Empirical Estimates of the Impact of Uncertainty Shocks during the U.S. Great Depression

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Abstract

The United States of the 1930s experienced unprecedented uncertainty including a severe banking crisis, major policy changes, and the breakdown of the gold standard. Uncertainty, as measured by three uncertainty measures I construct for the interwar period, was extremely high during recession periods but declined during recovery periods during the Great Depression. I outline several uncertainty shock events that coincide with recession periods. Simulations of the model show that uncertainty shocks generate declines in output, consumption, investment, and hours worked. I estimate several vector autoregressions to produce econometric estimates of the impact of uncertainty on the broader U.S. economy during this period.

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1 Introduction

The 1930s were an extremely uncertain decade which saw record stock volatility, the failure of a huge fraction of the nation’s banks, the breakdown of the gold standard, massive changes to monetary policies, and the threat of a world war which would erupt in the 1940s. During the Great Depression the prospects for both firms and households, especially their downside risk, was significant. Uncertainty shocks, defined here as an increase in the dispersion of expected future income or profitability, buffeted the American economy of the 1930s. While this uncertainty may be evident in hindsight, identifying it in practice is difficult as uncertainty represents a possibility of future events. This paper will make the case that stock volatility, newspaper indices of uncertainty mentions, and credit spreads are effective measures of uncertainty. All three measures are both closely correlated with each other and are high throughout the 1930s when output declines. However, these same uncertainty measures are all low during the recessions of the 1920s, even the deep recession of the early 1920s, as these were not recessions driven by uncertainty. The three uncertainty measures also are low or falling during the 1933-1937 and 1938-1941 recovery periods when output was growing, so uncertainty is strongly negatively correlated with the business cycle of the 1930s.

The idea of uncertainty can decrease investment has a long history, and Dixit and Pindyck and their coauthors have written extensively on this topic.\(^1\) They argue that firms prefer to postpone or reduce investment in largely irreversible projects if the dispersion of their expected return from a project increases. This effect is driven by the “bad-news principle,” as outlined by Bernanke (1983). With the “bad-news principle,” the downside risk is key, as firms are adverse to the potential for low profits on their investment. Another way to view this phenomenon is that the investment hurdle required under certainty would be to invest in all projects where the net present value of revenues exceeds the net present value of costs. Under uncertainty, on the other hand, the higher “hurdle rate” necessary for the project to be worthwhile will imply that the net present value of revenues will need to substantially exceed the net present value of costs. This difference is the “real-option”

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\(^1\)See Pindyck (1991, 1993); Abel et al. (1996); Caballero and Pindyck (1996); Pindyck (1988); Majd and Pindyck (1987); Dixit and Goldman (1970); Dixit (1992, 1993); Dixit and Pindyck (1994).
as the firm has an implicitly value to waiting that is extinguished by investing (McDonald and Siegel, 1986). Empirical support for these real-options effects in postwar data is strong, and this paper will examine the empirical evidence for the real-option effect on the macroeconomy of the 1930s.²

This paper begins by discussing previous empirical results on the link between uncertainty and the American Great Depression, especially the results of Romer (1990). Romer examines the uncertainty stemming from the Great Crash of 1929 and its effect on consumer durables purchases, which declined significantly in 1930. These prior empirical studies generally test the implications of the theories of investment under uncertainty and precautionary saving theory. Under orthodox models of investment under uncertainty at a micro-level, uncertainty should reduce investment and consumer durables purchases which are largely irreversible, as the agent prefers not to be burden with servicing these payments in the case of a negative outcome. Precautionary savings theories, based on a literature begun by Leland (1968), would predict that agents reduce consumption and increase savings to guard against the possibility of a bad future outcome. The results of these previous prior papers are compared to my results. These studies generally use OLS methods, annual data and partial equilibrium models where price channels are not considered. I use monthly data, focus specifically on the interwar period, and use VAR analysis to control for important confounding factors.

Bloom (2009) has shown that uncertainty shocks had a negative impact of employment, hours worked, and industrial production in the postwar period using a VAR framework. I provide evidence that uncertainty shocks had a significant negative effect on the American economy of the 1930s. This paper expands on Bloom’s work in several ways. Equivalent variables are included for the interwar period (1923-1941) at a monthly frequency, highlighting the extensive data available for the interwar period. This allows for a comparison of the empirical results regarding the effect of uncertainty shocks during the interwar as compared to the results for the postwar. I also incorporate

²Guiso and Parigi (1999) shows a negative relationship between investment and a firm’s expected variance of demand, as predicted by the theory of investment under uncertainty. Leahy and Whited (1996), using stock volatility as a measure of uncertainty, show that the relationship between uncertainty and investment is clearly negative. Kellogg (2010) show that uncertainty is negatively related to investment among oil firms, and Goel and Ram (1999) show that irreversible investment is negatively related to uncertainty among Australian firms. Bachmann et al. (2010) and Bachmann and Bayer (2011) find that uncertainty is not a plausible driver of the business cycle however.
several uncertainty measures in my empirical analysis which were not considered by Bloom. Bloom uses stock volatility as his measure of uncertainty, with a high volatility indicator used as his main uncertainty measure, and the level of stock volatility also considered as a robustness check. Following Alexopoulos and Cohen (2009), I use newspaper mentions of economic uncertainty as an alternative measure of uncertainty, which yields similar simulation results as for stock volatility. The newspaper of record for the United States, then as now, was the New York Times. For this reason, the uncertainty mentions in the New York Times is the baseline newspaper index in this study. The Wall Street Journal, the Los Angeles Times, the Chicago Tribune, and the Washington Post are also considered, and they are highly correlated with the results from the New York Times. Finally, I use the BAA-AAA credit spread as an alternative measure of uncertainty. This yields somewhat weaker impact of uncertainty shocks on output in the simulation. Overall, however, the result still holds that uncertainty shocks, identified through an increase in credit spreads, can generate recessions. I use vector auto-regression (VAR) analysis to show that increases in uncertainty are correlated with output declines, with a one-standard deviation increase in uncertainty corresponding to roughly a 2% decline in industrial output after ten months. These results are robust to using the newspaper index of uncertainty mentions, credit spreads, a high volatility indicator variable, and alternative orderings. Uncertainty shocks are associated with output declines in the American Great Depression.

2 Previous empirical results

Romer (1990) is the first of a series of empirical papers on the effect of heightened uncertainty and the Great Depression. Greasley and Madsen (2006) show that uncertainty, as measured by stock variability, helps precipitate the Great Depression through a large decline in investment. Flacco and Parker (1992) show that income uncertainty was very high following the Great Stock Crash of 1929 and that this reduced durable purchases in 1930. Frederer and Zalewski (1994) show that the banking crisis of the 1930s and the breakdown of the gold standard serve to propagate the Great Depression. Greasley et al. (2001) use Romer’s results as a baseline, but they extend her analysis along several dimensions. Greasley and Madsen (2006) use Lebergott data beginning in 1900 that
includes a services category to move beyond the focus on goods production. As services are a major component of consumer spending, the focus on goods severely limits the scope of Romer’s study. These preceding studies provide empirical evidence that uncertainty helped generate output declines in the Great Depression using largely OLS regressions and annual data.

Greasley et al. (2001) find that uncertainty, as measured by Romer’s share price variability measure, generates statistically significant declines in all categories of consumption. This is in contrast to Romer’s intuition that nondurables spending should increase, or at least not decrease, as households replace their reduction in consumer durables with increase in consumer nondurables purchases. Romer’s intuition comes from Bernanke (1983) with consumer durables standing in for investment in Bernanke’s model. Greasley et. al. cite papers on precautionary spending, such as Hahm and Steigerwald (1999), to argue that increased uncertainty should increase precautionary savings and thus decrease all types of consumption. Greasley et. al. also find a significant role for uncertainty in reducing consumer purchases in all categories through 1932, as uncertainty remains high, especially in 1932. These authors also consider several models of consumer spending. The first is an Ando and Modigliani (1963)-type lifetime income model that resembles the regression in Temin (1976), and the second is rational expectations permanent-income-hypothesis based model based on Hall (1978). Similar results are obtained for both models. The models are specified as follows:

\[
\ln C_t = \beta_0 + \beta_1 \ln Y^d_t + \beta_2 \ln W_t + \beta_3 \ln V_t + \beta_4 D_{1930} + \beta_5 D_{1931} + \beta_6 D_{1932} + \beta_7 D_{1933} + \epsilon_1t 
\] (1)

\[
\ln C_t = \alpha_0 + \alpha_1 \ln C_{t-1} + \alpha_2 V_t + \alpha_3 D_{1930} + \alpha_4 D_{1931} + \alpha_5 D_{1932} + \alpha_6 D_{1933} + \epsilon_2t 
\] (2)

where \(Y^d\) is log real disposable income, \(V\) is stock market volatility (a measure of income uncertainty), \(W\) is net wealth, and \(D_j\) is an indicator variable which is 1 in year \(j\) and 0 otherwise. Equation 1 relates current consumption to income and wealth as well as uncertainty, while the equation 2 has consumption related only to past consumption and uncertainty. Both these
models find a statistically (and economically) significant decline in consumption for 1932, and the Temin-style model finds significant declines for 1930 for all categories of consumption, and the Hall specification does not find statistically significant declines for 1932 for nondurables. However, Greasley et al. (2001) find positive effect of uncertainty on consumer durable purchases for 1931 under equation 1, though it remains negative under the specification of equation 2. For the year of 1930, Greasley et al. find that the estimated coefficients from the Temin-style regression can explain about 53% of the actual decline in consumer durables purchases, and 35.7% of the overall decline in consumption. This compares favorably to Romer’s result of overpredicting the decline in consumer durables purchases. For the Hall-type specification, share price variability can explain 50% of the fall in total consumption spending and the results for consumer durables is similar to that of the Temin-style specification. Greasley et. al.’s results are more convincing than Romer as they predict a large share of the decline in consumer durables purchases, but not overpredicting. Greasley et. al. also consider other years than 1930, even though the results are not as strong in these years. Among other papers, Flacco and Parker (1992) use a measure of income uncertainty to examine the impact of income uncertainty on consumption from 1930, and find that income uncertainty essentially explains the decline in consumer spending in the initial phases of the Great Depression.

My analysis extends these empirical analysis beyond the years of 1933 to consider the effect of heightened uncertainty on the post-1933 portion of the Great Depression. The focus on the Great Crash to the exclusion of the 1933-1941 period is unwarranted, as the recovery period and the 1937-1938 double dip recession were also driven by uncertainty. especially as other stock market crashes, such as that of 1987 have not caused significant uncertainty, as discussed by Romer. The case for uncertainty, especially for 1930-1932 during the heights of the American banking crisis, is a much more plausible period for uncertainty as a major driver of the business cycle, as all measures of uncertainty are persistently high. Romer’s excessive focus on explaining only the 1930 decline of consumption is based on Temin (1976), who finds that changes in income and various types of expenditure like consumption and investment were similar between the 1920-1921, 1937-1938, and 1929-1933 recessions, with the exception of the year 1930 where consumer durables fell more
than predicted. Mayer (1978) shows that Temin’s result is not robust to alternative specifications, though Olney (1989) finds that Temin’s estimates are reasonable.

Regardless of the specification, the central question of the Great Depression is not the comovement of various expenditure types, but rather why all types of expenditure, income, and output fell so much and for so long. Also, all of these studies use regression techniques which have been outdated at least since the work of Sims (1980). As all variables are mutually determined, an OLS regression cannot identify the effect of one variable on another, as the RHS variables also determines the LHS variable. While the assumptions necessary to identify VAR models is not always satisfying, it is superior to arbitrarily assigning convenient variables to the right-hand and left-hand side which are mutually determined. For this reason, I study the dynamic effect of uncertainty on overall output over time to see the dynamic effects of uncertainty in general equilibrium using VAR analysis to extend previous work on the effect of uncertainty in the Great Depression.

3 Uncertainty Measures

Uncertainty, which is based on an expectation of the future outcomes, cannot be measured directly. Because of this, several measures of uncertainty have been proposed as uncertainty proxies which I will use to analyze the level of uncertainty in the Great Depression. I construct four uncertainty measures: stock volatility, a high volatility indicator, a newspaper index, and a measure of credit spreads, and show that all of these measures are high during recession periods and low during recoveries and recessions that are not driven by uncertainty.

3.1 Stock Volatility

Several previous studies have linked uncertainty, stock volatility, and the Great Depression. Nabar and Nicholas (2010) find that uncertainty depressed the R&D investment of firms in the 1930s. Officer (1973) finds that stock volatility was similarly low before and after the Great Depression, while the 1930s themselves were extremely volatile. Schwert (1989) confirms this result, singling out the period between 1929 and 1939 as extraordinarily volatile. Schwert (1990) even finds a strong connection between stock volatility and severe recessions: "It is clear ... that severe recessions
are associated with higher stock volatility. ... Of course, the Great Depression, 1929-1933 and 1937-1938, is the most severe contraction and it is also the period when volatility was the highest during the 1834-1987 sample period.”

Cutler (1989) shows that, not only was the volatility of stock indices high in the 1930s, but the cross-sectional volatility of stock prices was high was well. Bloom (2009, p.657) suggests the Great Depression was an era characterized by persistent volatility and uncertainty which would be amenable to analysis by an uncertainty shock model such as in this paper. “The only historical example of a persistent second-moment shock was the Great Depression, when uncertainty-as measured by share-returns volatility-rose to an incredible 130% of 9/11 levels on average for the 4 years of 1929 to 1932.” I follow Schwert’s characterization of stock market volatility as directly reflecting economic uncertainty: “[T]he volatility of stock returns reflects uncertainty about future cash flows and discount rates, or uncertainty about the process generating future cash flows and discount rates” (Schwert, 1990, 85). Veronesi (1999) develops a financial model with a regime shift between high and low economic uncertainty which produces significant variation in stock volatility over time. This model helps resolve Shiller (1981)’s puzzle that stock volatility is too high to be justified by the volatility of dividends and provides a theoretical justification for the connection between uncertainty and stock volatility. Merton (1985) also argues that the 1930s stock volatility was partially driven by uncertainty over potential nationalizations and bankruptcies. The link between stock volatility and business cycles has been noted in previous literatures, even by authors that weren’t considering uncertainty directly. Bulan (2005) shows that stock volatility is negatively related to firm investment which confirms the negative relationship between stock volatility and investment. Senyuz et al. (2012) finds that stock volatility precedes and helps predict business cycles turning points, and high uncertainty is associated with recessions, and Mele (2009) finds that financial volatility can explain 30% of postwar output fluctuations.

Traditionally, financial economics has modelled equity returns as following a geometric Brownian motion, such as in Black and Scholes (1973). This implies that stock returns have a well-defined mean and variance. A more recent literature has examined stochastic volatility models where volatility itself varies, usually following an autoregressive process. I follow this latter method by
assuming that volatility is generally fairly stable, but occasionally is hit by a shock that increases
the dispersion of returns. The stock volatility measure that I use for this paper is the monthly
standard deviation of log equity returns. The Dow Jones Industrial Average is used as it has been
calculated since 1896 and thus provides excellent historical coverage.\footnote{As price indices are only available at the monthly level, calculations using the nominal and real prices yield the same standard deviation, so this is not an issue. For the modern period, a volatility index like the VIX or VOX are often used, as it is a forward looking measure of stock volatility based on the volatility implied by option-prices. As stock options are not available for the interwar period, I use observed stock volatility. Observed volatility is not very different than the VIX, which is an consistent with rational expectations, so this assumption is reasonable.}

3.2 Newspaper Indices

The newspaper uncertainty index I construct follows the “Main Street” index of Alexopoulos and
Cohen (2009). The newspaper index not only produces a alternative uncertainty measure to the
stock volatility measure, but also provides a measure that is not based on “Wall Street,” but is
based on journalists covering conditions in the broader economy. This index measures the number
of times “uncertain” or “uncertainty” and “economic” or “economy” appeared in articles in the New
York Times from 1923-1941. While the other uncertainty proxies are based on financial markets,
the newspaper index is driven by journalist covering the broader economy, and is not specifically
driven by factors arising in financial markets as is the case with stock volatility. To construct the
index, I used searchable ProQuest databases of the newspaper archives for the New York Times.
The number of articles per day is divided by the number of days in the month and multiplied by
30 so as to preserve the original scale. The New York Times index is the baseline newspaper index
as it is the paper of record for the United States, but other major newspaper for the United States
are also used to show that the result is not specific to New York City or due to local coverage of
Wall Street. Other major newspapers considered are the Chicago Tribune, Los Angeles Times, the
Wall Street Journal, and the Washington Post. The path of all newspaper indices are plotted in
Figure 1, and the major newspaper follow roughly the same path, confirming that all newspapers
are picking up the same underlying uncertainty.\footnote{A 7-month symmetric moving average is used to smooth out the newspaper index series and to make the general trends easier to observe.}
3.3 Credit Spreads

The final uncertainty measure is the interest rate spread between BAA and AAA rated corporate bonds as rated by Moody’s. This measure was discussed by Favero (2009) as another possible uncertainty measure, and credit spreads are also discussed in the context of uncertainty by Arellano et al. (2010) and Sim et al. (2010). The BAA rating is the lowest rating of investment-grade debt. All debt rated lower than BAA is considered “junk” status and thus much riskier. The highest rating of investment grade debt is a AAA rating, which is the safest rating. The AAA rating is assigned to organizations with a low default risk and is generally reserved for the stable and profitable corporation and fiscally sound governments. These credit spreads should rise if the profitability of corporations because more uncertain, as this will increase the default risk of more marginal corporations substantially. The BAA-AAA spread rose during the 2009 crisis after the Lehman uncertainty shock, and as we can see by the chart below, the BAA-AAA spread rose during the 1929-1933 and during the 1937-1938 recessions as well.

3.4 Volatility Indicator

Again following Bloom’s method, I compute a volatility indicator that is coded as 1 when monthly Dow stock volatility in the 95th percentile or higher over the sample period of 5/1896-4/2013 and 0 otherwise. For the sample period from 1896-2013, the 95th percentile for stock volatility is 0.019641 and mean volatility is 0.007758. Bloom used the threshold of 1.65 standard deviations above mean volatility, but I use the 95th percentile as the data does not exactly follow a Gaussian distribution. The volatility indicator is based on the significance level for a one-sided t-test with a 95% significance, so that the ones would reject at this significance level, while the zeros would not reject. These uncertainty shock dates are listed in Table 2 in the appendix. It is clear that most of the uncertainty shock events occur during the 1929-1933 and 1937-1938 recessions, which appear as bold in the appendix. While volatility does fluctuate even in relatively tranquil times, this indicator variable allows the episodes of uncertainty shocks to be delineated more clearly from normal fluctuations.
3.5 Synthesis

The stock volatility index, the newspaper index, and the credit spread measure are plotted against each other in Figure 2 of the appendix. The link between the three series is very close, as all rise during the shaded recession periods and fall during the recovery periods of the 1930s. Also, all the measures are low during the 1920s, which is consistent with the recessions of the 1920s being driven by monetary or other factors. Figure 3 shows the path of industrial production and a composite measure of uncertainty which combines the stock volatility index, the newspaper index, and credit spreads into one measure. The negative correlation between uncertainty and industrial output can be clearly seen, especially in the 1930s where higher uncertainty is correlated with output declines and low uncertainty is correlated with recovery periods.

This both confirms their robustness as uncertainty measures as well as the intuition that uncertainty was very high in the 1929-1933 and 1937-1938 recession phases of the Great Depression. In fact, the temporal ordering seems to be very close, so one might worry about reverse causality, where a recession causes agents to be uncertain about the future. Bachmann and Moscarini (2011) argue that recessions could generate endogenous uncertainty as recession are uncertain times. This reverse causation argument is not so fatal to the uncertainty hypothesis however, as uncertainty could be a propagation mechanism for the initial shocks of the Great Depression to get worse. It does seem that uncertainty rises slightly after the start of the 1929 and 1937 starting dates for the recessions of the 1930s. Ferderer and Zalewski (1994) argue that uncertainty surrounding the gold standard served to propagate the Great Depression, and the high persistence of the uncertainty shocks in this period could result from a similar channel.

4 Vector Autoregression

4.1 Overview

I use a vector autoregression to examine the relationship between uncertainty and the broader macroeconomy in the 1930s. A vector autoregression is a regression of all endogeneous variables on their own lags, all other variables, and all lags of all other variables. Thus, for a vector of
endogeneous variables \(x_t\) over \(n\) periods with coefficients \(B_j\) and error \(e_t\), the VAR is of the following form:

\[
x_t = c + B_1x_{t-1} + B_2x_{t-2} + \ldots + B_nx_{t-n} + e_t
\]

I produce a VAR similar to Bloom (2009)’s study of June 1962- June 2008 using identical or similar monthly time-series data for the interwar period. This is both due to Bloom’s model being a reasonable specification as well as to provide a comparison of the effect of uncertainty shocks in the prewar and postwar periods. The uncertainty measures considered are stock return volatility, the volatility indicator, the newspaper index, and the credit spread measure. The non-uncertainty variables considered include the average monthly stock return, the consumer price index, the Federal Reserve discount rate (as a measure of the monetary policy stance), hourly earnings (a measure of wages), hours worked in manufacturing, total manufacturing employment, and industrial production. The endogeneous variables of interest are hours worked, manufacturing employment, and industrial production, which I refer to as “macroeconomic quantities.” Modern economic studies continue to use manufacturing data due to its availability at a monthly frequency, while investment and other NIPA categories are only available at a quarterly frequency. These manufacturing data, as well as the other data series, were published at a monthly frequency for the interwar period beginning in 1923. These data were also available for the 1940s and beyond, but including the war years would introduce a period where conscription, rationing, price controls, and massive government spending would radically change the relationship between economic variables.\(^5\)

A vector autoregression is a regression of a variable on itself, its own lags, as well as a regression on other variables and their lags. This allows for interactions between the variables over time that are not visible in a cross-sectional regression (Sims, 1980). Without restrictions, the system is underdetermined, so structural assumptions informed by economic theory must be used for identification. The Cholesky decomposition assumes that anterior variables can affect posterior variables contemporaneously, but posterior variables cannot affect anterior variables contempo-\(^5\)

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\(^5\)As the federal funds rate did not yet exist, the discount rate of the New York City branch of the Federal Reserve is used as the representative interest rate for monetary policy.
raneously. This framework assumes that uncertainty cannot be measured directly, but that the uncertainty shock measures should rise on impact of an uncertainty shock. The uncertainty shock would then first affect prices (wage, consumer price index, and the interest rate), and then quantities (hours, employment, output). The Cholesky ordering of the variables in the baseline VAR is: stock return level, uncertainty proxy, discount rate, hourly earnings, consumer price index, hours worked, employment, and industrial production.

The ordering of the variables is meant to ensure that first the effect of the level of stock prices on other variables is removed before the effect of volatility is considered. Take the case of some other non-uncertainty shock, for example a monetary or a productivity shock, that is expected to decrease industrial output in the future. This type of shock, if only stock volatility is included, may appear to increase stock volatility. A change in the stock level will increase the standard deviation of stock returns and thus increase stock volatility. Placing the stock return level first in the ordering also controls for any impact on future economic variables, through expectations of changes in profitability, on current values of equity returns. This allows one to see the impact of stock volatility on output, employment, and hours separately from the impact of average stock prices on these variables. The VAR is run over a period of 12 months for the three main uncertainty measures, as well as a stock volatility indicator variable. The net impact of a one-standard deviation shock to the uncertainty shock measures on macroeconomic quantities (manufacturing employment, hours, and industrial output) are plotted in the appendix.

4.2 Impulse Response Simulation Results

4.3 Uncertainty Measures

The baseline impulse response function results in are shown in Figure 4. These charts show the effect of a one-standard deviation impulse to stock volatility on industrial output, manufacturing employment, and manufacturing hours worked is plotted over the course of 12 months, with the response of each variable plotted in deviations from the steady-state. The results for all specifications are both statistically and economically significant. For the uncertainty measure of stock volatility the impact on hours worked reaches its peak effect of over 1% after 8 months. For employment, the
peak effect of over 1% occurs after 8 months as well. The impact of stock volatility on industrial production is about 2%, and the peak effect is reached after about 8 months as well. As uncertainty, as measured by stock volatility, was persistently high during the 1930s, these coefficients show that uncertainty had a significant effect on the American economy of the 1930s.

In Figure 5 eliminate the stock return level, so that stock volatility is the first variable in the Cholesky ordering, and all the other variables remain as before. While it is important to control for the equity return level, this does tend to dominate other causes as the stock market is forward looking. We can see that the effect of an uncertainty shock is clearer without the inclusion of the stock level, but the general pattern remains of a negative impact of uncertainty. The impulse response simulations yield a peak impact of 1.25% after 10 months for hours worked, about a 2% decline in manufacturing employment, and about a 2.5% decline after a year for industrial production. While it is encouraging that a significant effect results from uncertainty even when controlling for the level of stock returns, the results without the stock market level are more reflective of the true effect of uncertainty on hours, employment, and output.

Figure 6 shows the same VAR as above using the New York Times newspaper index in lieu of stock volatility as my uncertainty indicator. The peak impact of a one-standard deviation increase in the newspaper index is over 1% for hours worked after a year, almost 2% for employment after a year, and a decline of approximately 2.5% for industrial output after a year. The similarity of the results for the newspaper index show that these results are not purely driven by some factor specific to the stock market. The results for the same VAR as above without the stock return level included are shown in Figure 7 and are broadly similar to the specifications with the return level though now the magnitudes are increased. For the simulation for the newspaper index without the stock return level, the peak impact on hours worked is 1.5% after a year, the impact on employment is over 2% after a year, and the impact on industrial production is over 3% after a year.

The effect of uncertainty, as measured by the BAA-AAA spread, is shown in Figure 8. The impact of uncertainty as measured by credit spreads is similar to that of stock volatility and the newspaper index, though generally weaker. This reflects the fact the credit spreads are a less “clean” uncertainty measure than stock volatility or the newspaper index, as credit spreads are
also determined by certain default risk, and not simply uncertainty over default. However, credit spreads are still associated with significant declines in output. The simulated impact of a one-standard deviation increase in credit spreads on hours worked is almost 1% after 11 months, about 0.75% for employment, and an impact of almost 2% on industrial output with a peak effect after 11 months. I also include a simulation which does not include the stock return level, which increases the magnitude significantly, as shown in Figure 9. In this more parsimonious specification, hours worked falls over 1.5% in 11 months, employment falls almost 2% over a year, and industrial output falls over 3% over 11 months.

Finally I present the result for the high volatility indicator. As shown in Figure 10 the volatility indicator again yields predictions in accordance with theory, with hours worked falling at most 1% 7 months after the shock, employment falling almost 1% after 8 months, and industrial output falling almost 2% after 7 months. The magnitude is slightly lower than for stock volatility itself, which probably reflects the high persistence of this indicator, which is a value of 1 in every month of 1931 for example. The results without the stock return level included, shown in 11, are again stronger than those the level included. Now hours worked falls almost 1.5% after 6 months, employment calls almost 2% after 7 months and industrial production falls almost 3% after 7 months in response to an increase in credit spreads.

Relative to the results from the modern period, the negative effect in the interwar periods take more time to become statistically significant. The interwar period also has less of a “rebound” effect (where industrial production rises above its initial value) as industrial production returns to trend slowly. Overall, I suspect this difference are driven by the persistence of the uncertainty shocks in the 1930s, which is not the case during the modern period where uncertainty shocks are discrete and short-lived. This persistence makes it difficult econometrically to identify the impact of an uncertainty shock versus lagged or leading uncertainty.

4.3.1 Durable Goods

The effect of uncertainty should appear through declines in durable purchases, which are lumpy purchases where income uncertainty should matter more relative to nondurable (and especially
service expenditure). Durable goods are also largely irreversible purchases where the depreciation, transaction costs, or installation all make for (at least partial) irreversibility. I test for the impact of uncertainty on durable purchases by replacing the macroeconomic quantities of manufacturing hours, manufacturing employment, and industrial output with employment in durable goods production and production of durable goods. All the other variables remain the same, and I perform the VAR for all four uncertainty measures. This VAR provides an analogy to the results of Romer (1990). Romer uses an OLS regression on annual data for consumer durable, consumer semidurables, total commodity production, stock returns as a measure of wealth, and squared monthly stock returns over the previous year to examine the relationship between stock variability and consumer durables purchases, using stock variability as a measure of uncertainty as in this study. This regression for pre-WW2 finds similar results as for post-WW2 using consumer durables, nondurables, and final goods production. The results for the Romer replication are presented in Figures 12-15. For durables, I find a one-standard deviation increase in stock volatility decreases durables employment by 1% with a peak impact after 8 months, and reduces consumer durables output by about 2% with a peak impact after 7 months. The results for the newspaper index predict a decline of 2% after about a year for durable employment and a decline of almost 4% with a peak impact after 12 months for durable production. The results for the credit spreads measure predict a decline of over 1% for durable employment and a decline of about 3% for durable production. Finally, the results for the stock volatility indicator predict a decline of over 1% after about 7 months for durable employment and a decline of over 2% with a peak impact after 7 months for durable production.

Though the decline in durable employment and production found using the newspaper index is larger for durable goods than for industrial production as a whole, the results for stock volatility on durables is roughly in line with the findings for overall industrial output, so it seems that the decline in industrial output is roughly similar between durable and nondurable goods. One reason for this could be due to nondurable manufactured goods also having significant durability, especially relative to services. Also, monetary factors could also be driving a decline in durable purchases.

6Hourly earnings for durable manufacturing is not available for the sample period which is why these are not included.
through an interest rate channel, which would be controlled for with the inclusion of the discount rate, so the amount that durables could decline would be reduced. As all manufacturing was badly hit by the Depression, it is perhaps unsurprising that the magnitudes of the declines are similar between nondurable and durable goods. However, it is clear that the standard effect of uncertainty generating declines in durable good production, as predicted by the uncertainty hypothesis, is operative here.

4.4 Robustness Checks

Figure 16 display are several robustness checks to ensure that the results are not driven by the ordering of the VARs or the choice of variables. Continuing to follow Bloom’s method for comparison, I also report the results of the standard specification using only a “trivariate VAR” (volatility, employment, industrial production), “quadvariate VAR” (volatility indicator, stock-market level, employment, industrial production) and the “quadvariate VAR in reverse” (industrial production, employment, stock market levels, and volatility shocks. The first two specifications are to ensure that the results are not driven by intermediate variables, and the final specification is to show that the results are not driven by reverse causality. The trivariate and quadvariate simulations show that the baseline results are not driven by a specific ordering and that uncertainty robustly drives declines in employment, output, and hours. The reverse quadvariate specification shows that industrial output and manufacturing employment do not have any predictive power for future values of stock volatility, which is consistent with causality running from volatility to macroeconomic quantities, and not the reverse.

5 Conclusion

This study has examined the effect of uncertainty shocks on the American economy of the 1930s. I constructed several measures of uncertainty to estimate how large uncertainty shocks were in the Great Depression, including stock volatility, a high volatility indicator, a newspaper index, and credit spreads. While the New York Times was use as the newspaper of record for the United States, other regional newspapers also exhibit a similar path over the interwar period. Empirical
evidence showed that the uncertainty measures are correlated with statistically significant declines in output, employment, and hours in later months. This result is robust to the indicator used, as all the uncertainty proxies all yield roughly similar results for all three macroeconomic quantities. These vector auto-regressions show that uncertainty shocks during the Great Depression caused declines in employment, hours, and industrial production. I find a peak impact of uncertainty, as measured by stock volatility, of approximately -3% for hours worked, -1.5% for employment, and -2% for industrial production. Reverse causality can be ruled out statistically by reversing the ordering of the VAR, as macroeconomics quantities like output have no future predictive power for stock volatility, while stock volatility does have predictive power for macroeconomic quantities. I discussed previous research by Romer and other papers that previously studied the relationship between uncertainty shocks and output declines in the 1930s. I discussed how my results differed from these previous studies, especially using modern VAR analysis, monthly, rather than annual data, and considering various price measures as additional controls. A VAR is run for durable employment and output which results in similar output declines as for broader manufacturing sector. This paper has shown that uncertainty played a major role in driving the output declines in the American economy during the Great Depression.

This paper estimated impulse response simulations for the interwar period that are somewhat different than similar estimated based on VARs estimated by Bloom (2009) for the postwar period. Beyond clear differences in the response of monetary policy between the Depression and the postwar, uncertainty shocks were much more persistent in the 1930s, which saw record and persistent stock volatility as well as high and persistent uncertainty as measured by the other uncertainty measures. In the postwar, uncertainty shocks were much more brief, which is one reason why Bloom uses the high volatility indicator as his main measure rather than the level of stock volatility. As uncertainty was much more persistent in the interwar, the high volatility indicator does not perform much better than the level of stock volatility in the vector auto-regressions. While other nations do not have the same data coverage for monthly data as the United States, an interesting extension of this research would be to use similar uncertainty measures such as stock volatility and newspaper mentions to see what role uncertainty played in the Great Depressions in other nations, such as the United
Kingdom, France, and the United Kingdom.
References


Temin, Peter, *Did Monetary Forces Cause the Great Depression?*, New York: Norton, 1976.
Figure 1: Newspaper Indices

Notes: These newspaper indices are constructed by performing a Boolean search for (uncertain OR uncertainty) AND (economic or economy). The number of articles per month are recorded and then divided by the number of days per month and multiplying by 30 to roughly preserve the monthly scale of articles. NBER recessions are in blue.

Source: ProQuest Historical Newspapers
<table>
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Figure 2: Three Uncertainty Measures for the Great Depression

Notes: “Stock Volatility” is 5-month moving-average of DJIA return volatility multiplied by 125. “Newspaper Index” is a newspaper index of economic uncertainty mentions in the New York Times per month. “BAA-AAA spread” is difference in interest rates between BAA and AAA rated bonds divided by 2. Blue bars are NBER recession periods.
Figure 3: Uncertainty and Industrial Production: 1920-1941

Notes: Uncertainty composite is an average of the stock volatility, newspaper index, and credit spreads measures listed in the previous chart. Industrial Production is from the Federal Reserve Board of Governors, and the series is divided by the level of industrial production of June 1929 for scale.
Table 2: **High Stock Volatility Indicator Variable: 1923-1941**

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**Notes:** X indicates a month when stock return volatility is above the 95th percentile of Dow Stock Volatility over the period 1896-2013. Bold X represents a high volatility event during a NBER recession month. No high volatility events 1923-1928.
Figure 4: Stock Volatility on Macroeconomic Quantities

Figure 5: Stock Volatility on Macroeconomic Quantities without Stock Return Level included
Figure 6: Newspaper Index on Macroeconomic Quantities

- **New York Times Newspaper Index on Hours Worked**
- **New York Times Newspaper Index on Employment**
- **New York Times Newspaper Index on Industrial Production**

Figure 7: Newspaper Index on Macroeconomic Quantities without Stock Return Level included
Figure 8: BAA-AAA Credit Spreads on Macroeconomic Quantities

Figure 9: BAA-AAA on Macroeconomic Quantities without Stock Return Level
Figure 10: High Volatility Indicator on Macroeconomic Quantities

Figure 11: High Volatility Indicator on Macroeconomic Quantities without Stock Return Level
Figure 12: Stock Volatility on Durable Employment and Durable Production

Figure 13: Newspaper Index on Durable Employment and Durable Production
Figure 14: Credit Spreads on Durable Employment and Durable Production

Figure 15: Volatility Indicator on Durable Employment and Durable Production
Figure 16: Alternative VAR Specifications and Reverse Causality