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ARTICLE



Dating COVID-Induced Recession in the U.S.

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ABSTRACT

The COVID-induced recession began in March 2020 for the United States. We identify this turning point by applying a Bayesian sequential quickest detection method to a real-time index of economic activity. Supporting evidence is also found from macroeconomic data releases and stock markets.

KEYWORDS

Big data; COVID-19; coronavirus; turning points

JEL CLASSIFICATION

E32

I. Introduction

We perform a real-time analysis of the health of the U.S. economy induced by the coronavirus. To this end, we take advantage of the Bayesian sequential quickest detection (Bsquid) method of Li, Sheng, and Yang (2020) and a new ‘big data’ index of economic activity proposed by Brave, Butters, and Kelley (2019). The Bsquid method accurately identifies business cycle peaks and troughs for the five most recent recessions, but within a much faster time frame than official announcements by the National Bureau of Economic Research (NBER). This superior performance comes from the appealing feature of the Bsquid method that depends on a state-dependent, rather than fixed, threshold to identify changes in business cycle. Furthermore, the new index uses a much broader array of data to measure the overall health of the U.S. economy than the NBER does in its process. Using this method, we find that a recession began at the same time as the pandemic response accelerated in Europe and the U.S. – March 2020.

Our paper builds on a large literature on now-casting and forecasting business cycle turning points; see Chauvet and Piger (2008), Berge and Jorda (2011), Stock and Watson (2014) and Berge (2015), among many others. Compared to these papers, we explicitly model a decision maker’s dual requirements of timeliness and accuracy and frame the problem of monitoring business cycles as a sequential stopping time. Our paper is also

related to the growing literature trying to understand and measure the pandemic effects on a range of economic factors. Some focus on COVID-induced uncertainty and market volatility (Baker et al. 2020a; Gormsen and Koijen 2020). Others study more direct effects on business ability to operate and supply chains (Barrero, Bloom, and Davis 2020; Bartik et al. 2020; Meyer, Prescott, and Sheng 2020). Yet, others consider the effects on the labour market due to shelter in place orders and the drastic consumption decline in mid March and April (Cajner et al. 2020; Gregory, Menzio, and Wiczer 2020). To our knowledge, we are the first to formally identify and announce the beginning of COVID-induced recession in the U.S.

II. Data

We use a real-time ‘big data’ index of U.S. economic activity, developed by Brave, Butters, and Kelley (2019). The Brave-Butters-Kelley (BBK) index summarizes the information in a large panel of 500 U.S. time series, broadly reflecting the set of real economic activity indicators commonly used to forecast U.S. GDP. Figure 1 plots the BBK index. The shaded areas denote the recessions identified by the NBER (upper panel) and the Bsquid method (lower panel), which are discussed in greater detail in the next section. As Figure 1 shows, the BBK index movements track closely with both methods’ identified recessions. While it normally trends around zero, it drops quickly around the onset of

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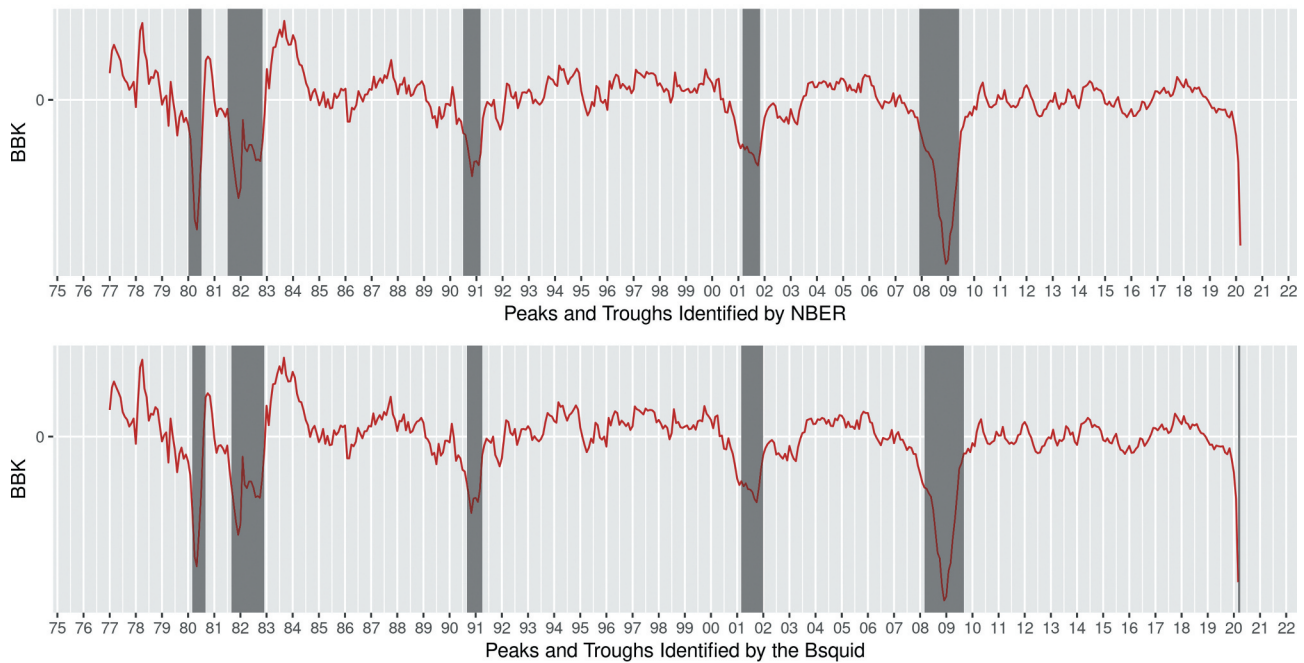


Figure 1. Monitoring recessions with the BBK index. Note: The BBK index is plotted using the data vintage released on 1 May 2020 from <https://www.chicagofed.org/publications/bbki/index>. The NBER dates of business cycle are downloaded from <https://www.nber.org/cycles/cyclesmain.html>. The business cycle dates based on the Bsquid method come from the authors' own calculation.

a recession before returning to near-zero, or to higher values in the case of the 1980s recessions, by the end of the downturn.

III. Identifying turning points – pseudo out-of-sample analysis

We apply Li, Sheng, and Yang (2020)'s Bsquid method to date the past five recessions. They frame monitoring business cycles as a Bsquid problem to a two-state hidden Markov process. To derive the stopping time (i.e., the threshold), they specify a loss function that captures the dual requirements of timeliness and accuracy. Bayes' rule is used to update the probability of a regime switch. If the posterior probability of a regime switch exceeds the threshold, the Bsquid method identifies a turning point; otherwise, no break will be declared and the process will continue.

We focus on the recessions occurred after 1978, since the NBER made no formal announcements when it determined the dates of turning points before 1978. Our pseudo out-of-sample analysis uses the most recently available data vintage. To date peaks, we take the beginning of an expansion identified by the Bsquid method as given and aim

Table 1. Identifying peaks with the BBK index.

Peaks identified by		Peaks announced by		Months ahead of
NBER	Bsquid	NBER	Bsquid	
Jan 1980	Mar 1980	Jun 1980	Mar 1980	3 months
Jul 1981	Sep 1981	Jan 1982	Sep 1981	4 months
Jul 1990	Sep 1990	Apr 1991	Sep 1990	7 months
Mar 2001	Mar 2001	Nov 2001	May 2001	6 months
Dec 2007	Mar 2008	Dec 2008	Mar 2008	9 months

at detecting the end of the expansion. Table 1 summarizes the results. The first column includes the peaks defined by the NBER. The second column includes the peaks identified by the Bsquid method. Comparing the NBER dates to those identified by the Bsquid method illustrates the accuracy of the newly established dates. The Bsquid method identifies the beginning of five recessions with reasonable accuracy, all within three months of the NBER date. Furthermore, our method produces no false positive signals over the sample period. The third and fourth columns show the dates announced by the NBER and the Bsquid method, respectively. On average, the Bsquid method announces the peak faster than the NBER and the average lead time for the five peaks in the sample is about 6 months.

To date troughs, we adopt the same method, except that we take the beginning of a recession

Table 2. Identifying troughs with the BBK index.

Troughs identified by		Troughs announced by		Months ahead of NBER announcement
NBER	Bsquid	NBER	Bsquid	
Jul 1980	Sep 1980	Jul 1981	Sep 1980	10 months
Nov 1982	Dec 1982	Jul 1983	Dec 1982	7 months
Mar 1991	Apr 1991	Dec 1992	Apr 1991	20 months
Nov 2001	Jan 2002	Jul 2003	Jan 2002	18 months
Jun 2009	Sep 2009	Sep 2010	Sep 2009	12 months

identified by the Bsquid method as given and aim at detecting the end of the recession. Table 2 presents the results. The Bsquid method identifies five troughs accurately, all within three months of the NBER date. Most importantly, our method shows systematic improvement over the NBER in the speed with which these troughs are announced. On average, the Bsquid method announces the five business cycle troughs 13 months ahead of the NBER announcement. The maximum lead time is 20 months for the 1991 trough.

IV. Dating COVID-induced recession in real time

We use the BBK data vintage released on 1 May 2020. Follow Li, Sheng, and Yang (2020),

we calculate the posterior probability of a regime switch (i.e. from an expansion to a recession) and compare this probability to the optimal stopping time. As illustrated in Figure 2 where the probability of a regime switch first exceeds the optimal stopping time, the Bsquid method identifies a turning point in March 2020. Thus, using the May 2020 data vintage, we conclude that COVID-induced recession began in March 2020.

Interestingly, on 8 June 2020, the NBER announced that a peak occurred in February 2020. The committee's decision is mainly driven by the payroll employment measure which reached a peak in February.¹ There are three main reasons why the turning point identified by the Bsquid method differs from that of the NBER. The Bsquid method identifies turning points with reasonable accuracy as soon as possible. As a result, firms would be better prepared for inventories, labour and capital, households would determine their consumption and saving they turn out to need, and the Federal Reserve would change its policy stance much earlier. By contrast, the NBER dating

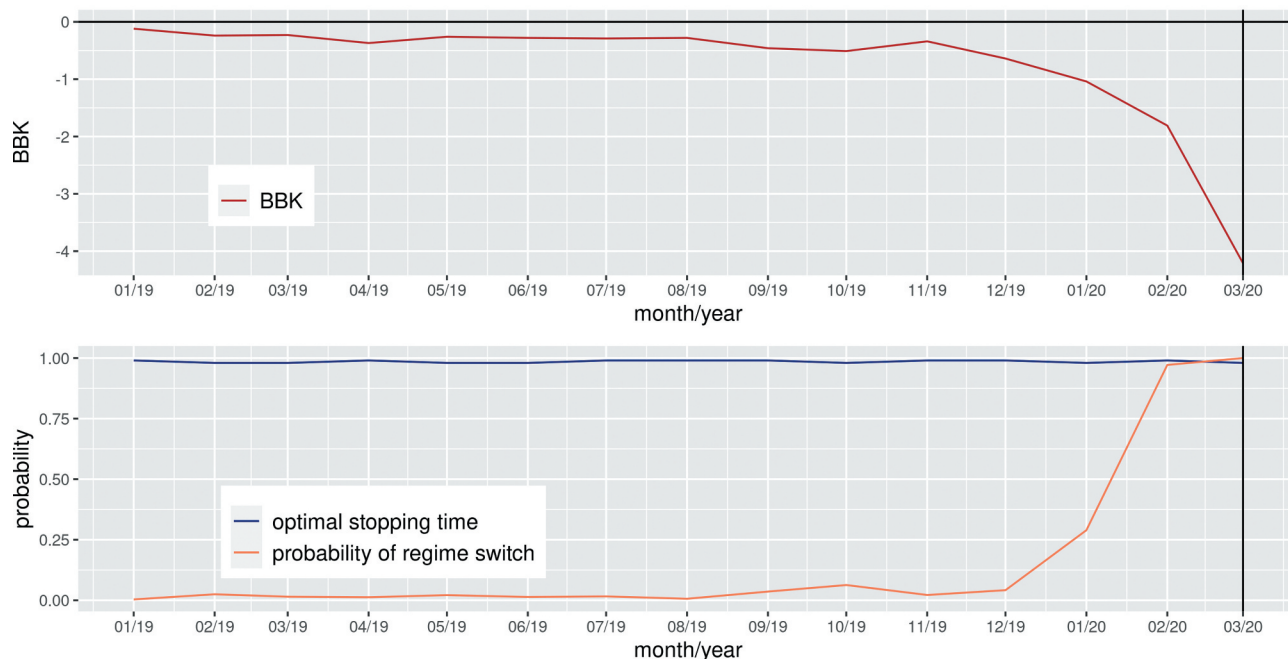


Figure 2. Dating the peak of March 2020. Note: The upper panel plots the BBK index. The lower panel plots the probability of a regime switch from an expansion to a recession, against the optimal stopping time derived under the Bayesian framework. When the probability of a regime switch exceeds the optimal stopping time, a turning point occurs in March 2020.

¹For further details, see <https://www.nber.org/cycles/june2020.html>

committee aims for the accuracy at the cost of timeliness. Indeed, financial markets had little reaction following the NBER's declaration.² Another reason is that we use a 'big data' index. By contrast, the NBER mainly focuses on four monthly coincident indicators.³ Thirdly, the Bsquid method is an objective and transparent algorithm for monitoring recessions in real time and is completely free of political considerations.

The superior performance of our method is mainly driven by the state-dependent stopping time (i.e. threshold), which is in stark contrast to using a fixed threshold. For example, the document posted on Chicago Fed website suggests using -1 as the recession threshold in practice. The fixed threshold considers only large deviations of the index from the mean of zero but ignores the duration of these deviations. By contrast, the Bsquid method captures both the magnitude and persistence of these deviations.

Next, we discuss other evidence in support of March 2020 as the beginning of COVID-induced recession. For instance, weekly unemployment insurance claims increased by more than a factor of 32 from March 7 to 28 March 2020.⁴ Nonfarm payroll employment, industrial production and real personal income all began to experience a decline in March after being relatively stable since 2018. Investors began to respond accordingly with the S&P 500 dropping dramatically in March.

We conclude by noting three other studies of the COVID-19 crisis pointing to a steep decline beginning in March (Baker et al. 2020b; Binder 2020; Cajner et al. 2020). Given the evidence from key indicators and other studies, it seems clear that there was a rapid deterioration in the health of the U.S. economy in mid-March 2020, which gives us added confidence in our method dating the start of a pandemic-induced recession as occurring in that same month.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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²Using the July 2020 data vintage of the BBK index that includes revisions of the component series and methodological enhancements, our method would identify February 2020 as the peak. Yet, to date recessions in real time, we have to use the data available when performing the analysis, that is, the data vintage released on 1 May 2020.

³In a separate experiment, we analyse the Conference Board's composite index of coincident indicators. As aptly pointed out by a reviewer, this index is more aligned with the NBER definition of a recession. Using this index, our method identifies April 2020 as the peak. Detailed results are available upon request.

⁴Accessed on 19 May 2020 from <https://oui.doleta.gov/unemploy/claims.asp>

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