DOI: 10.1111/ehr.13160

THE ECONOMIC HISTORY REVIEW

ORIGINAL ARTICLE

The role of sentiment in the US economy: 1920 to 1934

Ali Kabiri[1,4] | **Harold James**[2] | **John Landon-Lane**[3] | **David Tuckett**[4] | **Rickard Nyman**[4]

[1]University of Buckingham and FMG, London School of Economics and Political Science

[2]Princeton University

[3]Rutgers University

[4]University College, London, Centre for the Study of Decision-Making Uncertainty

Correspondence
David Tuckett
Email: d.tuckett@ucl.ac.uk

[Correction added on 11 May 2022, after first online publication: Acknowledgements text and Corresponding author have been updated in this version.]

Funding information
Institute of New Economic Thinking, Grant/Award Numbers: IN01100025, IN1300051; EPSRC, Grant/Award Number: EP/P016847/1; Centre for the Understanding of Decision-Making Uncertainty by the Institute of New Economic Thinking, Grant/Award Number: INO16-00011; Eric Simenhauer Foundation of the Institute of Psychoanalysis (London)

Abstract

This paper investigates the role of sentiment in the US economy from 1920 to 1934 using digitised articles from *The Wall Street Journal*. We derive a monthly sentiment index and use a 10-variable vector error correction model to identify sentiment shocks that are orthogonal to fundamentals. We show the timing and strength of these shocks and their resultant effects on the economy using historical decompositions. Intermittent impacts of up to 15 per cent on industrial production, 10 per cent on the S&P 500 and bank loans, and 37 basis points for the credit risk spread suggest a large role for sentiment.

KEYWORDS
algorithmic text analysis, business sentiment, Great Depression, US interwar economy

JEL CLASSIFICATION
N12, N22, E32, D89

Understanding what delivered the shock of the Great Depression has become what Ben Bernanke memorably called the 'holy grail' of macroeconomics; but we know from medieval stories that the knights almost never succeed in their quest.[1] Although the US economy was dynamic at the

[1] Bernanke, *Essays*, p. 5.

beginning of the twentieth century, the National Bureau of Economic Research (NBER) measured 10 recessions from 1899 to 1933. From 1920 to 1934, credit and sentiment played a prominent role in the expansion and subsequent crisis in the US economy according to many historical accounts.[2] This paper examines whether these credit and business cycles can be explained partly in terms of sentiment, or market psychology.

By the summer of 1932, the US stock market had fallen by 90 per cent from its 1929 peak, amidst the most severe depression in US history. Economists Benjamin Graham and David Dodd lamented the exuberance of the 1920s and the undervaluation of the US stock market in the market trough in 1932.[3] Irving Fisher in 1932 cited 'pessimism' as one of the factors prolonging the slump: 'Everybody's opinion is largely guided by the opinion of everybody else, even the people with the coolest heads will at least "fear the fears of other men" and contribute to the panic of which such fears are a part'.[4] New ideas about the role of human psychology in the economy were given greater credence following the publication of Keynes' *The general theory of employment, interest and money*. The role of expectations that Keynes' new theory set out has been widely accepted. The role he attached to 'animal spirits' (i.e. the role of human emotion in human cognition) has remained more controversial. He wrote of how 'the uncontrollable and disobedient psychology of the business world' determined the marginal efficiency of capital. [5]

A disaggregation of sentiment shows its particular importance in the period before the Great Depression; during the Great Depression, the identification exercise makes it hard to separate negative sentiment from the negative real economic performance. There may be a spiral in which economic news generates more negative sentiment, which leads then to worse economic performance and so on, but the causal mechanism in that process – unlike in the pre-1929 era – cannot be clearly identified.

Sentiment looks for signals, and some part – rather larger than the real extent of the ties of the United States to the world – is derived from the interpretation of developments elsewhere. In 1925, Edward V. Decker, president of the Northwestern National Bank Minneapolis, explained how 'we are learning more to work together, farmers, bankers, businessmen, railroad men, and we propose to march forward with a united front, believing and expecting that we will have our share of the world's prosperity during the next few years'.[6] On the other hand, events elsewhere have had the capacity to shake Americans' confidence and security.

One such channel of sentiment and views about future prospects was especially important in the United States in the 1920s. Before the US entry into the First World War in 1917, the US economy looked rather cut off from world events. However, in the 1920s, there were financial and political linkages in the form of war debts and reparations. Although, because of its size, the United States was not an open economy, the perception of links to the wider world played a disproportionate role at particular turning points: the end of the postwar deflation in 1921, and the emergence of prosperity in 1926 and of uncertainty in 1929 and 1930.

New research analysing news article data and a lexicon approach to searching for words with positive and negative emotional content (the technical term is 'valence') has been shown to be

[2] See, for example, Graham and Dodd, *Security analysis*; Fisher, *Booms*; and Keynes, *General theory.*

[3] Graham and Dodd, *Security analysis.*

[4] Fisher, *Booms*, p. 33.

[5] Keynes, *General theory*, p. 317.

[6] 'Banking opinion shows confidence: Northwest, clear to the Pacific Coast, cheered by fine crops, feels sure of good times', *The Wall Street Journal*, 10 January 1925.

useful in understanding financial outcomes.[7] Others use the analysis of news media or other digital sources to derive information about expectations and economic behaviour.[8] Recently, these innovative approaches have evolved to include very large long-run datasets of digitised news media examining the predictability of stock market volatility and stock prices and the impact of uncertainty induced by government policy.[9]

Specific historical applications of news article analysis have also emerged. One strand uses news media data to examine inflation expectations, and others use uncertainty indexes derived from news media to examine the role of economic, government policy, and political uncertainty in economic outcomes, in the interwar period.[10] Increased uncertainty has in the past been an explanation for the transmission mechanism between the stock market collapse and a reduction of orders and of demand that started the descent into the Great Depression.[11] New research focusing on emotions specifically uses a diverse range of text sources to understand emotions, sentiment, and wellbeing that cover the interwar period.[12]

The volatile credit and business cycles of 1920–34 provide the ideal setting to investigate the role of sentiment using these new techniques and novel datasets on the basis of modern empirical research and several prominent contemporary accounts of the period that emphasise behavioural effects. Evidence of sentiment-based mispricing of financial assets has been found by examining closed-end fund premia, while others suggest that a significant overvaluation of the stock market occurred from 1927 to 1929.[13] Shiller illustrates over- and undervaluation in the late 1920s and early 1930s US stock market.[14] We investigate the impact of sentiment on major components of the macroeconomy to better understand them in a dynamic setting and, to the best of our knowledge, present the first paper to use this specific approach in a comprehensive dynamic macroeconomic model.

We hypothesise that newspaper articles of the time contain both information related to the state of emotions or confidence of economic agents and factual information about or related to the fundamentals of the economy. In our model, the emotion or 'sentiment' component can have independent effects on the economy that are not directly related to the fundamentals they describe and we control for expectations of future fundamentals through several mechanisms.[15] Our aim is to illustrate two key points: first, what these sentiment shocks look like when expectations and

[7] See, for example, Tetlock, 'Giving content to investor sentiment'; Loughran and McDonald, 'When is liability not a liability?'; Püttmann, 'Patterns of panic'.

[8] See, for example, Ramey and Shapiro, 'Costly capital reallocation and the effects of government spending'; Romer and Romer, 'Macroeconomic effects of tax changes'; Dominguez and Shapiro, 'Forecasting the recovery'; Choi and Varian, 'Predicting the present'; Haddow et al., 'Macroeconomic uncertainty'.

[9] Manela and Moreira, 'News implied volatility'; Garcia, 'Sentiment during recessions'; Baker et al., 'Measuring economic policy uncertainty'.

[10] See, for example Binder, 'Estimation of historical inflation expectations'; Daniel and ter Steege, 'Inflation expectations'; Jalil and Rua, 'Inflation expectations'.

[11] See for example, Romer, 'The Great Crash'; Lennard, 'Uncertainty and the Great Slump'; Mathy and Ziebarth, 'How much does political uncertainty matter?'; Mathy, 'How much did uncertainty shocks matter'.

[12] Borowiecki, 'How are you, my dearest Mozart?'; Hills et al., 'Historical analysis'; Hanna et al., 'News media and investor sentiment'.

[13] De Long and Shleifer, 'The stock market bubble'; White, 'The stock market boom and crash'; Rappoport and White, 'Was there a bubble'.

[14] Shiller, 'Do stock prices move'; idem, *Irrational exuberance*.

[15] Tuckett and Nikolic, 'The role of conviction'.

fundamentals are accounted for; and second, the scale, timing, and locus of related impacts on the economy.

To investigate our hypothesis, we utilise a computer algorithm to conduct large-scale text analysis of digitised newspaper articles that measures the emotional word content in economic and financial narratives from approximately 1000 sentiment-containing items per month in *The Wall Street Journal* (*WSJ*) from 1920 to 1934. We use our algorithm, which counts sentiment-indicating, or 'emotionally loaded', words to produce an index for *WSJ* for the period 1920–34. Our index measures the balance between two emotion groups that are broadly analogous to excitement (approach) and anxiety (avoidance) in text data, using a lexicon of approximately 150 words for each category utilising ordinary English words associated with these two major groups. We calculate the difference between word counts from each word group normalised by the total word count per month to derive our index at a monthly frequency. We label this the business-sentiment index. We produce an analogous sentiment index using digitised articles from *The New York Times* (*NYT*) in the same way as *WSJ*. *WSJ* was a smaller (but still substantial) circulation paper, focused on business and finance news and is a key source of information to people involved in stock transactions, while *NYT* is a much broader news source. *WSJ* had a circulation of 18 750 in 1920, which grew to about 50 000 by the summer of 1929: an expansion which itself is an indication of the extent to which stock market engagement had become popularised in the great boom of the 1920s.[16] The *NYT*-based sentiment index is used to extract general news-based sentiment from the *WSJ*-based sentiment index. The procedure that we use to do this is outlined in Section II.

Having constructed our indexes, we assemble a database of the macroeconomy from 1920 to 1934 at a monthly frequency. To perform the empirical investigation, we utilise a 10-variable vector error correction model (VECM) to identify a business-sentiment shock that is orthogonal to a large number of important variables. These variables include output, the stock market, prices, interest rates, and variables to control for inflation expectations and business credit distress. The model also uses an *NYT*-based general news-sentiment index to filter out general news shocks.

We are subsequently able to analyse and interpret episodes where structural shocks to our VECM are at their most intense and refer back to the actual news articles driving these effects. We do this by scoring each article individually for its net level of positive or negative business-sentiment words. We then perform historical decompositions utilising this model to illustrate clearly the impact of these structural shocks on all of the macroeconomic and financial variables. This method allows us to compare the actual with the counterfactual path of the economy without the impact of business-sentiment shocks.

The results show our business-sentiment index has robust and economically meaningful effects on the real economy. We illustrate the timing and intensity of these effects for industrial production (IP), the S&P 500 stock market index, bank loans, prices, interest rates, credit risk spreads, and term spreads. The impacts are large, reaching up to 15 per cent of the initial value for IP and 10 per cent for the S&P 500 and bank loans in specific time periods. Analysis of the business-sentiment levels in the specific news articles, which create the structural shocks and their subsequent impacts on the economy, illustrates the potential sources of the shocks.

We proceed as follows. Section I describes the *WSJ* article data and macroeconomic data, and the method for constructing the business-sentiment index. Section II sets out the econometric method and reports the results of the empirical investigation of the effect of business sentiment on the economy. In Section III, we use historical decompositions of subperiods to investigate the impact of business sentiment on the economy, while in Section IV we report our summary and conclusions.

[16] Rosenberg, *Inside the WSJ*, p. 46.

I | CONSTRUCTION OF A BUSINESS-SENTIMENT INDEX

The analysis is based on the ProQuest digital archive of *WSJ*, which in its entirety consists of 1.07 million individual digitised news items published between 1920 and 1934, converted to an XML format that is machine-readable. We also collect news items from *NYT* from 1920 to 1934 in a similar fashion. We focus only on the period 1920–34 using *NYT* and *WSJ* owing to data availability for the macroeconomic time series used in the analysis. We filter both databases by removing non-relevant items such as theatre reviews, legal notices, classified advertisements, and display advertisements, leaving a total of 738 275 digitised items in our analysis. This is an average of 4400 digitised items per month, of which there is an average of 945 digitised items that contain at least one word from our sentiment lexicon. The items that contain at least one word from our sentiment lexicon account for a monthly average of 46 per cent of the total number of words contained in the dataset. See the online Appendix for a more detailed discussion of the data.

We measure business sentiment as a summary statistic of words in news articles related to the two emotion groups. The selection of the word lists differs from existing lexicons. Examples of existing lexicons include Loughran and McDonald (LM), and the Harvard-IV- Lasswell combined dictionary.[17] These provide alternative indexes of sentiment based on positive or negative valence; however, none has word lists specifically for excitement (approach) or anxiety (avoidance). Our sentiment index is based on conviction narrative theory (CNT).[18] CNT is a theory about decisions taken under radical uncertainty. It posits that the mental substrate underlying such decisions is a narrative – a summary representation of relevant causal, temporal, analogical, and normative information available to the decision maker – that is selected to support action although its outcome is ex ante uncertain because it evokes feelings of either approach or avoidance.[19]

The word lists were carefully constructed by expert judgement to capture approach and avoidance emotions – originally conceived as excitement and anxiety, in the very specific sense as to whether the the words convey more, or less, conviction about action. A recent paper highlights the key differences between LM and our index using the Binder features of the words.[20] The area where our lexicon differs from that of LM across 65 Binder features is in the emotion groups linked to 'cognition', 'drive', 'arousal', 'fearful', and 'surprise'. The index we produce reflects the emotions leading to action or avoidance in the beliefs about firms, consumers, investors, and the overall economy that are contained in the news.

For each of the two groups, we use a word list, or lexicon, that consists of about 150 words.[21] The word lists we use are not exhaustive and were first developed using expert judgement from a team consisting of a social anthropologist, a sociologist, a psychoanalyst, and a clinical psychologist.[22] We use a 'bag of words' technique and tokenise the articles to be able to match the words

[17] Loughran and McDonald, 'When is a liability not a liability?'. Harvard-IV-Lasswell http://www.wjh.harvard.edu/~inquirer/homecat.htm. (accessed in January 2021).

[18] Tuckett and Nikolic, 'The role of conviction'; Chong and Tuckett, 'Constructing conviction'.

[19] Johnson, Bilovich, and Tuckett, 'Conviction narrative theory'.

[20] Binder et al., 'Toward a brain-based componential semantic representation'; Turton et al., 'Differentiating approach and avoidance'. By 'Binder-features', we refer to the 65 general word categories developed in Binder et al. to capture the fundamental semantic features that people use to define concepts in their minds.

[21] See Tables A11 and A12 in the online Appendix for full list of words.

[22] Tuckett et al., 'Tracking phantastic objects'.

in each lexicon with the words in each article.[23] We do not treat the data for 'Negation', as the correlation between negated and non-negated sentiment time series in earlier work developing the method was 0.999, so it was not deemed necessary. We do not automatically stem the words in the lexicon in this analysis. Stemmed variants of words were already considered by the experts when constructing the lexicon. Those that were considered important were included, and those that were considered to be not important were not included. Automatic 'stemming' in this case has the danger of being too broad, capturing stems of words we do not want or were originally excluded by the expert panel. In the excerpts from articles given below, we italicise the words from the lexicon.

For the summary statistic of a collection of texts, we count the frequency of excitement/approach words (Approach_t) and anxiety/avoidance words (Avoidance_t) and then scale these numbers by the total number of words per period (N_t). To arrive at a single statistic, we subtract the avoidance statistic from the approach statistic as in equation (1). Data are collected at daily frequency but collated at monthly frequency to ensure a higher signal-to-noise ratio. The formula for the construction of business-sentiment is

$$\text{Sent}_t = \frac{|\text{Approach}_t| - |\text{Avoidance}_t|}{N_t}. \tag{1}$$

During the period 1920–34, there is some variation in the number of words published in a month (see online Appendix). On average, there are 945 digitised items containing sentiment per month, and these items account for an average of 46 per cent of all words analysed. One issue that may reduce the accuracy of our algorithm in capturing business sentiment is that the modern lexicon we use may not match the language typically used in this period. This issue is partially negated as we use two counterbalancing lists of words, which should be equally affected by any such bias. Furthermore, Manela and Moreira demonstrate that modern lexicons can be successfully used to measure 'news implied volatility – NVIX' back to 1889.[24]

Figure 1 reports the sentiment series obtained from *WSJ* from 1920 to 1934 constructed using equation (1). Some notable points in US history are clearly visible in figure 1 and consistent with historical accounts of these periods. A major slide is apparent from 1929 through to 1934, at the deepest point of the Great Depression. It is striking that, in the 1920s, two relatively mild NBER recessions (those beginning in May 1923 and October 1926) are both accompanied by large negative spikes in business sentiment. With the Great Depression, after August 1929, business sentiment follows the economy on its downward path.

As a robustness check of the *WSJ* data as compared with other financial and business news sources of this period, we use the *Commercial & Financial Chronicle* (*CFC*) – a popular weekly financial news source based in New York. These news article data are gathered from the Federal Reserve Bank of St Louis – FRED database.[25] The correlation between the business-sentiment indexes from the *CFC* and *WSJ* from 1907 to 1934 is 0.74, indicating that the *WSJ* business-sentiment index captures consistent information on the economy and financial markets that is not specific to *WSJ*. Another alternative news source is the sentiment index of Garcia, who uses

[23] See, for example, Tuckett, *Minding the markets*; Tuckett and Nikolic, 'The role of conviction'; Bruner, *Acts of meaning*; Berezin, 'Emotions and the economy'; Damasio, *The feeling of what happens*; Bandelj, 'Emotions in economic action and interaction'.

[24] Manela and Moreira, 'News implied volatility'.

[25] Source: https://fred.stlouisfed.org (accessed in June 2019).

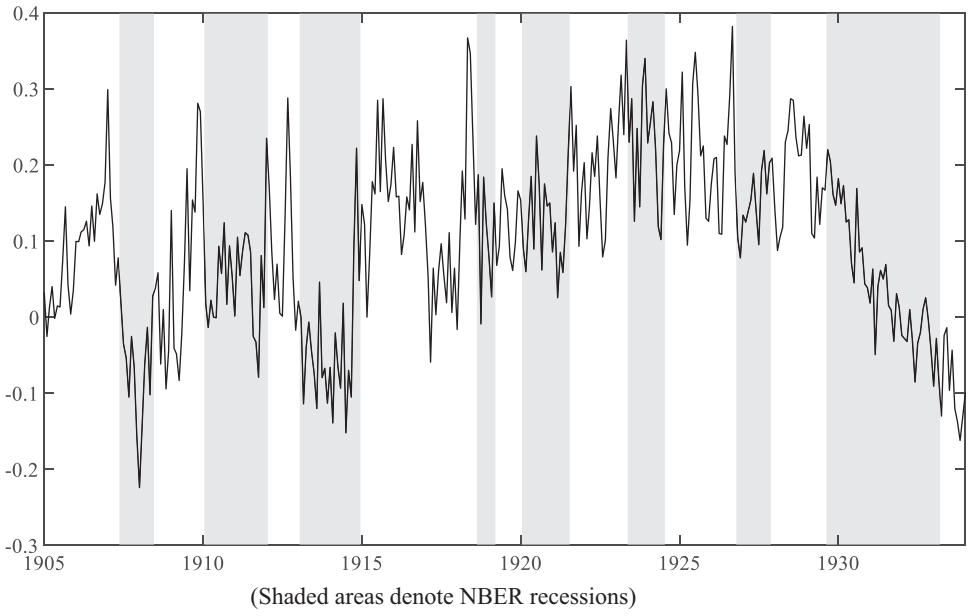

FIGURE 1 Index of business sentiment for *The Wall Street Journal* (*WSJ*) (1920–34). The series depicted is constructed using equation (1) and reflects the difference between approach and avoidance words in articles appearing in *WSJ*. The series is calculated at a monthly frequency. The shaded regions are NBER recession dates. *Source*: Authors calculations; see Section I

a different lexicon to construct a sentiment index based on two columns that were regularly published in *NYT*. Our sentiment index has a correlation of 0.57 with that of Garcia, which is not surprising since the columns that are followed focus on financial markets rather than business and finance.[26]

WSJ is one source of financial information that agents used during this period. *WSJ* had an estimated 7000 readers in 1902, climbing to 50 000 by the end of the 1920s. It can be seen as a good source of information for financial market and business professionals, rather than a general readership.[27] An alternative source of information that agents read during this period was *NYT*. *NYT*, however, reports on events other than business and the financial markets, whereas *WSJ* is a more specialised publication. Using equation (1), we construct a business-sentiment series based on articles from *NYT* in addition to the business-sentiment series constructed from *WSJ*. A priori, there is no expectation that the two business-sentiment series would contain the same information, and in our analyses, reported below, we include both series. The business-sentiment series constructed from both *WSJ* and *NYT* are reported in figure 2. It is clear from inspection of the figure that the information obtained from *WSJ* is different from the information obtained from *NYT*. In particular, the business sentiment obtained from *WSJ* declines at a faster rate than that from *NYT* from 1928 to 1932.

It should be noted that there are several other approaches to measure business sentiment. A notable approach is that of LM.[28] This index has been used widely as a benchmark and as a way

[26] Garcia, 'Sentiment during recessions.'

[27] Rosenberg, *Inside the WSJ*.

[28] Loughran and McDonald, 'When is a liability not a liability?'.

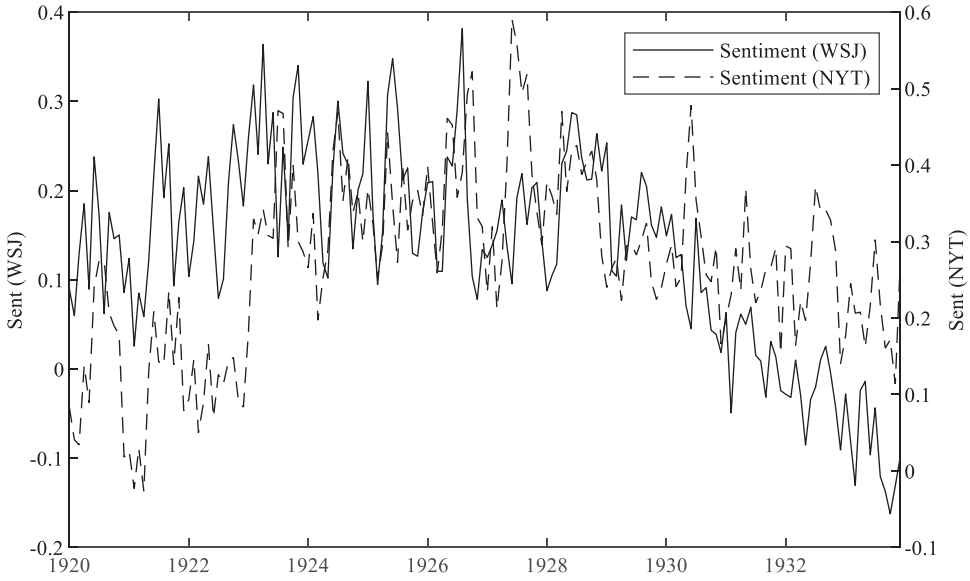

FIGURE 2 Comparison of business sentiment constructed from *WSJ* and *NYT*. The solid line represents the sentiment series obtained from *WSJ*, and the dashed line represents the sentiment series obtained from *NYT*. The left-hand axis is the scale for the *WSJ* sentiment series, and the right-hand axis contains the scale for the *NYT* sentiment series. The sentiment series is constructed using equation (1). *Source*: Authors calculations; see Section I

of measuring business sentiment in financial news text analysis, most recently in Calomiris and Mamysky.[29] This lexicon comprises 2355 negative and 354 positive words and is more tailored to financial reports. As a robustness check, we also construct a business-sentiment series using the lexicon of words from LM.

Figure 3 depicts the business-sentiment series that we construct using the approach/avoidance lexicon and the business-sentiment series constructed using the lexicon of words from LM. While the two series depicted show similar patterns, there are some noticeable differences. One noticeable difference is that the underlying trend in the business sentiment that we construct turns negative earlier in 1928 than the underlying trend in the business-sentiment series constructed using the lexicon of words from LM. The differences in the two series show that the *WSJ*-derived sentiment series moves before the *NYT*-derived sentiment series. Note that the *NYT*-derived series is derived from all articles in *NYT*, not just business- and finance-related articles. Our conjecture is that sentiment in non-business-related news moves after sentiment in business and finance news.

One thing to note is that a limitation of text-based approaches is that there is no way to determine the cause of the sentiment of the writer. We can only observe the topic of the article, not the cause of the underlying emotion. A writer's language can betray their emotion but not the root cause of their emotion. Thus, it is difficult to know what caused the turning point in the observed emotion from reading the articles alone. Analysis of the topics of articles during the period in which the sentiment series turn does not yield strong insights as to what caused the change in the trend of emotion.

[29] Calomiris and Mamaysky, 'How news and its context drive risk'.

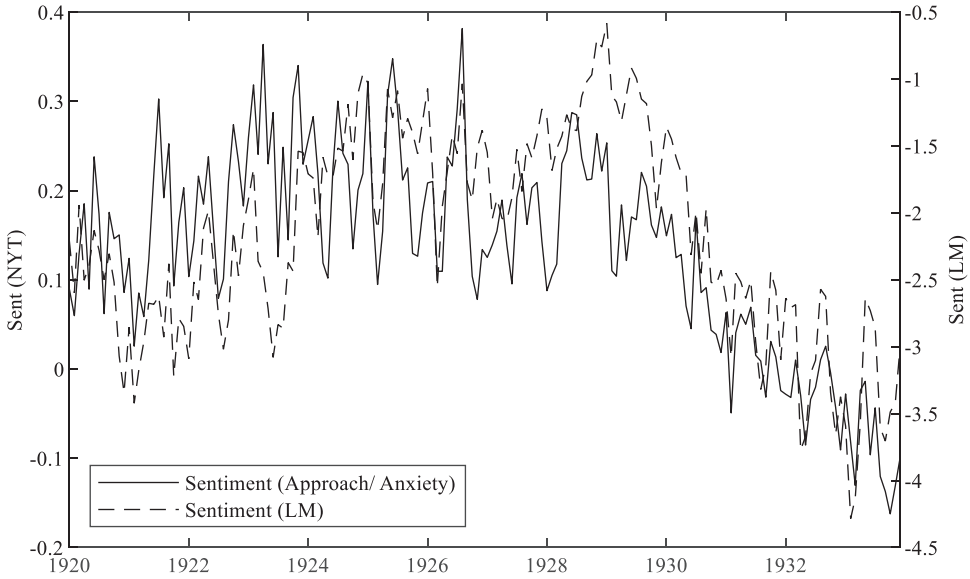

FIGURE 3 Comparison of business sentiment from *The Wall Street Journal* (*WSJ*) with alternative Loughran and McDonald series. The solid line represents the sentiment series obtained from *WSJ* using the approach and avoidance lexicon, while the dashed line represents the sentiment series obtained from *WSJ* using the lexicon of Loughran and McDonald. *Source*: Authors calculations; see Section I

II | IDENTIFICATION OF THE IMPACT OF BUSINESS SENTIMENT ON THE ECONOMY

To determine the impact of business sentiment on the real economy, a VECM was estimated that contains the following variables: the (natural) logarithm of IP, the logarithm of the Standard and Poor's 500 stock market index (SP), the logarithm of the secured bank loans (LOANS), the logarithm of the price level (CPI), the nominal interest rate (R^{3m}), the term spread (R^{term} – the 10-year rate minus the 3-month rate), the credit risk spread (R^{risk}), a measure of economic policy uncertainty (EPU), and our measures of business sentiment (S^{NYT} and S^{WSJ}).[30] The interest rates are the 3-month time-loan rates at New York banks, and the credit risk spread is the spread between Moody's seasoned Baa corporate bond yield minus the long-term (over 10 years) Treasury composite yield. This credit risk spread is 'an indicator of the strength of lender preferences for safe, liquid assets (and hence of the difficulty of borrowers in obtaining funds) …'.[31] Time series for these data are depicted in figure A5 in the online Appendix together with the constructed business-sentiment data from *WSJ* and *NYT*.

[30] Data sources are as follows: IP (http://fred.stlousi.org/series/INDPRO, first accessed January 2019), Stock Market (http://www.econ.yale.edu/~shiller/data.htm, first accessed January 2019); Bank Loans (https://fred.stlouisfed.org/series/M14074USM027NNBR>, first accessed January 2019); CPI (https://fred.stlouis.org/series/M04128USM350NNBR, first accessed January 2019); R^{3m} (data used in Cecchetti, 'Prices during the Great Depression'; interest rate data from Mankiw and Miron, 'Changing behavior'); EPU, Baker et al., 'Measuring economic policy uncertainty'). The stock market data are based on Cowles and Associates, *Common Stock Indexes, 1871–1937* indexes of US stock prices for 59 industrial groups; the data were accessed first in 2017.

[31] Bernanke, 'Nonmonetary effects', p. 266.

IP is included to incorporate the real side of the economy into the model. We include IP rather than GDP/GNP as IP is available at monthly frequency while GDP/GNP is only available at quarterly frequency at best. During this period, the service component of the US economy was not as large as it is today. We believe the benefit of estimating the model at the monthly frequency outweighs the loss of the information caused by using IP over GDP/GNP.

Bank loans are also used in the model. Alternative specifications used M1 and M2. The results we obtained from these alternative specifications were qualitatively similar to the results presented here. Bank loans make up a large part of deposits, and so the bank loans series contains similar information to M1 and M2. More importantly, the inclusion of bank loans allows us to model a channel for why business sentiment affects output. Our hypothesis is that business sentiment affects, at the margin, decisions to take out loans, which then impacts investment and, finally, output. As there are no reliable investment data for this period, we included bank loans instead.

We use two sources of news. Our aim is to investigate the business-sentiment content of news from *WSJ* as this news is focused on business, finance, and the economy. We include the information gathered from *NYT* as well to control for general news, as this paper had a larger circulation during this time. *NYT* circulation in December 1928, for instance, was 429 537.[32]

The shock to business sentiment is identified using an orthogonalised decomposition of the variance–covariance matrix obtained by estimating a VECM. Note that we also estimated a vector autoregression (VAR) model in 'levels' as a robustness check. The results from the VAR were qualitatively similar to the results from our preferred VECM specification.

The business-sentiment series constructed from *WSJ* is ordered last in our model. This has a number of implications for the interpretation of the shocks that are identified. First, the business-sentiment shock is orthogonal to all other shocks in the model. That is, the business-sentiment shock is orthogonal to the shock to output, shock to the stock market, shock to bank loans, shock to the price level, shock to the short-term interest rate, shocks to the term and credit risk spreads, shock to EPU, and shock to the sentiment obtained from *NYT*. There is no structural interpretation to these shocks, but it is reasonable to expect that these shocks include aggregate demand and aggregate supply shocks, along with credit market and monetary shocks.

As the business-sentiment variable is ordered last, the identified business-sentiment shock does not have an immediate impact on any of the variables in the econometric model. It is possible, however, that the business sentiment that is measured is contaminated by 'news'. By ordering business sentiment last, we are allowing the 'news' contamination in measured sentiment to be filtered away, leaving pure sentiment. Our reasoning is two-fold: first, news about the economy is internalised in stock and credit markets. The business-sentiment shock that is identified is orthogonal to shocks to stock and credit markets. Second, the business-sentiment shock only affects the other variables in the system with a delay. Thus, we are identifying shocks to the slow-moving (or long-run) component of business sentiment, not the short-run component. We find that the long-run component of business sentiment is not contaminated by non-business news.

It should also be noted that the approach of using written text to identify sentiment cannot identify the original cause of the sentiment. There is no guarantee that the topic written about in the article is the cause of the underlying sentiment being betrayed by the author's use of approach or avoidance words.

The data used in our analysis all contain a unit root, and the Johansen test for co-integration yields evidence of four co-integrating vectors. Information criteria suggest that the VECM should

[32] 'Circulation. gains in December', *The New York Times*, 24 January 1929, p. 21.

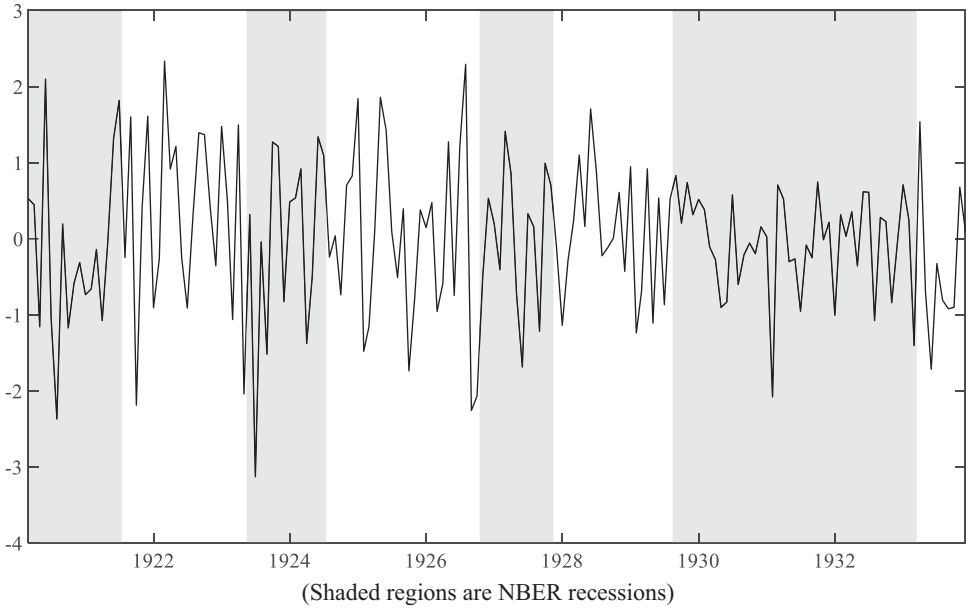

FIGURE 4 Identified business-sentiment shock. The solid line represents the identified (orthogonalised) business-sentiment shock obtained from ordering *The Wall Street Journal* (*WSJ*) sentiment series last in a 10-variable vector error correction model. The shaded regions represent NBER recessions. *Source*: Authors calculations; see Section II

be estimated with one lag.[33] The VECM was estimated with the variables ordered as listed above. Orthogonalised shocks are identified using a Cholesky decomposition of the residual variance–covariance matrix. Given the ordering, the business-sentiment shock obtained from *WSJ* is interpreted as a 'pure' business-sentiment shock after controlling for shocks to IP, the S&P 500 stock market index, bank loans, price level (CPI), interest rates (3 months), the term spread, the risk spread, EPU, and general news.

The VECM was estimated using likelihood methods. The full results are available in the online Appendix.. The estimates show a stable long-run relationship between the time series, with the business-sentiment series obtained from *WSJ* having a positive and significant long-run relationship with IP, the S&P 500 stock index, and bank loans. The identified business-sentiment shock is depicted in figure 4. The grey areas in the figure represent the NBER recession dates for this period.

Table 1 reports the forecast error variance decomposition (FEVD) for each variable to a one-standard-deviation shock to business sentiment. The results show that the identified business-sentiment shock accounts for up to 16 per cent of the forecast error variance for IP over the medium to long term (20 months), up to 2.5 per cent of the forecast error variance for the S&P 500 stock index, up to 12 per cent of the forecast error variance of bank loans, and up to 3.5 per cent of the forecast error variance of the credit risk spread.

Figure 5 reports the response of each variable to the business-sentiment shock identified from the VECM. The confidence intervals are constructed using Hall's method with 1000 bootstrap

[33] Johansen, *Likelihood-based inference*.

TABLE 1 Forecast error variance decomposition of a shock to business sentiment

Period	ip	*sp*500	loans	p	R^{3m}	R^{term}	R^{risk}	EPU	s^{NYT}	s^{WSJ}
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	78.42
2	1.85	0.17	0.46	0.01	0.02	0.02	0.17	1.17	0.13	72.98
3	4.67	0.51	3.92	0.03	0.02	0.02	1.19	1.09	0.92	67.80
4	7.54	1.12	7.47	0.08	0.02	0.02	2.58	1.45	2.22	63.91
5	10.00	1.76	10.07	0.19	0.02	0.01	3.38	1.75	3.21	61.04
10	15.43	2.35	12.68	0.82	0.01	0.01	2.63	1.63	4.91	53.80
15	16.31	2.36	11.73	1.08	0.03	0.01	2.01	1.81	5.40	49.92
20	16.49	2.32	10.92	1.19	0.06	0.02	1.63	1.86	5.42	47.15

Note: Numbers reported are in percentages. Lowercase variables are in logarithms.
Source: authors calculation. See Section II.

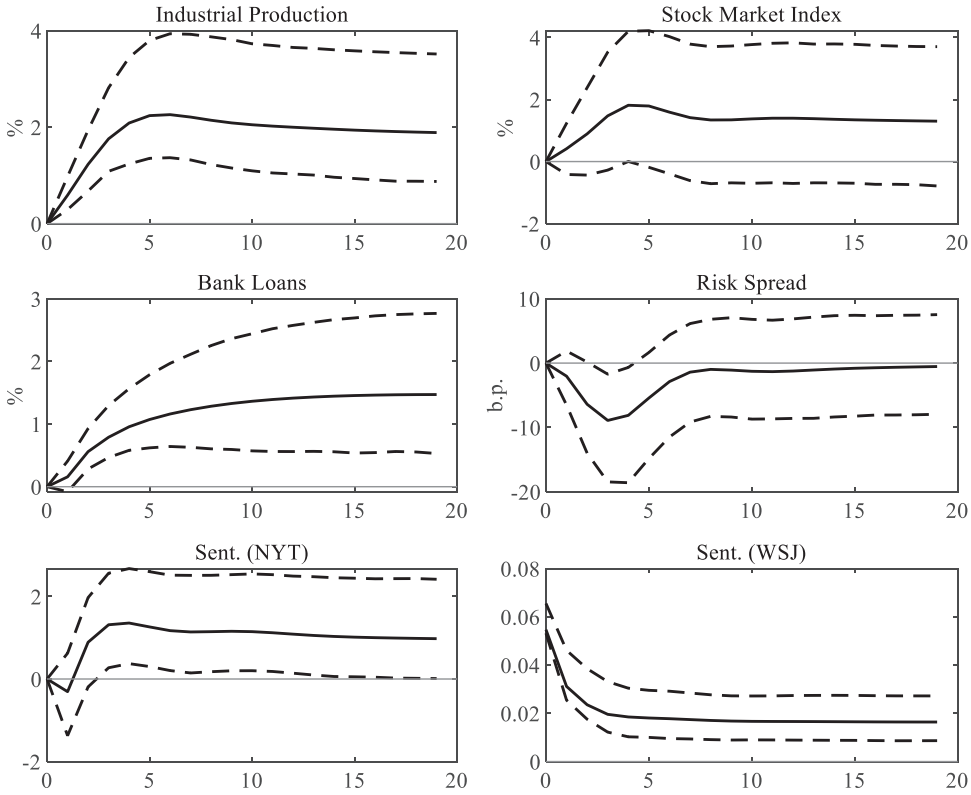

FIGURE 5 Impulse response functions for business-sentiment shock. The solid lines represent the mean impulse response of the selected variables to a one-standard-deviation shock to the business-sentiment shock. The business-sentiment shock was obtained from ordering the *WSJ* sentiment series last in a 10-variable vector error correction model. The dashed lines represent a 95 per cent bootstrapped confidence interval using 1000 bootstrap replications using the method of Hall, *The bootstrap and Edgeworth expansion*. *Source*: Authors calculations; see Section II

replications.[34] The business-sentiment shock has a positive and significant impact on IP, the S&P 500 stock index, bank loans, the credit risk spread, and the business-sentiment series obtained from *NYT*. The business-sentiment shock has a significant and negative impact on the credit risk spread and EPU.

The online Appendix contains the full set of impulse response functions. The evidence shows that the identified business-sentiment shock does have an impact on important real variables with a delay between three and eight months. This is consistent with the FEVDs reported in table 1.

We have shown that the identified business-sentiment shock affects output, the stock market, business loans, and the credit risk spread. The inference is that business-sentiment affects the economy through the credit channel. That is, a positive shock to business sentiment increases business loans and lowers the credit risk spread, a key measure of the price Baa-rated firms pay for raising capital through the bond market.

Note that the emphasis of this analysis is the identification of the component of shocks to business sentiment that is orthogonal to a large number of fundamental shocks. These shocks are then used in historical decompositions for different subperiods of our sample. It is important then that the identified shocks have a consistent interpretation across the whole sample. The FEVD and impulse response functions are not the main priority of the analysis. Alternative approaches to estimating the impulse response function, such as the method of local projections, were not considered, as this approach does not yield an innovation to sentiment with a consistent interpretation across the sample.

Before analysing our results for some important periods of our sample, we performed a number of robustness tests of our specification. We first reversed the order that the two-sentiment series appeared in the model. The results were unchanged, suggesting that the sentiment series obtained from *NYT* contains different information to the business-sentiment series obtained from *WSJ*.

The next robustness checks were to replace the sentiment series obtained from *NYT* with alternative sentiment series obtained from *WSJ* using the different lexicons of LM and alternative *NYT*-based series from Garcia. Our results again did not change, suggesting that the lexicon of approach/avoidance words used does contain different information to the standard lexicons used in the literature.

III | HISTORICAL DECOMPOSITIONS OF IMPORTANT PERIODS IN OUR SAMPLE

The FEVD and the impulse response functions, reported in figure 5, report the average impact of a 'pure' business-sentiment shock on each series in the model. In this section, we focus on specific periods to assess the impact of the business-sentiment shock using historical decompositions. The historical decompositions report the counterfactual experiment of what would have happened had the business-sentiment shock not occurred. That is, the business-sentiment shock is set to zero for all dates in the subperiod and a counterfactual series is created using the estimated model. The periods that we chose are either periods where there are large one-off shocks to business sentiment or periods where there are runs of shocks of one sign. The historical decomposition therefore allows us to report the accumulated impact of the business-sentiment shocks.

[34] Hall, *The bootstrap and Edgeworth expansion*.

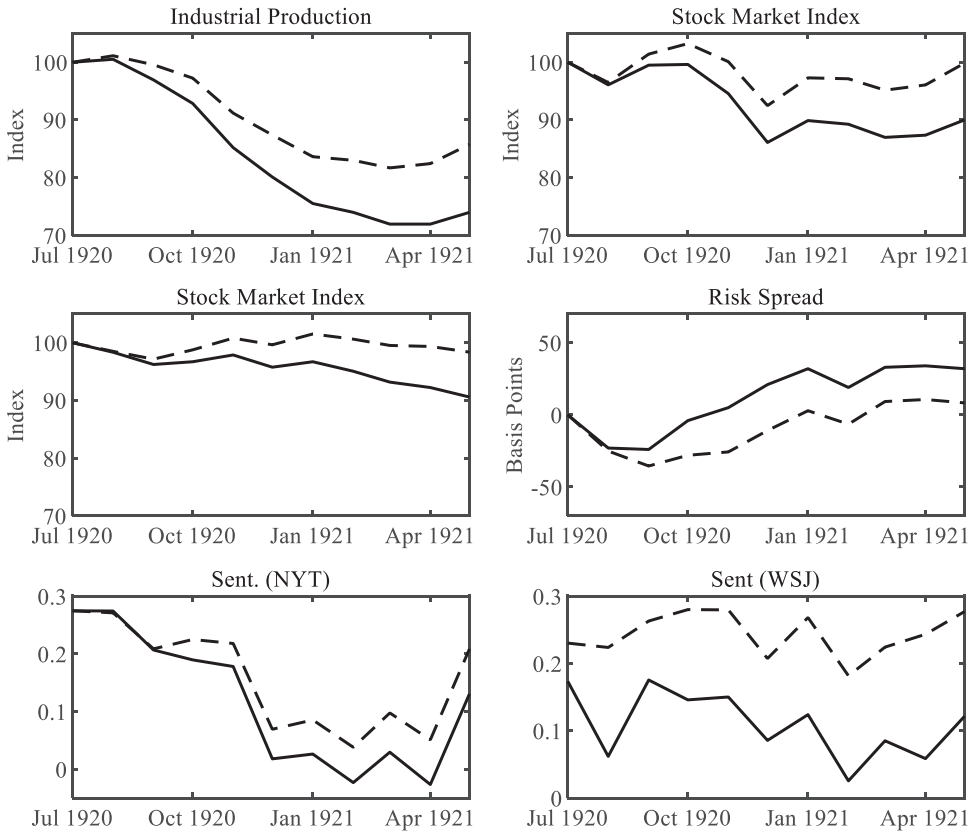

FIGURE 6 Historical decomposition for July 1920 to May 1921. Industrial production, the stock market, bank loans, and prices are normalised to equal 100 for the first date of each subperiod. The credit risk spread is measured in deviations (in basis points) from the value at the first date of each subperiod. The solid line is the actual data, while the dashed line is the counterfactual series with the business-sentiment shock removed. *Source*: Authors calculations; see Section III

In what follows, we look in more detail at some periods in our sample and comment on what might have driven business sentiment during these periods. In particular, how much optimism, and how much worry, was generated by observations of domestic developments. In addition, how far did articles reflect a concern that foreign developments, financial instability, and worries about government debt levels, but also labour militancy, might spill over into the United States? The online Appendix reports historical decompositions for all variables and for a larger set of subperiods. Here, we report the historical decomposition for important variables and for periods in which there were some large impacts.

During the early 1920s, there was a sharp recession in the United States. The first period that we investigate using historical decompositions is the period from July 1920 to May 1921. During this period, there was a run of moderately large negative business-sentiment shocks, as seen in figure 4.

Figure 6 depicts the historical decomposition for this period. The solid line in each tile is the actual data for this subperiod and the dashed line is the counterfactual series under the assumption that the business-sentiment shocks are set to zero from July 1920 to May 1921. To compare IP, the stock market index, and bank loans, each variable is normalised to be 100 at the start of the

period. For the credit risk spread, the historical decompositions are reported in deviations from the initial value, in basis points.

It is quite clear from the figure that the run of moderately large business-sentiment shocks in late 1920 to early 1921 had a significant impact on some of the variables of our system. Measured business sentiment, obtained from *WSJ*, would have been roughly four times higher had business sentiment only been driven by the other shocks in the system. The impact of this lower business sentiment was to lower IP, lower the stock market, lower bank loans, and increase the credit risk spread.

As can be seen by the dashed line, had it not been for the run of negative business-sentiment shocks, IP would have been 15 per cent higher than it actually was. That is, the accumulated impact of the run of negative business sentiment during this period was to lower industrial output by about 15 per cent. The impact on the stock market was 11 per cent, and the impact on bank loans was about 8 per cent. The credit risk spread was about 25 basis points higher.

During this period, the run of negative business-sentiment shocks had a significant impact on IP and the stock market. The credit channel is the obvious explanation for this as we see that bank loans decrease because of the negative business sentiment, and it was also more expensive for Baa-rated firms to raise capital in the bond market.

The articles that score high on 'avoidance' dealt with domestic conditions in the United States, but also with the impact of foreign political uncertainties, especially the western military push of the Soviet armies, and the uncertainty about Germany and reparations. In July 1920, the highest-rating article in 'avoidance' terms reported on the complaint of Comptroller of the Currency John Skelton Williams about the 'excessive and burdensome interest rates, running up to 10 per cent, 12 per cent and 15 per cent and higher' charged by New York banks.[35] Other articles dealt with transportation difficulties and coal shortages, with discussions that the wartime control of coal might be required to combat bottlenecks in the supply of bituminous coal and anthracite.[36] In August 1920, a substantial number of articles were concerned with the slow pace of downward wage adjustments and consequent threats to profitability.[37] While consumer prices were falling during this period, railway wages were not. There was deep concern that the Interstate Commerce Commission was not allowing railroads to increase their shipping prices, which was affecting profits. This meant that railroads were not investing in increased capacity, leading to problems with capacity constraints within the system.

The next period in the early 1920s is from June 1921 to March 1922. This reflects the expansion of output after the end of the recession in 1921. This is also a period of predominantly large positive shocks to business sentiment. A characteristic article is the upbeat reflection of Charles M. Schwab, the steel magnate and former director-general of the wartime Emergency Fleet Corporation: 'Out of the decisions which are made within the few months there may arise the *greatest* prosperity the world has ever known … it is impossible for me to be anything but an optimist. To me the world is so full of opportunity and *promise* and *confidence*, that I cannot look forward to anything but a future full of *brilliance* and abundance'.[38]

[35] 'Comptroller Williams criticises money rates', *The Wall Street Journal*, 31 July 1920: 1 (number 1 in avoidance in July 1920).

[36] 'Coal may go back to government control', *The Wall Street Journal* 12 July 1920: 9 (number 3 in avoidance in July 1920).

[37] 'Western bank doubts if prices decline much', *The Wall Street Journal*, 13 Aug 1920: 10 (number 1 in avoidance in August 1920).

[38] 'Schwab says we won war shall we win the peace?', *The Wall Street Journal*, 29 April 1921 (number 1 in approach in April 1921).

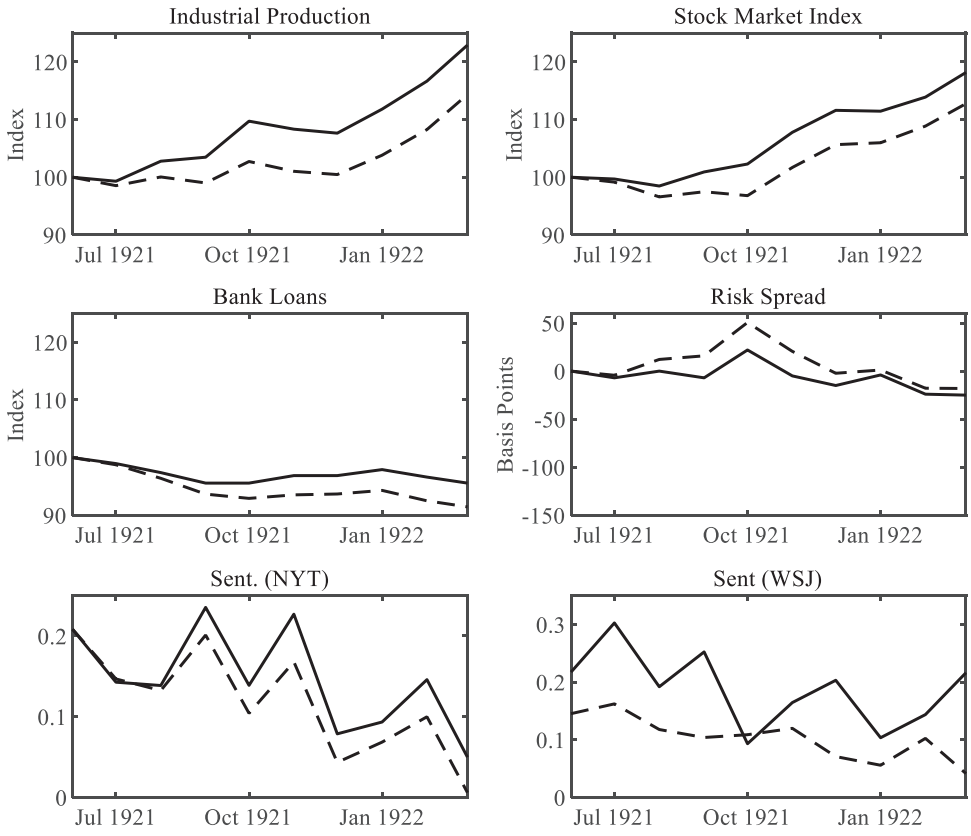

FIGURE 7 Historical decomposition for June 1921 to March 1922. Industrial production, the stock market, bank loans, and prices are normalised to equal 100 for the first date of each subperiod. The credit risk spread is measured in deviations (in basis points) from the value at the first date of each subperiod. The solid line is the actual data, while the dashed line is the counterfactual series with the business-sentiment shock removed. *Source*: Authors calculations; see Section III

The historical decomposition for this subperiod can be found in figure 7. This period is a mirror image of the previous subperiod in that the run of predominantly positive business-sentiment shocks have significant and positive impact on IP, the stock market, bank loans, and the credit risk spread. IP is 7 per cent higher than the counterfactual IP series, the stock market is 5 per cent higher, bank loans are 4 per cent higher, and the credit risk spread is 28 basis points lower in October 1921. Again, this points to business sentiment affecting the economy though the credit channel.

The next period that we investigate is the period from May to November of 1923. In May, July, and September, there are large negative shocks to business sentiment, with the July 1923 shock being the largest shock over the whole sample, as seen from figure 4. This is also the start of an official recession. Figure 8 depicts the historical decomposition for this period. The accumulated impact of these large negative business-sentiment shocks is that IP is 12 per cent lower than the counterfactual series, the stock market index is 9 per cent lower, market index and bank loans are 6 per cent lower, and the credit risk spread is 37 basis points higher. The historical decompositions reported in figure 8 all show that the negative sentiment shocks had a significant and negative effect on the economy.

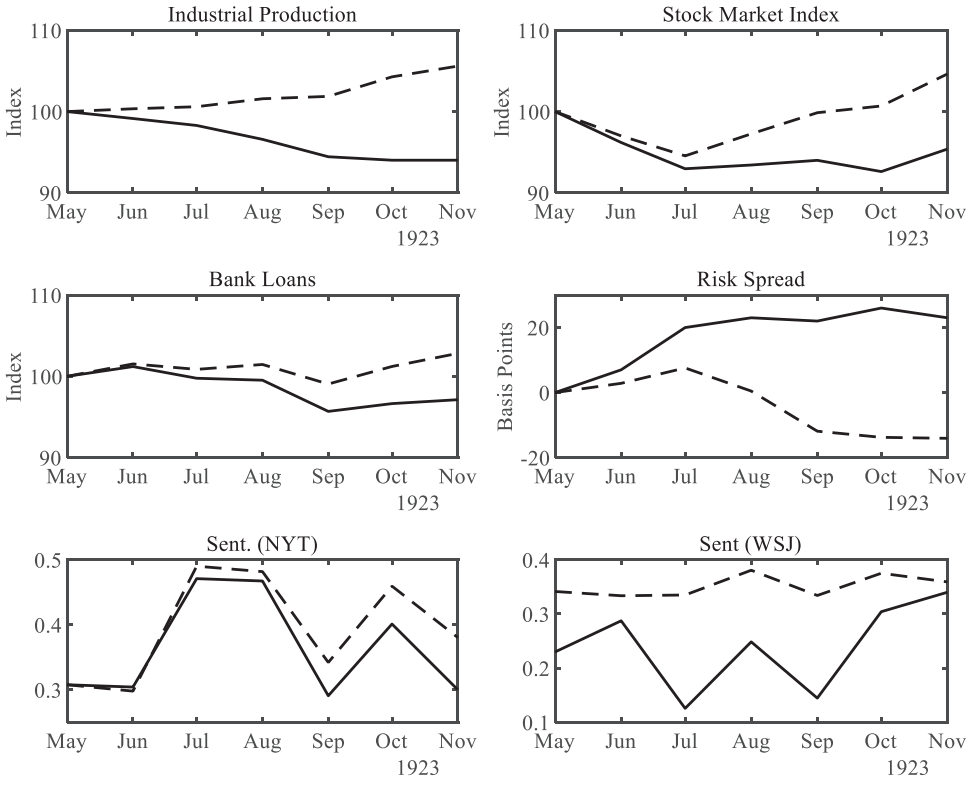

FIGURE 8 Historical decomposition for May 1923 to November 1923. Industrial production, the stock market, bank loans, and prices are normalised to equal 100 for the first date of each subperiod. The credit risk spread is measured in deviations (in basis points) from the value at the first date of each subperiod. The solid line is the actual data, while the dashed line is the counterfactual series with the business-sentiment shock removed. *Source*: Authors calculations; see Section III

These sentiment shocks relate very clearly to conditions in Europe. A characteristic piece in *WSJ*, the highest-rated piece in 'avoidance' terms in July 1923, the month of the greatest negative shock, was a report on the return to the United States of Oscar W. Underwood, Democratic Senator from Alabama and two-time serious contender for the Presidency, who spent four months in Europe observing economic and political conditions:

> 'most, like myself, have failed to realise how exhausted by war are many of the nations of Europe, both as to governmental finance and private endeavour. There is a hectic business development along certain lines, but it more largely comes from the money of the profiteer. … Stability of government is almost as *uncertain* as stability of finance. In one country it may be a near revolution that *threatens*, in another a change of ministry, but in either event the government working under such conditions is generally weak, and drifting from day to day without effective policy for the future, instead of moving forward to a goal that can be won by political courage with a definite policy'. [39]

[39] 'Underwood says Europe is worse', *The Wall Street Journal*, 6 July 1923 (number 1 in avoidance, July 1923).

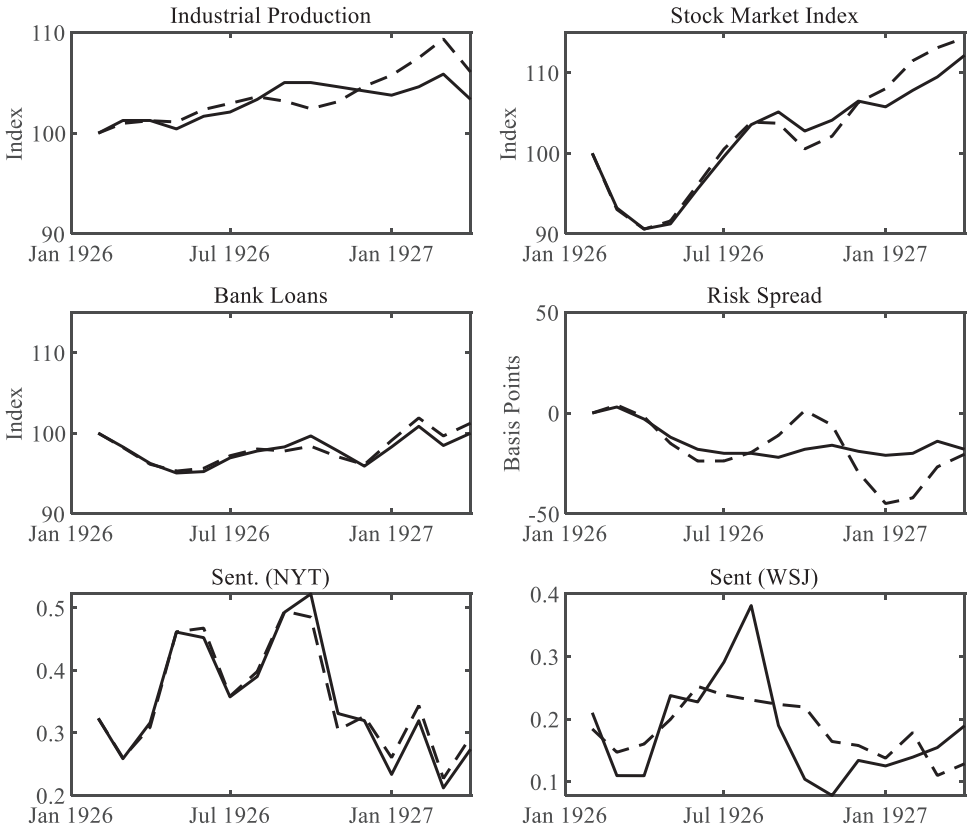

FIGURE 9 Historical decomposition for February 1926 to April 1927. Industrial production, the stock market, bank loans, and prices are normalised to equal 100 for the first date of each subperiod. The credit risk spread is measured in deviations (in basis points) from the value at the first date of each subperiod. The solid line is the actual data, while the dashed line is the counterfactual series with the business-sentiment shock removed. *Source*: Authors calculations; see Section III

In addition, Underwood then complained that American policy was unhelpful: 'We seem to be just observing and drifting'. The case is not that the European misery was hurting America directly, but that it was dragging down business sentiment.

The year 1926, in which growth was generally sustained and resilient, provides some interesting examples of how sentiment shocks affect economic outcomes. Starting in May 1926 and ending in August 1926, there is a surge in our business-sentiment index, culminating in a large positive business-sentiment shock in both July and August of 1926. However, in September 1926, there is an almost equally as large negative business-sentiment shock that lasts for two months, as can be seen in figure 4.

The impact of the large swings in business sentiment can be seen in the historical decompositions depicted in figure 9. The impact of the positive business-sentiment shock in July and August is profound. In fact, had it not been for the business-sentiment shock in July and August, business sentiment would have fallen. The same is observed for IP. The actual IP series continues its upward trend from August to September, whereas the counterfactual series (dashed line) shows IP declining during this period. Had it not been for the positive business-sentiment shock in August,

it appears that IP should have fallen. The gap between the actual IP and the counterfactual IP is maximised in October and is equal to 3 per cent. At the same time, the stock market index is 3 per cent higher than the counterfactual series and the bank loans is about 1 per cent higher than the counterfactual value. The credit risk spread is also impacted by the business-sentiment shock in August. The actual credit risk spread is flat throughout the latter part of 1926, whereas the counterfactual credit risk spread series is 19½ basis points higher than the actual spread.

The model predicts that, had it not been for the large positive business-sentiment shock in August, the economy would have had a sharp negative correction. In September, there is a sharp negative business-sentiment shock, and this shock has the opposite effect on the variables of the model. Actual IP falls, whereas the counterfactual series would have risen. By the end of 1926, the impact of the two, opposing business-sentiment shocks cancelled each other out.

This is an interesting period, as the impact of the business-sentiment shock appears to be sharp but short-lived. In the summer (June through August), there was a general level of anxiety about events in Europe, especially the currency problems in Belgium and France, but this is more than made up by positive news. The positive news is dominated by stories about railroads and crops, that is, about the events driving the US domestic economy. During this period, there are many articles containing a high number of approach words that refer to record crop yields in the upper plains and high profits for railroads, especially the Great Northern railroad. Also during this time there were articles extolling the soundness and competitiveness of the US economy. There is also a notably high degree of triumphalism.

An ecstatic article on the way foreign countries perceived the 150th anniversary of the Declaration of Independence, for instance, commented on 'the *amazing* progress that has been made by the United States' and details of the '*incredible* total' of American wealth: 'Articles are appearing in the British press describing the money glut in the United States – the vast hoard of more than half the gold of the world. The American government has a surplus of $350 000 000, says the daily press, while the British government has a deficit of at least $100 000 000'.[40] The story with the highest approach rating starts with a celebration of US Steel's '*brilliant* performance'.[41] However, there is no one unifying theme in this triumphalism, suggesting that the run-up of business sentiment during the middle of 1926 reflects a surge in sentiment rather than being the result of any specific news.

In September 1926, there followed an equally sizeable negative business-sentiment shock, with worries about US trade performance and competitiveness, as exports to Canada and Germany produced gold outflows from the United States.[42] Interestingly, the top article in avoidance terms concerned allegations of market manipulation through the press – *WSJ* and the Dow Jones ticker. C. W. Barron, the president of Dow Jones, assured the readers of his newspaper that he had never had occasion to sack any reporter for 'faithlessness'.[43] There is also discussion of bad weather in Texas and disease and pestilence in the cotton crop. This period provides an example of a short sharp bout of enthusiasm followed by what appears to be an overreaction the other way. The

[40] 'Herbert N. Casson, 'America's progress astounds Britain: publication of facts on wealth of United States amaze people of older nation', *The Wall Street Journal*, 19 July 1926, p. 10 (number 4 in approach, July 1926).

[41] 'Market comment: buying grows in volume big investment demand', *The Wall Street Journal*, 1 July 1926, p. 16 (number 1 in approach, July 1926).

[42] 'Gold flowing in both ways: exports going to Canada and Germany', *The Wall Street Journal*, 9 Sep 1926, p. 8.

[43] 'U.S. Steel – General Motors: B.C. Forbes tells 'inside story' of now famous articles by Dow, Jones & Co', *The Wall Street Journal*, 1 Sep 1926, p. 11 (number 1 in avoidance in September 1926).

impact on IP is short and sharp as well. The overall impact is about 4 per cent, with a short increase when the counterfactual series suggests IP should have gone the other way.

Then there are two large negative sentiment shocks at the same time that fundamentals would suggest an increase in IP was likely. Actual IP fell when the counterfactual IP series, where the sentiment shocks are set to zero, was rising. We also see the stock market index rising slower than what would have been predicted without the sentiment shocks, and we see that the credit risk spread would have been substantially lower had it not been for the negative business-sentiment shocks in September and October.

The turn to a strong negative business-sentiment shock in September and October 1926 well illustrates the way in which it is not specific news, but rather general doubts, often about market integrity, that pulled down investor spirits. Some of the shock came simply from the technical operation of the market and the constraints on credit it imposed. Thus, at the end of September, there was heavy calling of loans, and 'stocks dragged through another day of *uncertainty* as a result of heavy requisitions for money in connection with October first settlements'. There was, in consequence, 'a heavy drain on credit available for speculative purposes', leading to considerable selling of stocks carried on margin.[44]

The more interesting articles, and ones that score highest in negative sentiment, looked at accusations that the market was being rigged. On this issue, *WSJ* was generally defensive, and argued that the charges were ill-founded; but it is plausible that just the discussion of the issue sowed seeds of doubt. Thus, for instance the highest-ranking article in avoidance in September 1926 was an interview with B. C. (Bertie Charles) Forbes, the founder of *Forbes Magazine*, over the handling in *WSJ* of an interview with JP Morgan partner Thomas Cochran, and claims that the newspaper had tried to manipulate stock in the financial interest of its writers or staff. Forbes gave a forceful defence, but perhaps protested too much:

> 'I have trained the Dow-Jones staff over many years; and if a single member of it was faithless to his trust, or gave any subscriber an advantage over any other subscriber, or in any way used his information for private personal gain, he would be shunned by his associates ever before he would be by me decapitated. I am happy to say that I do not recall ever having to discharge a reporter in any city for faithlessness to his trust as a financial journalist'.[45]

The second highest in avoidance terms in September was also an article about accusations of market manipulation, this time by the oil industry after the Attorney General of Texas brought a suit against the Marland Oil Company.[46]

The same debate was at the top of the negative articles in October 1926 that delivered yet a new sentiment shock. 'Corporate publicity, as a question affecting the investor in securities, looms largely in the public eye today. This is due to a great extent to the articles by Professor William Z. Ripley who has been attacking such corporations as *fail* [sic] to give their stockholders and the investing public at large a full account of their activities and financial standing'. Again, *WSJ* attempted a defence of corporations against the charges of rigging: 'The work of the stock exchange making for fuller information for stockholders has not won the praise it deserves; in

[44] 'Market comment', *The Wall Street Journal*, 30 September 1926.

[45] 'U.S. Steel – General Motors', *The Wall Street Journal*, 1 September 1926 (number 1 in avoidance September 1926).

[46] 'Texas suit may not embarrass Marland', *The Wall Street Journal*, 27 September 1926 (number 2 in avoidance September 1926).

fact, the exchange often has been for its *failure* to insist on such publicity. These criticisms have been due for the most part to the fact that few people understand the limitations under which the exchange naturally operates, or are aware of the efforts it has made and is still making'.[47] There were similar discussions of accusations that the major houses were manipulating the bond market, and again *WSJ* was defensive: 'some of the agitation has no relation whatever to the question of helpfulness to the corporation but is rather a poorly disguised attempt to handicap larger banking houses, which by years of active counsel and work have acquired the designation of bankers for this or that company, with the pretence also of aiding the smaller houses'.[48]

Finally, the foreign themes appeared again, with articles that defended the status quo against doubts or pessimism scoring high. *WSJ* thus relayed a report of a prominent banker, Henry M. Robinson, President of First National Bank of Los Angeles, denying that the reparations settlement was unsustainable, producing an article whose ostensible message was upbeat or comforting. 'It is rather surprising that bankers and economists in the United States should be expressing opinions to the effect that there must be a revision of the Dawes Plan, when the Agent General's report gives them nothing on which to base their assertions'.[49] Just the discussion of uncertainties was sufficient to engender market nervousness.

The period leading up to the October 1929 crash is of particular interest. From April to August of 1928, there is a run of moderately sized positive sentiment shocks. Then, starting in February 1929 through July 1929, there is a run of large negative sentiment shocks, with the largest negative sentiment-shock occurring in May 1929.

The historical decomposition for the period from April 1928 to December 1928 can be found in figure 10. The run of positive business sentiment in the middle of 1928 can be seen to have impacted IP, the stock market, bank loans, and the credit risk spread considerably. By December 1928, the accumulated impact of the positive sentiment shocks amounts to a difference of 9 per cent for IP, 6 per cent for the stock market index, 4.5 per cent for bank loans, and 29 basis points for the credit risk spread. Had it not been for the positive sentiment in the middle of 1928, IP would have been flat while the credit risk spread would have risen sharply.

As shown in figure 4, there are large negative business-sentiment shocks in the first half of 1929, with the largest negative shocks occurring in February, March, and May of 1929. The historical decomposition for this period can be found in figure 11. It can be seen that the run of negative business-sentiment shocks in early 1929 had the effect of dampening IP. By September 1929, industrial output was 3 per cent lower than the counterfactual series. The overall shapes of the actual and counterfactual series were the same, but had it not been for the negative business-sentiment shocks, IP would have been lower. The stock market and bank loans were also lower, by 2.5 per cent and 1 per cent, respectively. The credit risk spread was higher by seven basis points compared with the counterfactual. The impact of the negative business-sentiment shocks was to steadily raise the cost of bond financing for Baa-rated firms.

With one exception, in February 1929, the lead-up to the dramatic stock market events is punctuated less by worries about bad or dangerous developments than by a cooling of enthusiasm, a diminution of the grounds for any euphoria. There was a shortage of any general optimistic vision. In February 1929, there was a surge of avoidance terms, mostly associated with the Federal Reserve's restriction of broker loans. The daily 'Abreast of the Market' market gossip and news column of 11 February explained that:

[47] 'Stock exchange's publicity effort', *The Wall Street Journal*, 4 October 1926 (number 1 in avoidance, October 1926).

[48] 'Bonds and bond men', *The Wall Street Journal*, 8 October 1926 (number 6 in avoidance, October 1926).

[49] 'Says Germany can meet reparations', *The Wall Street Journal*, 23 October 1926 (number 2 in avoidance, October 1926).

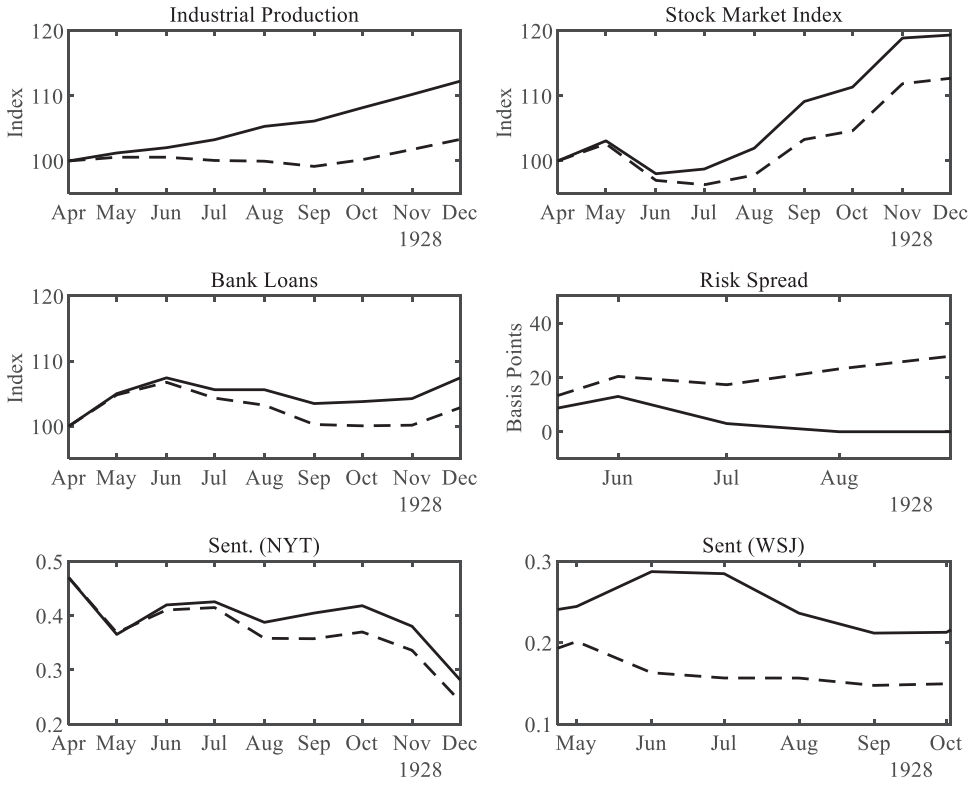

FIGURE 10 Historical decomposition for April 1928 to December 1928. Industrial production, the stock market, bank loans, and prices are normalised to equal 100 for the first date of each subperiod. The credit risk spread is measured in deviations (in basis points) from the value at the first date of each subperiod. The solid line is the actual data, while the dashed line is the counterfactual series with the business-sentiment shock removed. *Source*: Authors calculations; see Section III

> 'Sentiment generally continues pessimistic. There is a feeling that the latest warning of the Federal Reserve Board has attracted more attention than those of the past month and as a result, a general tendency to clean house is noted, particularly among those outsiders who have been outspokenly optimistic right along. Conservative observers plan to continue to favour taking profits whenever opportunities are presented, because they feel that before the market reaches a level where good buying will be encountered stocks can be repurchased at more reasonable figures'.[50]

Writers were highly critical of the Federal Reserve's crackdown on broker's loans, and there was commentary during this period that this would affect business' access to credit, as money would be diverted to the stock market from commercial loans. The newspaper reported on a National City Bank report's 'alarm' at extraordinary growth of unregulated non-bank loans being made for speculative purposes, not because the size of brokers' loans is of itself dangerous, but because non-bank lenders feel little responsibility towards the money market and may withdraw their funds at

[50] 'Abreast of the market: a daily column of comment', *The Wall Street Journal*, 11 February 1929, p. 16.

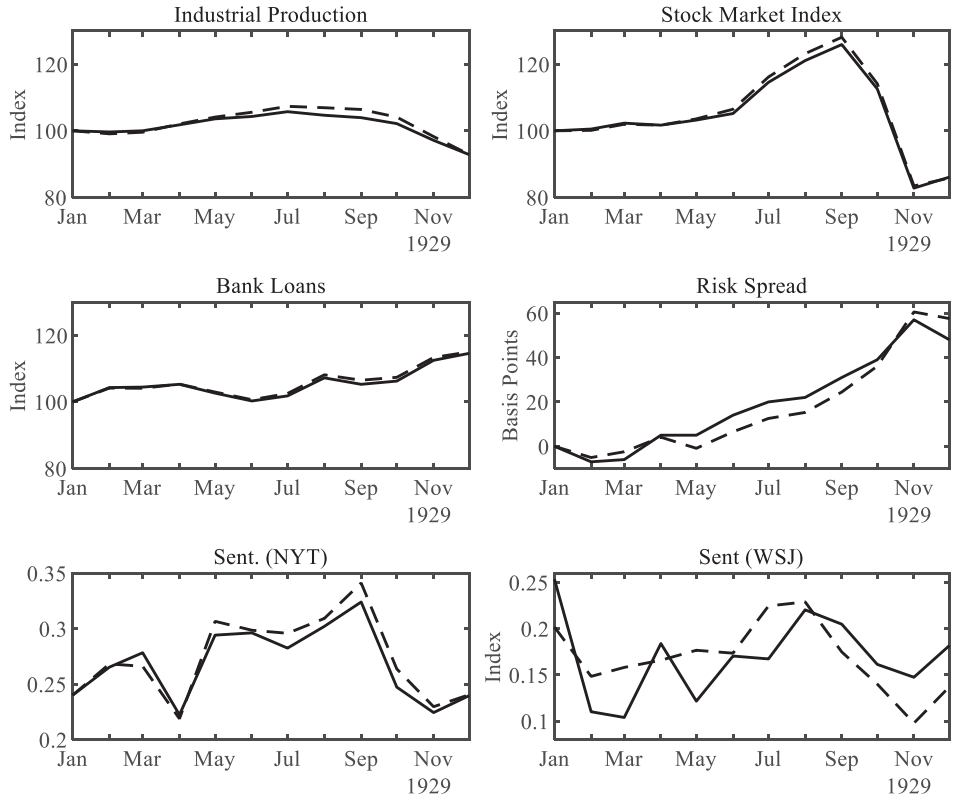

FIGURE 11 Historical decomposition for January 1929 to December 1929. Industrial production, the stock market, bank loans, and prices are normalised to equal 100 for the first date of each subperiod. The credit risk spread is measured in deviations (in basis points) from the value at the first date of each subperiod. The solid line is the actual data, while the dashed line is the counterfactual series with the business-sentiment shock removed. *Source*: Authors calculations; see Section III

a moment's notice, thus placing upon banks the responsibility of maintaining the money market on an even keel.[51]

There were complaints about the 'smug silence' of the Federal Reserve Bank of New York[52] Other worries included difficulties for railroad mergers, such as objections to a merging of the Chesapeake and Ohio with the Baltimore and Ohio.[53]

For the rest of the year leading up to the October crash, however, there is not so much of a surge in avoidance terms as an absence of approach terms, a lack of reasons to be enthusiastic about the economy or stock market. After October 1929, there is a long period of prevalence of avoidance terms, unsurprisingly, given the worsening state of economic news.[54]

[51] 'Others' loans create alarm: city bank stresses danger of potential …', *The Wall Street Journal*, 4 February 1929.

[52] 'No place for mysteries', *The Wall Street Journal*, 19 February 1929, p. 1.

[53] 'Merger plans of trunk lines: C. & O. and B. & O. unification …, from the Wall Street Journal Washington bureau', *The Wall Street Journal*, 21 February 1929, p. 1.

[54] Note that EPU is rising towards the end of 1929, which is consistent with Romer, 'The Great Crash'. Our results (see online Appendix) show that this increase in EPU is driven by news rather than by our identified business-sentiment shock.

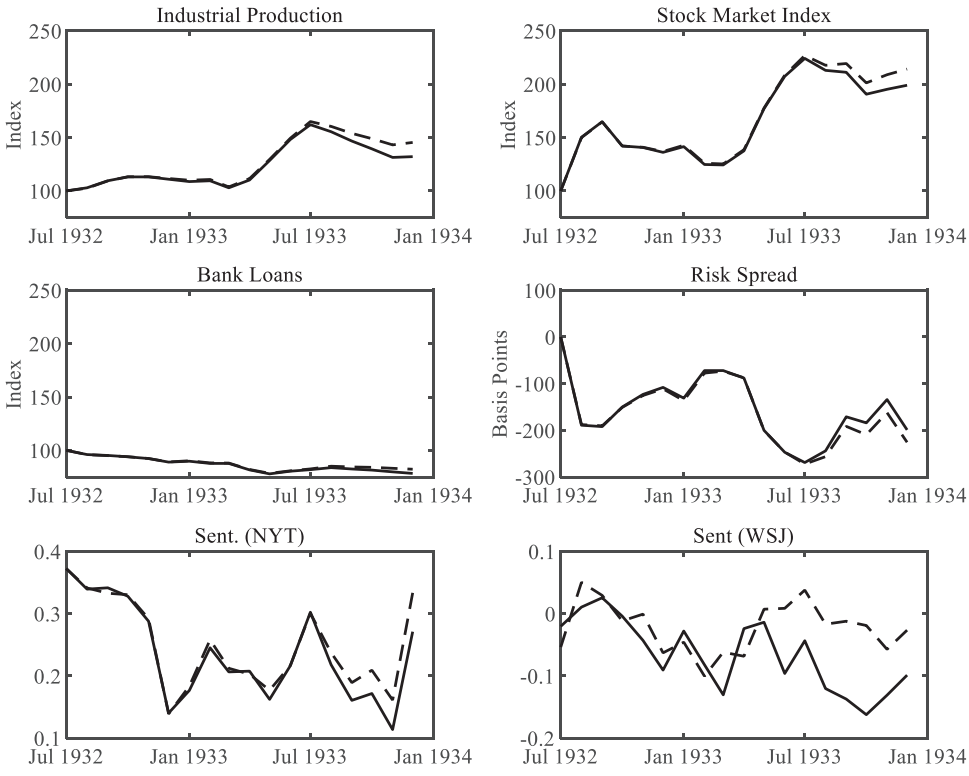

FIGURE 12 Historical decomposition for July 1932 to December 1933. Industrial production, the stock market, bank loans, and prices are normalised to equal 100 for the first date of each subperiod. The credit risk spread is measured in deviations (in basis points) from the value at the first date of each subperiod. The solid line is the actual data, while the dashed line is the counterfactual series with the business-sentiment shock removed. *Source*: Authors calculations; see Section III

From 1930, news was generally negative, but so of course was the reality that was being reported. IP fell 20 per cent in 1930 and a further 20 per cent in 1931. The stock market fared even worse. The online Appendix shows the effect of business sentiment during this period. While there are some impacts, they are relatively small compared with the overall changes in the variables of interest. The only period where business sentiment appears to make a sizeable impact is towards the end of 1933 where a run of negative business-sentiment affected IP and the stock market. This can be seen in figure 12. During this period, IP rose by 50 per cent and the stock market doubled. The run of negative business shocks in the later part of 1933 lowered IP by 10 per cent and lowered the stock market index by 7.5 per cent. Bank loans were down by 5 per cent, and the credit risk spread increased by 25 basis points in October of 1933.

These shocks appear much more clearly in the reporting and news interpretation of *WSJ* than in *NYT*, and reflect a worry about the political direction of the Roosevelt administration and the New Deal. Thus, the top-ranking 'avoidance' article in July 1933 is simply a report of the 'bombshell' message that Roosevelt deployed to break up the sputtering London World Economic Conference.[55] Other articles worry about the effect of the new labour codes on wage costs and profitability

[55] 'Roosevelt sees', *The Wall Street Journal*, 28 July 1933 (number 1 in avoidance, July 1933).

in the energy industries,[56] or about the way in which the administration was relying on a policy of depreciating the dollar: 'as the practical difficulties of industrial and agricultural control develop, this tendency to cling to and emphasise currency management will become more marked'.[57] The measurement of business sentiment then reflects a real drag on the economic recovery process that was central to the objectives of the new administration.

It should be noted that there were many important news events during the 1930s, such as Britain leaving the gold standard, that do not show up in the identified business-sentiment shocks. This lends credibility to our assertion that we have filtered out news shocks from the identified business-sentiment shock.

IV | SUMMARY AND CONCLUSIONS

According to several historical accounts, the credit and business cycles of the 1920s and the Great Depression were influenced by sentiment, but these accounts struggle to measure the precise impact. This paper uses novel techniques and new data sources to investigate the scale and timing of the impact of these sentiments on the macroeconomy, in a dynamic setting, and thus to precisely specify how sentiment moved the economy at critical moments.

We hypothesise that newspaper articles of the time contain information related to the state of emotions or confidence of economic agents as well as information about the fundamentals of the economy. We use over 250 000 digitised articles from *WSJ* to algorithmically derive a monthly business-sentiment index based on emotion-related words. The emotion component is constructed to be orthogonal to the fundamental shocks to the real economy and credit markets through the use of a VECM. We interpret the business-sentiment shocks as capturing the change in economic agents' perceptions over time.

We show the identified business-sentiment shocks had economically significant effects on IP, the S&P 500 stock market index, bank loans, and credit spreads during some important periods of our sample, implying a distinct role for business sentiment in the credit and business cycles of the 1920s and the Great Depression.

In some periods, such as in 1921 and 1926, changes in agents' perceptions are hard to reconcile with any specific events in the news. In these cases, foreign and domestic news were creating mood music, rather than specific information, with rhapsodising about the 'greatest prosperity the world has ever known' alternating with gloom, frequently spurred by Europe's intractable political problems, but also by reflections on the organisation and structure of American business.

We contribute to the literature in a number of ways. Firstly, while the focus of attention in prior studies has been the stock market, inflation expectations or uncertainty, we investigate the major components of the macroeconomy, including the financial side, in a dynamic setting. Secondly, our method employs digitised data for historical time periods using very large textual databases, establishing further these emerging techniques for use in historical finance and macroeconomics. We also show that our sentiment index contains different information to existing state-of-the-art sentiment lexicons and provide a method of sentiment analysis that can be applied to other historical databases. Lastly, by using data at the monthly frequency, we are able to provide a clearer

[56] 'Oil, coal codes raise questions of labor costs', *The Wall Street Journal*, 15 July 1933 (number 3 in avoidance, July 1933).

[57] 'Currency alone may rule trade', *The Wall Street Journal*, 8 July 1933 (number 13 in avoidance, July 1933).

understanding of the nature and timing of business-sentiment shocks and the intensity and timing of the reactions of major subcomponents of the economy. This allows for much-improved identification of when and how these business sentiments behaved and how they transmitted across the economy.

ACKNOWLEDGEMENTS

David Tuckett wishes to acknowledge support from the Institute of New Economic Thinking (grants no. IN01100025 and IN1300051), the Eric Simenhauer Foundation of the Institute of Psychoanalysis (London) and to the UK Research Councils (EPSRC grant reference EP/P016847/1 and a grant from the ESRC-NIESR Rebuilding Macroeconomics network). Rickard Nyman has been supported by a grant to the Centre for the Understanding of Decision-Making Uncertainty by the Institute of New Economic Thinking (Grant no INO16-00011) and the Eric Simenhauer Foundation of the Institute of Psychoanalysis (London).

Ali Kabiri wishes to acknowledge support from Mr Norbert Podschlapp.

The authors would like to thank Charles Goodhart for valuable advice and suggestions, Jacob Turton for research assistance and D'Maris Coffman for early guidance on sources. Any errors are our own.

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SUPPORTING INFORMATION

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How to cite this article: Kabiri, A., James, H., Landon-Lane, J., Tuckett, D., and Nyman, R., 'The role of sentiment in the US economy: 1920 to 1934', *Economic History Review*, (2022), pp. 1–28. https://doi.org/10.1111/ehr.13160