular measure of recovery strength, the time required to return output to the pre-crisis level, confounds the depth of the recession with the strength of recovery. For many purposes, it is important to separate the notions of contraction depth and recovery strength.

Where does that leave the current recovery? It remains an outlier, as one of the few cases where output did not return to the level of the previous peak after the duration of the recession. In this it resembled two very different recessions, the Great Depression and 1990. Significantly, both of those combined financial problems and (real) housing price declines, albeit of strikingly different magnitudes. We provide suggestive evidence that supports housing as at least a partial factor. Others point to policy uncertainty as having a role (Baker, Bloom, and Davis 2015), but at this point the evidence does not provide a definite resolution. The unanswered question, of course, relates to causality; tracing out the exact shocks, and their transmission, remains key. Must housing recover for the recovery to take off, or will the economy pull the industry along? Would monetary policy, credit policy or fiscal policy be an appropriate response? These are questions for another day.

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Table 1—: Output Change in Business Cycles, 1880-2011

Peak	Trough	Crisis Date	RGDP Change		Percent Change	
			Contraction	Recovery	Contraction	Recovery
March 1882	May 1885	June 1884	2.59	5.14	3.15	6.25
March 1887	April 1888	No	-3.36	2.32	-3.75	2.70
July 1890	May 1891	No	-1.03	13.27	-1.05	13.72
January 1893	June 1894	May 1893	-12.38	17.21	-11.09	17.33
December 1895	June 1897	Oct. 1896	1.67	4.86	1.41	4.04
June 1899	December 1900	No	2.92	15.39	2.10	10.88
September 1902	August 1904	No	3.34	31.37	2.09	19.23
May 1907	June 1908	Oct. 1907	-24.13	23.54	-11.82	13.08
January 1910	January 1912	No	7.71	11.55	3.61	5.22
January 1913	December 1914	Aug. 1914	-19.38	24.28	-8.33	11.39
August 1918	March 1919	No	-23.86	-43.67	-8.34	-16.66
January 1920	July 1921	No	-7.66	33.28	-3.42	15.39
May 1923	July 1924	No	13.99	12.32	5.43	4.54
October 1926	November 1927	No	-3.78	26.84	-1.26	9.08
August 1929	March 1933	Oct. 1930+	-99.95	87.64	-31.60	40.51
May 1937	June 1938	No	-21.96	27.52	-6.96	9.37
February 1945	October 1945	No	-122.94	-49.97	-19.25	-9.69
November 1948	October 1949	No	3.86	40.02	0.81	8.36
July 1953	May 1954	No	-15.96	48.43	-2.53	7.88
August 1957	April 1958	No	-21.95	46.31	-3.15	6.86
April 1960	February 1961	No	-4.04	42.22	-0.54	5.62
December 1969	November 1970	No	-1.80	50.50	-0.16	4.45
November 1973	March 1975	1973-75	-42.00	88.90	-3.18	6.96
January 1980	July 1980	No	-35.10	61.00	-2.23	3.96
July 1981	November 1982	1982-84	-42.40	153.42	-2.64	9.81
July 1990	March 1991	1988-91	-29.09	23.25	-1.36	1.10
March 2001	November 2001	No	21.92	57.71	0.73	1.90
December 2007	June 2009	Sept. 2008	-182.49	153.21	-5.14	4.55

Recoveries are measured by the duration of contraction after the trough; RGDP in 1972 dollars.

+Additional crises in Mar.-June 1931 and Jan-March 1933.

Source: Authors' calculations based on Bordo and Haubrich (2010), Balke and Gordon, and NIPA accounts. Crisis dates from Eichengreen and Bordo (2002) and Lopez-Salido and Nelson, (2010) with monthly dating from Gorton and Tallman (2015).

Table 2—: Regressions of 4 quarter expansion growth on contraction amplitude

Variable	All	No 29	Post-Fed	Post WW2
Constant	6.434*** (1.044)	6.434*** (1.044)	5.658*** (1.301)	5.539*** (1.242)
FinDum	-0.5864 (1.293)	-2.360* (1.381)	-1.254 (1.536)	-0.404 (1.917)
C_{Amp}	-0.565 (0.556)	-0.565 (0.556)	-0.510 (0.705)	0.756 (0.541)
$FinDum * C_{Amp}$	0.796 (0.593)	1.219** (0.559)	0.692 (0.704)	-0.816 (0.740)
R^2	0.16	0.20	0.12	0.20
F-Test $\chi^2(2)$	2.18	8.13**	1.574	2.605
Sig level	0.34	0.02	0.46	0.27
N	27	26	17	11

HAC robust standard errors in parentheses
 *, **, ***-Significant at 10%, 5% and 1% level

Table 3—: Regressions of expansion growth on contraction amplitude

Variable	All	No 29	Post-Fed	Post WW2
Constant	7.229*** (1.875)	7.229*** (1.090)	6.281*** (1.026)	5.159*** (1.251)
FinDum	-3.663* (2.246)	-2.251 (1.820)	-4.376** (1.776)	-1.168 (2.538)
C_{Amp}	-0.790 (0.573)	-0.790 (0.573)	-0.677 (0.738)	0.415 (0.488)
$FinDum * C_{Amp}$	1.886*** (0.552)	1.549** (0.603)	1.893** (0.735)	0.109 (0.849)
R^2	0.51	0.23	0.67	0.06
Chow Test $\chi^2(2)$	15.51***	7.48**	11.95***	0.303
Sig level	0.004	0.02	0.003	0.86
N	27	26	17	11

HAC robust standard errors in parentheses
 *, **, ***-Significant at 10%, 5% and 1% level

Table 4—: Regressions of expansion growth on contraction amplitude and RNR crises severity

Variable	All	No 29	Post-Fed	Post WW2
Constant	6.839*** (1.144)	7.207*** (1.098)	6.215*** (1.036)	4.811*** (1.388)
FinDum	1.708 (2.703)	-0.755 (1.884)	0.111 (2.305)	0.764 (2.109)
C_{Amp}	-0.382 (0.462)	-0.767 (0.566)	-0.640 (0.727)	0.761 (0.60605)
$RnRDum * C_{Amp}$	0.103*** (0.031)	0.316*** (0.122)	0.123** (0.048)	-0.227** (0.124)
R^2	0.55	0.23	0.66	0.14
Chow Test $\chi^2(2)$	18.23***	7.86**	13.70***	4.43
Sig level	0.000	0.020	0.001	0.109
N	27	26	17	11

HAC robust standard errors in parentheses
 *, **, ***-Significant at 10%, 5% and 1% level

Table 5—: Regressions of expansion on contraction depth, stock price, bank loans, risk spread, and residential investment 1920-2007

Variable			
Constant	5.016*** (1.238)	3.851** (1.573)	3.574*** (1.337)
C_{Amp}	-1.051*** (0.064)	-1.104*** (0.223)	-0.914*** (0.115)
Spread		2.194 (1.400)	-2.970*** (0.856)
Stock		14.029*** (5.242)	14.873*** (4.311)
Loan		6.333 (17.866)	1.677 (12.669)
ResInv			7.616*** (2.247)
N	16	16	16
R^2	0.84	0.91	0.93

HAC robust standard errors in parentheses
 *, **, ***-Significant at 10%, 5% and 1% level

DATA APPENDIX

Construction of the quarterly bank loan numbers. We started with the annual numbers for all commercial banks, *Millennial Statistics*, table Cj253 “commercial banks-number and assets,” Total Loans. After 1914Q4 these are made quarterly by interpolation using the RATS *disaggregate* (linear, ar1) procedure using total loans for all member banks, from the Fed’s *Banking and Monetary Statistics, 1914-1941* No. 18, All Member banks-Principal assets, “Loans” p. 72-74. The data were pushed forward to 1955 Q4 using the data from Banking and Monetary Statistics 1941-1970 table 2.1 All Member Banks A. Total assets and number of bank loans. There were several missing quarters, which we interpolated using No. 48, Weekly Reporting Banks in 101 Leading Cities-Principal Assets and Liabilities, weekly and monthly.

To go back further, we again began with the Millennial statistics, and interpolated again, this time using national and state bank data. The national bank data came from the NBER series, adding up NBER 14016, Loans and Discounts, national banks, country districts, NBER 14018, Loans and discounts, national banks, Reserve cities other than central, and NBER 14019, Loans and Discounts, National Banks, Central Reserve cities. Some judgment was used to apportion the data into quarters.

Annual State bank data comes from Millennial Statistics, Cj151, State banks, Loans and discounts. It was made quarterly by linear interpolation. The state and national bank numbers were added together and used to interpolate the Millennial statistics annual number. This let us interpolate from 1896 to 1913. Then we attached the series for state and national banks, discounting by the ratio for that series to the Millennial series in 1914. This gave us a series from 1882 to 1955. Figure A1 shows the series.

FURTHER ROBUSTNESS RESULTS

The next step is to check whether the results depend on using RGDP as an output measure. One approach is to use per capita income (population taken from Millennial Statistics): the cycles with a financial crisis show a positive correlation between contraction depth and recovery strength. Though not reported here, the regression analysis for per capita RGDP follow along the same lines as RGDP; going out only 4 quarters into the expansion shows no significant difference between crisis and non-crisis cycles. Going out further into the recovery, the difference is highly significant, again with the intercept dummy negative and the slope dummy positive.

Industrial production is a less comprehensive measure of output, but it is also available monthly and so makes another natural comparison point. We use two data sets (both taken from Mark Watson’s website) used in Watson (1994). For January 1884 to December 1940 we use the Miron and Romer (1990) IP numbers. For January 1947 to December 1990 we use Watson’s post-war approximation of the Miron-Romer numbers, which re-weights the post-war index to approximate the Miron-Romer pre-war index. The gap means we cannot calculate statistics for the 1945 contraction, but as discussed above, we drop that from the results for other reasons. With this data, strong recoveries follow steep recessions in both

crisis and non-crisis cycles. The response looks similar, and indeed is not significantly different in a statistical sense, but we wish to stress that it certainly is not the case that crisis recoveries look weaker.

A third check for robustness is with different definitions of the business cycle. This is perhaps particularly important in our case because the early NBER cycles were determined before the development of the GDP concept, much less its implementation. As a result, cyclical troughs do not always coincide with troughs of RGDP. We use the Bry-Boschan (1971) approach to finding cyclical turning points, as implemented by the RATS program `bryboschan.src`. This results in a smaller number of business cycles (18 as opposed to 27) and a somewhat different distribution of crisis cycles—10 instead of 9. Table B1 reports the regression results. The striking change is that Bry-Boschan cycles show that a deep recession is followed by a strong recovery, regardless of whether or not there is a financial crisis. It remains true, however, that the response of the two groups is (statistically and economically) different: as before, crisis cycles have a lower intercept but a higher slope. Again the bounce back is stronger for a good sized crisis cycle.

Another possible relationship between contractions and expansions concerns their shape. One obvious measure of shape is steepness, or change in output divided by duration. Tables B2 and B3 report the results of regressing the steepness of the recovery against the steepness of the contraction, again dropping 1929 and looking at post-Fed and post-World War II periods.

Steepness does pick out differences between recoveries with and without financial crises. The financial crisis dummy is significantly negative in six of eight cases, turning positive for the post-World War II period both times. So everything else equal, crisis recoveries are smaller. But everything else is not equal, for the interaction term is significantly positive in the same six cases, while the coefficient on contraction depth is insignificant, small, and generally negative. The conclusion is that crisis recoveries show a strong relationship between contraction depth and recovery strength, but the noncrisis recoveries do not. Far from overturning the stylized fact, crisis recoveries account for it!

Steepness is not the only measure of shape. For example, the contraction might be “L” shaped, that is, dropping quickly at first, but then only slowly reaching a trough. (Macroeconomic Advisors, 2009) The recovery might be slow, with a “U” shape as opposed to a quicker recovery yielding a “V” shape. Some even described the 2007 cycle as having a “square root sign” shape. Quantifying shape seems a daunting task, but Harding and Pagan (2002) have a measure of how much the change in output deviates from a straight line. The specifications we have considered, however, have not uncovered any meaningful relationship between the shape of the contraction and the shape of the recovery.

Another approach preserves the interaction between the simple dummy for financial crises but adds controls for financial conditions during the recovery. To capture both the market-based and the intermediary-based aspects of finance, we include stock prices and bank loans. It is perhaps more common to measure financial conditions via some sort of credit spread, and in our earlier work we followed that tradition and looked at the spread between Baa and safe bonds, or between different grades of railroad bonds for the 19th

century. Credit spreads were considered in the section on housing, but here we look more on the quantity side. While certainly the price of credit should matter, some authors (Owens and Schreft 1995) define a “credit crunch” as nonprice rationing of credit, and thus observable mostly from the quantity side. Schularick and Taylor (2012) use (annual) bank lending as a measure of credit conditions. The stock price index for 1875-1917 is the Cowles commission index, releveled to match the Standard and Poor index which begins in 1917. For bank lending, we construct a new quarterly series from 1882 to 2010 for all commercial banks, detailed in the appendix.

Table B4 reports the results of regressing the expansion strength against contraction depth, the change in real loans over the expansion and the change in the stock index over the expansion. It is meant to uncover whether financing problems held back the recovery. Because adding dependent variables reduces the degrees of freedom, we only report results for the entire sample and for a subsample that excludes the 1929 cycle. The interaction term is positive in the entire sample, both at four quarters and duration, and positive, statistically significant and quantitatively large in three of the four cases considered. Again it appears that if there is a difference between cycles with and without a crisis, the rebound from a financial crisis is particularly strong if the recession was deep.

Looking at the controls, however, shows that financing matters for the recovery, though the results do depend on the horizon, particularly for bank lending. Loans are quantitatively and statistically significant except when 1929 is dropped from the four-quarter specification. Higher bank lending is associated with a stronger recovery. The effect on the stock index is more consistent across horizons. There is a positive relationship between changes in the stock index and the strength of recovery, both with and without the Great Depression. Of course, particularly with the stock market, causality is hard to determine, and the results may only be telling us that strong recoveries have bull markets.

Table B1—: Bry-Boschan Cycles: expansion growth on contraction Amplitude

Variable	All	No 29	Post-Fed	
Constant	4.841** (2.151)	4.841** (0.215)	6.139*** 2.204	***
FinDum	-5.536** (2.665)	-2.546 (0.300)	-6.924*** (2.649)	
C_{stp}	0.286*** (0.104)	0.286** (0.104)	0.225** (0.104)	
$FinDum * C_{stp}$	0.950*** (0.158)	0.432* (0.2.30)	1.081*** (0.115)	
R^2	0.85	0.34	0.95	
Chow Test $\chi^2(2)$	176.3***	1126***	13.52***	
Sig level	0.000	0.000	0.000	
N	17	16	11	

HAC robust standard errors in parentheses

*, **, ***-Significant at 10%, 5% and 1% level

Table B2—: Regressions of 4 quarter expansion steepness on contraction steepness

Variable	All	No 29	Post-Fed	Post WW2
Constant	1.833*** (0.252)	1.833*** (0.252)	1.713*** (0.363)	1.430*** (0.310)
FinDum	-0.906*** (0.298)	-0.916*** (0.300)	-0.923* (0.473)	2.096*** (0.593)
C_{stp}	-0.776** (0.346)	-0.776** (0.346)	-0.771** (0.390)	0.366 (0.453)
$FinDum * C_{stp}$	1.585*** (0.368)	1.617*** (0.366)	1.487*** (0.405)	-3.787*** (0.764)
R^2	0.42	0.41	0.39	0.30
Chow Test $\chi^2(2)$	22.77***	23.48***	13.52***	25.61
Sig level	0.000	0.000	0.001	0.000
N	27	26	17	11

HAC robust standard errors in parentheses

*, **, ***-Significant at 10%, 5% and 1% level

Table B3—: Regressions of expansion steepness on contraction steepness

Variable	All	No 29	Post-Fed	Post WW2
Constant	1.965*** (0.361)	1.965*** (0.361)	2.068*** (0.487)	1.467*** (0.269)
FinDum	-1.3741*** (0.381)	-1.371*** (0.382)	-1.513*** (0.540)	2.126*** (0.717)
C_{stp}	-1.475** (0.627)	-1.475** (0.627)	-1.652** (0.641)	0.655** (0.3050)
$FinDum * C_{stp}$	2.475*** (0.639)	2.468*** (0.643)	2.616*** (0.649)	-4.253*** (1.037)
R^2	0.48	0.47	0.54	0.56
Chow Test $\chi^2(2)$	123.45***	22.972***	17.615***	38.90
Sig level	0.000	0.000	0.000	0.000
N	27	26	17	11

HAC robust standard errors in parentheses
 *, **, ***-Significant at 10%, 5% and 1% level

Table B4—: Regressions of expansion on contraction depth, controlling for change in stock price, and bank loans 1887-2007

Variable	All(4Q)	No 29 (4Q)	All (Dur)	no 29 (dur)
Constant	3.206 (1.084)	3.563*** (1.168)	3.723*** (1.206)	3.031** (1.252)
FinDum	-0.400 (1.112)	-2.908 (1.793)	-5.158*** (1.746)	-1.025 (1.762)
C_{Amp}	-0.535 (0.567)	-0.535 (0.557)	-0.719 (0.588)	-0.652 (0.573)
$FinDum * C_{Amp}$	0.853 (0.558)	1.219** (0.573)	1.909*** (0.560)	1.243** (0.532)
Loan	0.307*** (0.093)	0.200 (0.131)	0.199*** (0.071)	0.361*** (0.110)
Stock	0.127*** (0.041)	0.143*** (0.042)	0.146*** (0.044)	0.108*** (0.041)
R^2	0.32	0.33	0.68	0.41
Chow Test $\chi^2(2)$	2.35	5.45*	18.48***	5.62*
Sig level	0.309	0.066	0.000	0.060
N	26	25	26	25

HAC robust standard errors in parentheses
 *, **, ***-Significant at 10%, 5% and 1% level

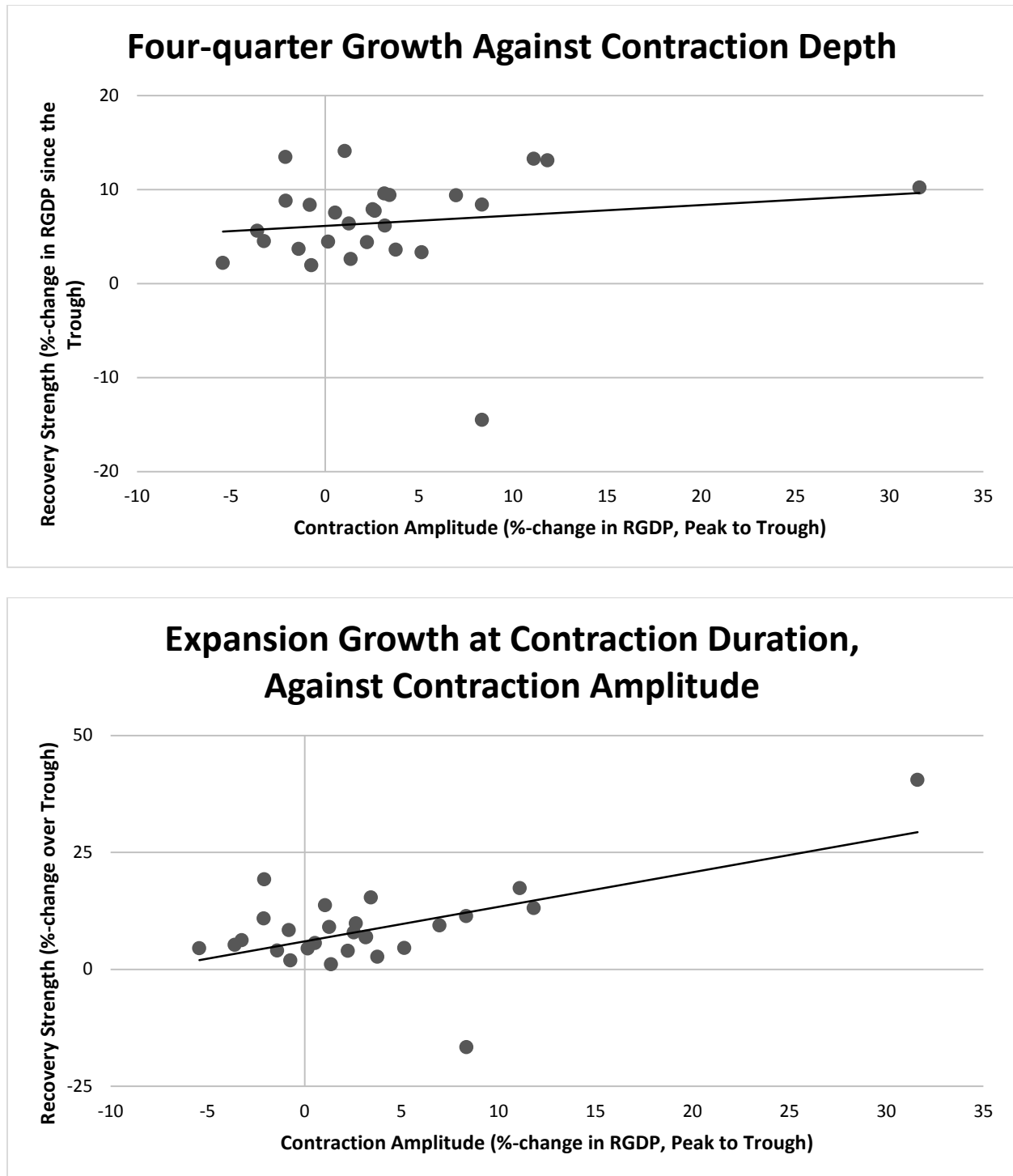


Figure 1: Expansion growth against contraction depth: all cycles.

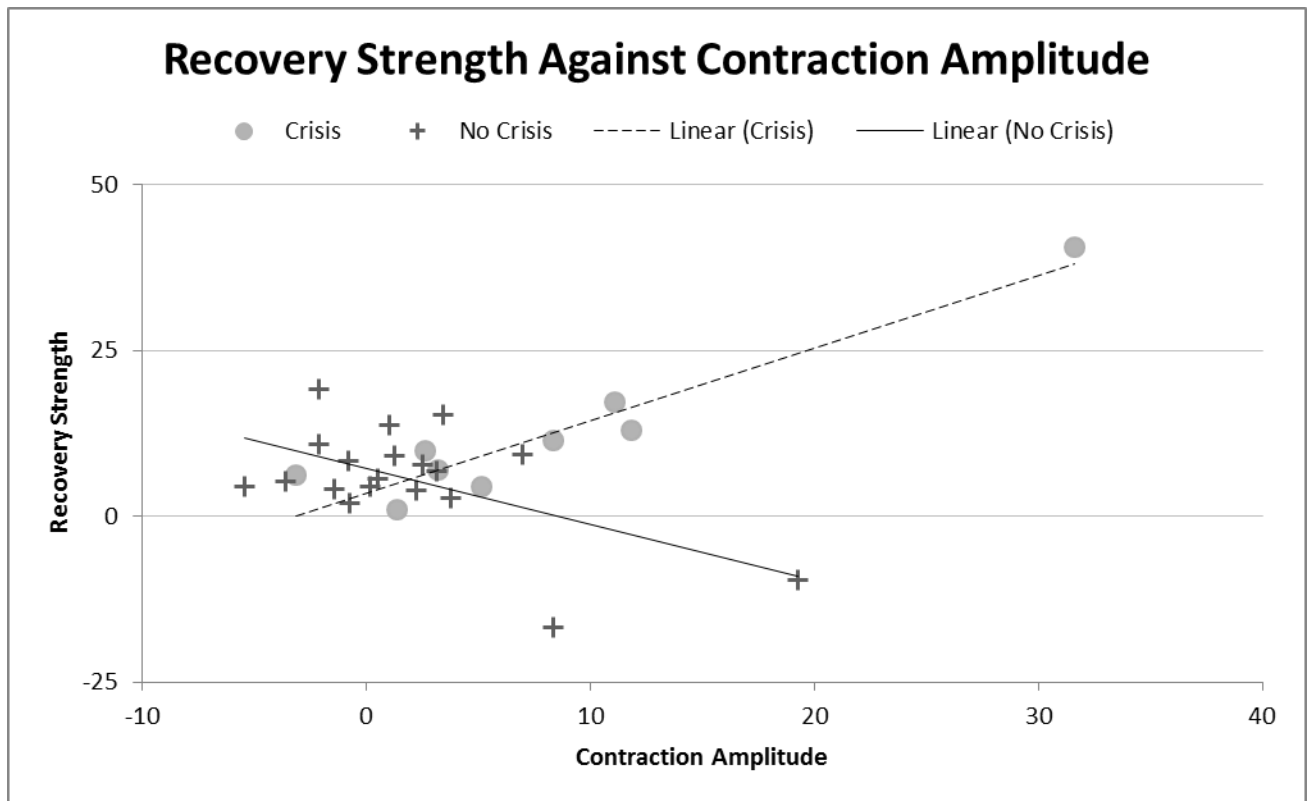


Figure 2: Recovery strength vs contraction amplitude, crisis and non crisis cycles

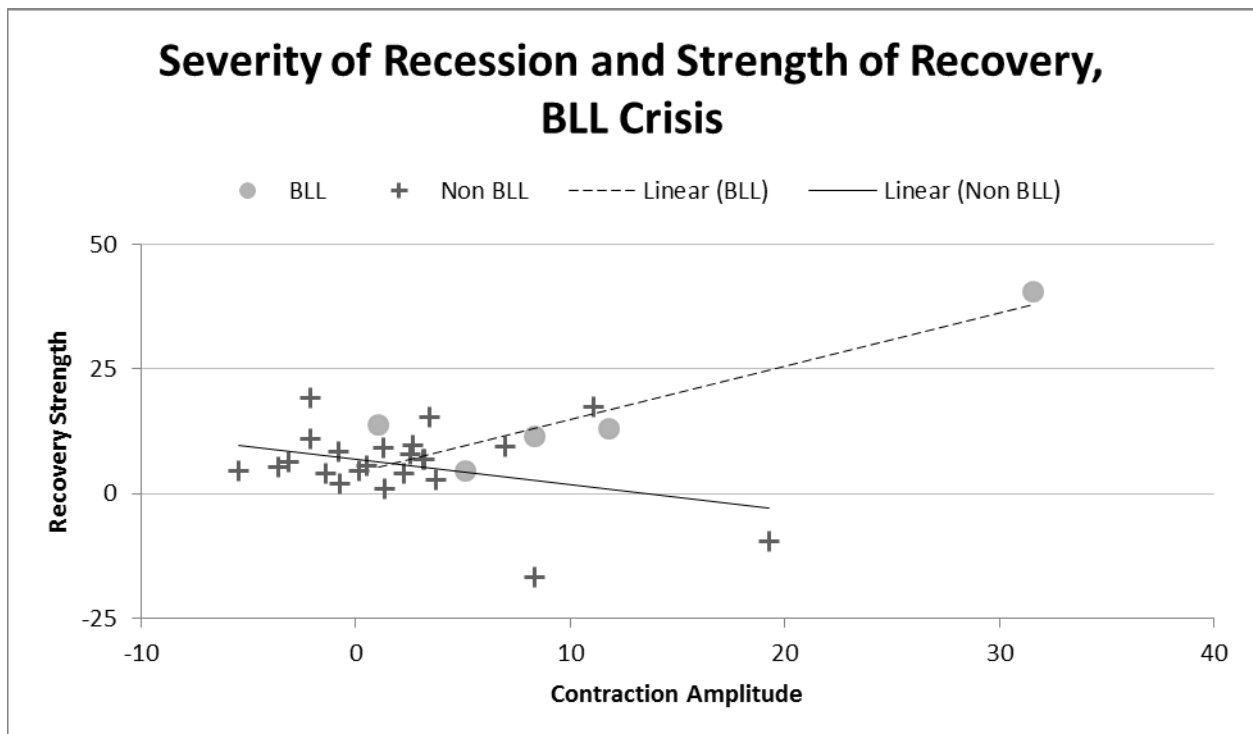
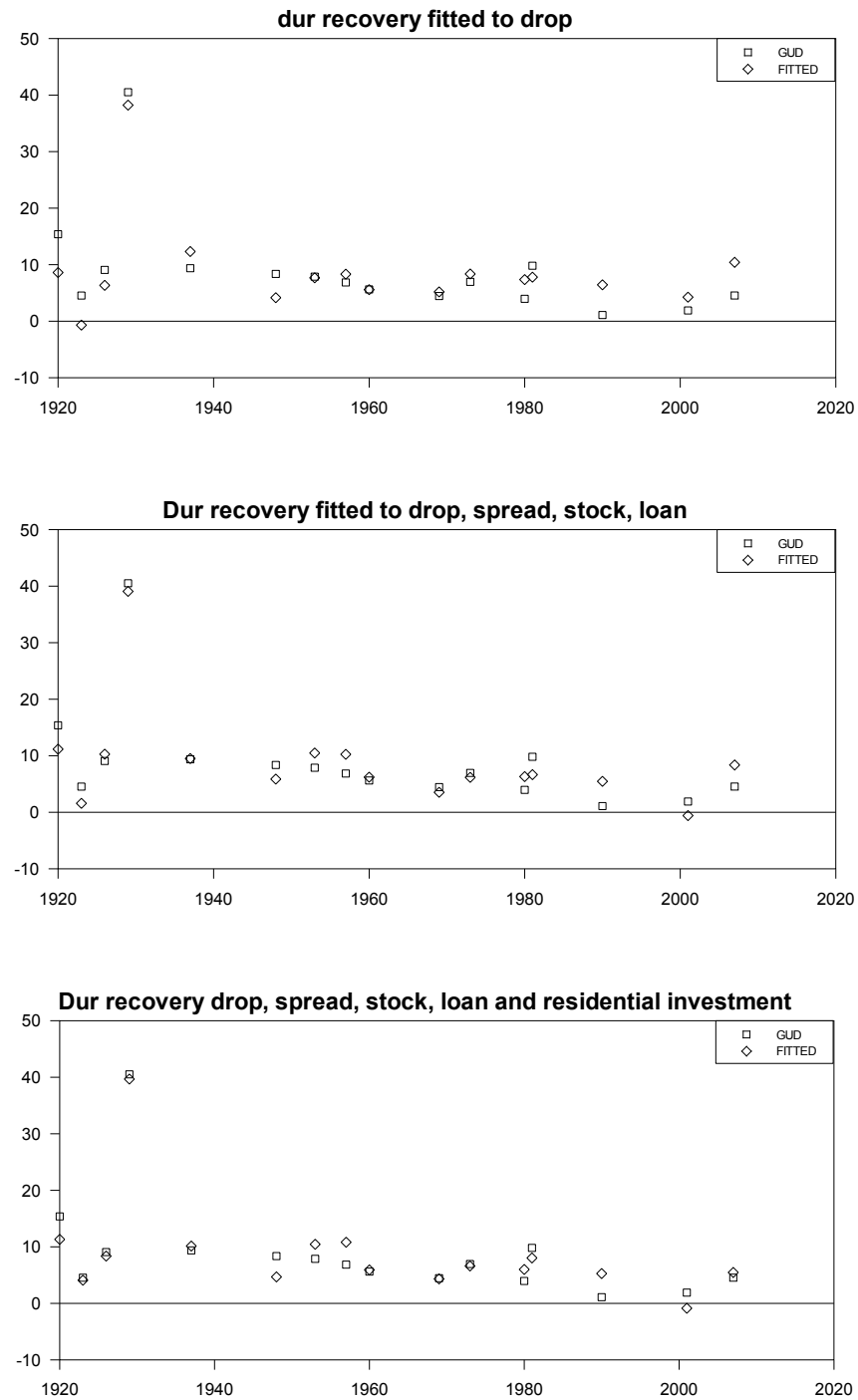


Figure 3: Bordo-Landon-Land crises

**Figure 4: Actual and Fitted Values, Duration Recovery**

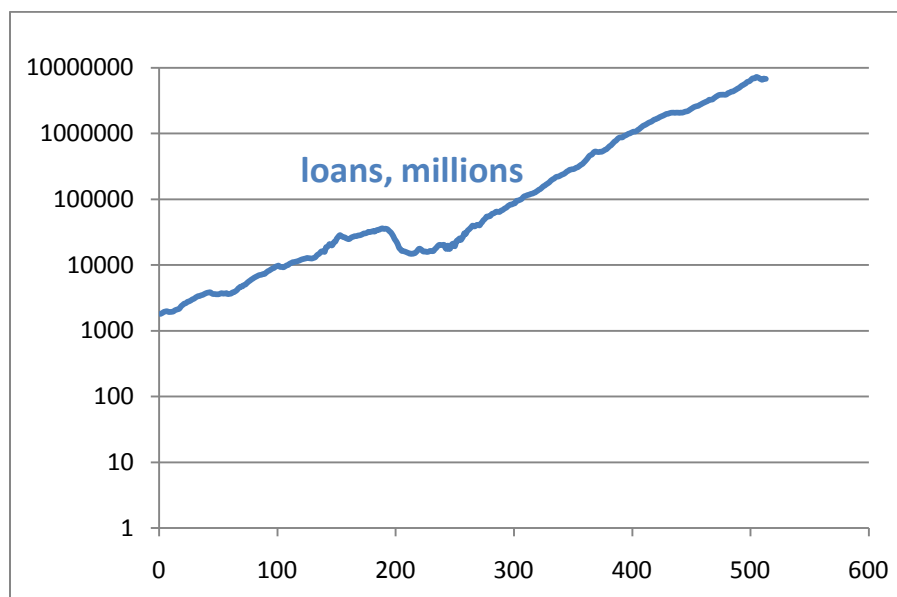


Figure A1: Bank Lending, on a log scale.