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Regional Spotlight

State Business Cycles vs. COVID

Our state business cycle dating algorithm was no match for COVID-19.

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The COVID-19 pandemic disrupted lives, livelihoods, and economies—abruptly and severely. This was true for the U.S. economy and for all 50 states.

The pandemic also affected key processes for gathering economic data and for assessing economic trends. Our state coincident indexes and our state business cycle algorithm were no exception.

In 2015, we developed an algorithm that uses our state coincident indexes to determine the peaks and troughs for each state's business cycle.¹ Regional economists value this consistent delineation of state business cycles as a starting point for their own research.

However, the pandemic introduced two key problems.

First, our state coincident indexes rely heavily on data from the Bureau of Labor Statistics (BLS). As the pandemic began to disrupt the economy in March 2020, the abrupt, severe economic changes presented numerous challenges to the BLS in maintaining its production of consistent, reliable monthly estimates of state unemployment rates and payroll jobs. The resulting

idiosyncrasies in the official BLS statistics directly influenced our state coincident indexes, leading our algorithm to frequently assign a state’s peak as March 2020, rather than February.²

In addition, we designed our algorithm with a set of simple, objective criteria intended to reflect the subjective decision-making process of the Business Cycle Dating Committee (BCDC) of the National Bureau of Economic Research (NBER). Those criteria included a minimum duration of four months to qualify as a new phase of a business cycle. However, in July 2021, the BCDC broke with convention: Although it noted that the pandemic-driven contraction was uncharacteristic of other recessions, the BCDC affirmed that the severe pandemic contraction would be considered a recession with a peak in February 2020 and a trough in April 2020—despite being a mere two months long. The BCDC’s decision forced us to reexamine our algorithm’s criteria.³

In this article, we briefly review the general intent of state business cycle dating, including the development of our 2015 algorithm. We also explore the atypical aspects of the BCDC’s recession determination during the pandemic, and we document how our algorithm performs in relation to the pandemic.

Next, we justify our decision to break from our own convention and treat the pandemic downturn as a recession. In the process, we delineate the duration of each state’s unique pandemic recession. However, we conclude that we don’t need to change our original algorithm—barring future pandemics.

Understanding Business Cycles

To understand why the pandemic disrupted business cycle dating, we must first understand business cycles.

Economists often characterize fluctuations in economic activity as alternating periods of expansion and contraction (or recession).⁴ For well over 60 years, economists have usually deferred to the NBER’s dating of the U.S. business cycle.⁵ In 1978, the NBER formed its BCDC to determine the peaks and troughs in economic activity. According to the NBER, “a recession is a period between a peak and a trough, and an expansion is a period between a trough and a peak” (Figure 1).

In determining a recession, the BCDC does not follow a fixed formula, but rather forms judgments. “The NBER’s traditional definition of a recession is that it is a significant decline in economic activity that is spread across the economy and that lasts more than a few months.”

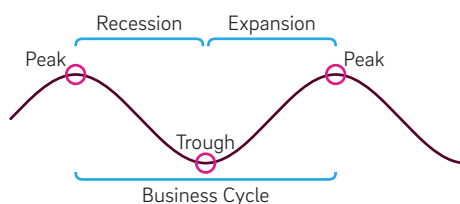
In its determinations, the BCDC focuses on a monthly chronology, considers a range of monthly economic indicators, and accounts for both the duration between turning points and the depth of a downturn.

However, there is no committee (let alone 50 committees) to determine individual state business cycles, so, many regional economists use our state coincident indexes to identify state-level business cycles.⁶

FIGURE 1

Economists Characterize Fluctuations in Economic Activity as Alternating Periods of Expansion and Contraction (or Recession)

The National Bureau of Economic Research is the acknowledged expert for identifying peaks and troughs for the U.S. economy.



We designed our state coincident indexes to model the underlying growth of a state’s economy using an assortment of available data. We use three monthly variables (nonfarm payroll employment, average hours worked in manufacturing, and the unemployment rate) plus one quarterly variable (real wages and salaries plus proprietors’ income) to reveal an underlying (or hidden) monthly variable that represents a state’s economic growth.⁷ This is a suitable proxy for the “range of monthly measures of aggregate real economic activity published by federal statistical agencies,” which are used by the BCDC to date the national business cycle.⁸

However, an individual state’s coincident index is inherently more volatile than the U.S. coincident index, because the underlying state data are more volatile than the U.S. data and the U.S. coincident index smooths out variation among the states. This makes it hard for researchers to determine each state’s peaks and troughs.

In 2015, we developed an algorithm that uses our coincident indexes to determine business cycle dates for all 50 states.⁹ First, we calibrated our coincident index for the U.S. economy against the five U.S. recessions since 1979 (as determined by the NBER). This allowed us to establish relatively simple, straightforward criteria that we could apply to the state indexes.

These criteria included a minimum duration and a minimum intensity for the periods determined to be recessions and expansions between the demarcated peaks and troughs. This calibration enables us to supplant the BCDC’s subjective decision-making process with an objective algorithm.

Without the minimum-duration and minimum-intensity criteria, we would find a much

See *Determining State Peaks and Troughs*.

higher frequency of recessions in many states. Greater volatility is one reason. However, a state may also experience significant job losses in the aftermath of a hurricane, a labor strike, or a corporate merger accompanied by layoffs. Generally, the negative effects from such an event do not persist for more than a month or two. Moreover, such shocks are typically limited to only a few states, if not just one. Although individuals and families impacted by such shocks experience significant

economic hardship, economists tend to differentiate these short-lived, idiosyncratic events from recessions.¹⁰

However, significant economic shocks are often the trigger for national economic recessions. So, what should we make of the COVID-19 pandemic, which caused employment in most states and the nation to plummet for just two months (or less) before recovering?

An Atypical Recession

The two-month pandemic recession was not a typical recession.

In a November 2021 op-ed for the *New York Times*, Austan

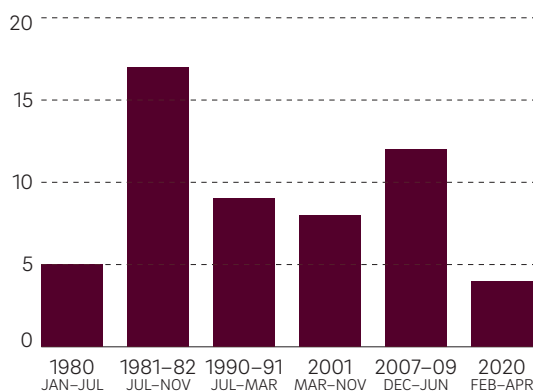
Goolsbee, now serving as president of the Federal Reserve Bank of Chicago, noted that the pandemic was not a recession in the normal sense, although it was an economic disaster for some.¹¹ “Past business cycles look nothing like what the United States has gone through in the pandemic,” Goolsbee wrote, “so [economic forecasters] are [looking in] the wrong place to find lessons for where things are going now.” The path of recovery depends more on “how quickly we can control the spread of the virus than it is about recession fundamentals.”

The NBER had already acknowledged this difference and broke two conventions in doing so.

On June 8, 2020, the BCDC determined that U.S. economic activity had reached a peak in February 2020 and that a recession had begun, bringing a sudden end to the longest expansion (at 128 months) since at least 1854.¹² “The unprecedented magnitude of the decline in employment and production, and its broad reach across the entire economy,” the BCDC announced, “warrants

FIGURE 2
The NBER Was Unusually Quick to Identify the COVID Recession

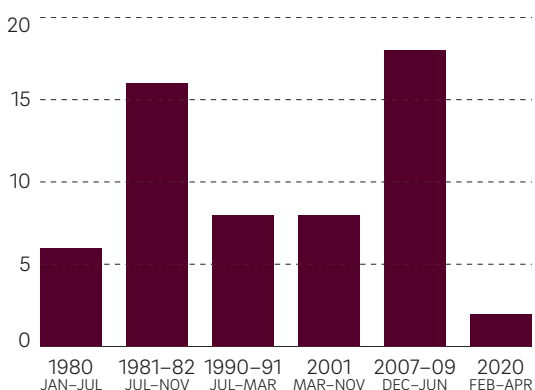
Number of months from the beginning of a recession to the NBER’s announcement that a recession had occurred, 1978–2023



Source: National Bureau of Economic Research.

FIGURE 3
Recessions Usually Last Several Months

But the COVID recession was unusually short. Duration of a recession in months, 1978–2023



Source: National Bureau of Economic Research.

the designation of this episode as a recession, even if it turns out to be briefer than earlier contractions.”

Declaring the peak after observing only three more months of data was an unusually fast determination and a break from convention (Figure 2). The BCDC typically waits for one or two years of data revisions before dating a peak or trough, but the sheer size of the decline afforded confidence that the decline would not be revised away.

On July 19, 2021, the BCDC announced that U.S. economic activity had reached its trough in April 2020, affirming that this was (at two months) “the shortest U.S. recession on record.”¹³ The BCDC reiterated that a recession (usually) involves “a decline in economic activity that lasts more than a few months,” but in a second break from convention it chose to declare this two-month contraction an exception because of the severity and the reach of the decline (Figure 3).

In this case, the BCDC noted “that the pandemic and the public health response have resulted in a downturn with different characteristics and dynamics than prior recessions.”

Our Algorithm During COVID

With or without new criteria, our algorithm fails to adequately capture state-level recessions during the pandemic period. When we use our original criteria with our latest re-estimated coincident indexes, our algorithm identifies a recession in only 13 states (Figure 4).¹⁴ The problem is the duration of the decline, not its depth.

The onset of the pandemic triggered a sudden and severe decline in payroll jobs and a concomitant rise of state unemployment rates to extreme levels in all 50 states. In turn, extreme declines in our state coincident indexes easily surpassed the threshold for a recession in all states and in the nation.

To understand just how extreme these declines were, let’s examine the deepest one-month decline for each of the 50 states during the pandemic and during the Great Recession. During the Great Recession, these numbers range from –0.3 percent (in Georgia) to –3.3 (in West Virginia), but during the pandemic they range from –3.8 percent (in Arkansas) to –52.4 (in Michigan). The average decline for all 50 states during the pandemic was –22.0 percent (Figure 5).

The common thread during COVID was April, which saw the severest decline in every state’s coincident index except Wyoming, where the index fell most steeply in May.¹⁵

However, the worst of the pandemic was very brief. The downturn lasted no more than three months in 37 states and the nation (exactly two months in 14 states and the nation; just one month in 12 states) (Figure 6).

Moreover, most of the 13 states where the downturn was long enough to qualify as a recession did so only because they happened to have experienced a few months of modest decline immediately before and/or after the onset of the pandemic (Figure 7). Only West Virginia, Wyoming, and (just barely) New Jersey exhibited the depth and duration of a typical recession prior to February, when the pandemic began to influence the economy.

West Virginia and Wyoming—the nation’s largest coal-producing states—were still coping with downturns in the coal industry

when the pandemic hit. As for New Jersey, its recession might have ended in October 2019—a short, shallow recession like the ones in Louisiana and Maine in mid-2019.

When we change the algorithm’s criteria to allow for a recession of only two months, we identify 38 states and the nation as in recession, but we still miss 12 states (Figure 8).

However, if we allow a two-month downturn to qualify as a recession, then we identify dozens of additional state-level recessions (and expansions) from 1979 through 2019. Most of the additional recessions would simply be representative of the greater volatility in state economic data, especially among smaller state economies.

Although a few additional recessions might result from identifiable, state-level idiosyncratic events, such as a hurricane or labor strike, economists would not categorize most of these events as a trigger for a new business cycle.

Researchers can allow for a two-month recession or stick with the minimum four-month standard, but neither option is ideal.

Discretion and Convention

Like the NBER, we decided to break with convention.

For general research purposes, we feel that the pandemic is best treated as

a severe negative shock, like a labor strike or hurricane, rather than as another turn of the business cycle.

Moreover, the subsequent recovery had little in common with a typical expansion. Rather, the economy appeared to do as well as possible in the face of ongoing attenuated negative shocks from the pandemic—that is, the shocks were much smaller than before but still a constraint on the full resumption of activity.

However, for specific questions, a researcher may prefer to call the pandemic downturn a recession. As there are no “right” answers, we’ve made the following decision regarding how we date each state’s business cycle.

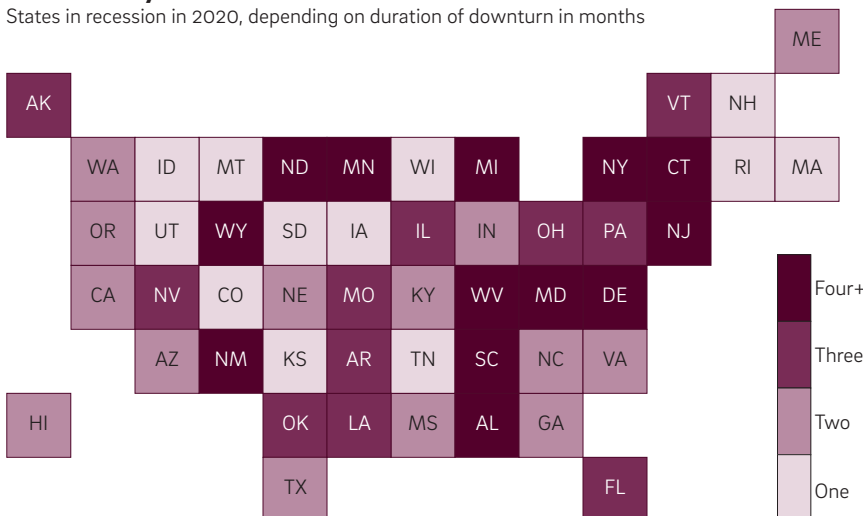
In the spreadsheet available on the State Coincident Indexes webpage—provided as a tool for researchers—we identify the peaks and troughs for all 50 states using our traditional criteria across the entire time frame, except for the negative months adjacent to March 2020. Regardless of whether an individual state’s pandemic contraction lasted for one month or several months, we indicate a recession in all 50 states. However, we distinguish the 13 states for which our algorithm would have identified a recession, and further highlight the three states in which a recession was already underway.¹⁶

Ultimately, each researcher must use their own discretion in how they treat a given state’s pandemic-related recession.

FIGURE 6

If We Allow for a Briefer Recession, We Identify More States in Recession

States in recession in 2020, depending on duration of downturn in months

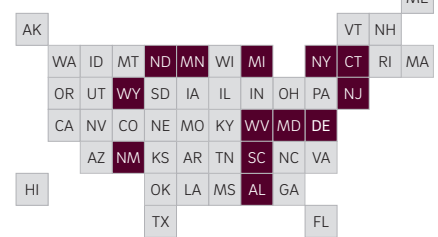


Source: State Coincident Indexes, Federal Reserve Bank of Philadelphia.

FIGURE 4

According to Our Algorithm, a COVID Recession Occurred in Only 13 States

States in recession during COVID, 2020

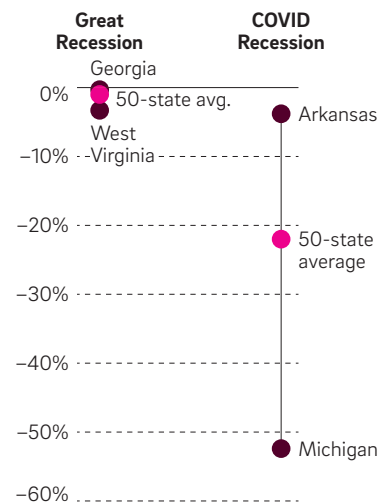


Source: State Coincident Indexes, Federal Reserve Bank of Philadelphia.

FIGURE 5

COVID’s One-Month Declines Dwarfed the Great Recession’s Declines

Range of the deepest one-month economic declines for states during the Great Recession (2007–2009) and the COVID recession (2020)

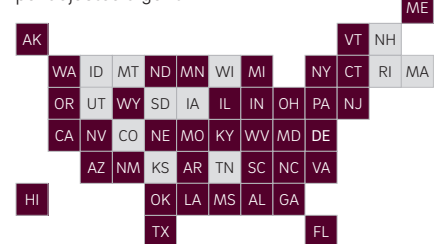


Source: State Coincident Indexes, Federal Reserve Bank of Philadelphia.

FIGURE 8

When We Allow for a Two-Month Recession, 38 States Were in Recession

States in recession in 2020, per adjusted algorithm

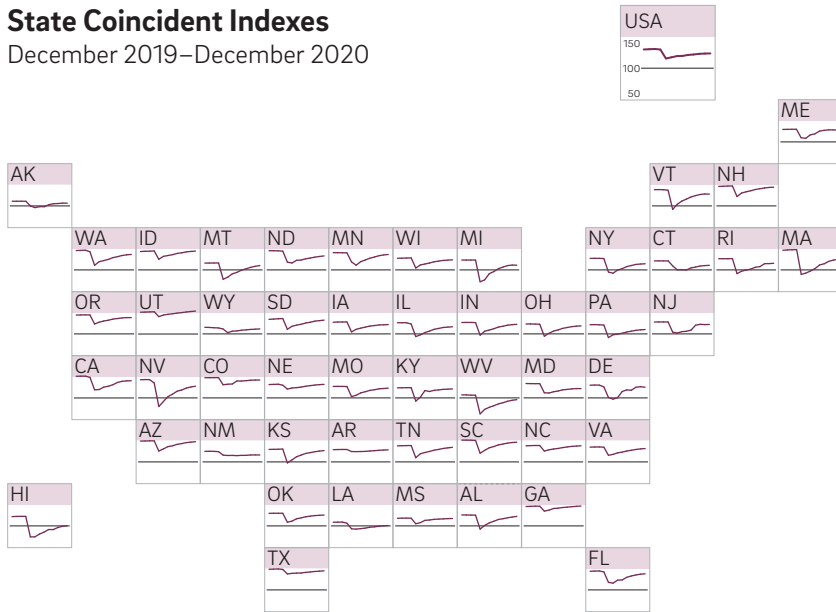


Source: State Coincident Indexes, Federal Reserve Bank of Philadelphia.

FIGURE 7

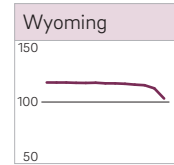
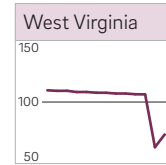
State Coincident Indexes

December 2019–December 2020

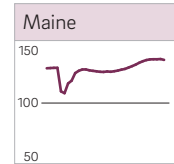
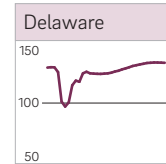


Source: State Coincident Indexes, Federal Reserve Bank of Philadelphia.

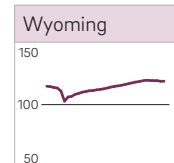
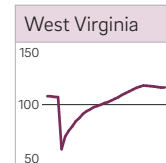
At Least Two States Were Already in Recession May 2019–May 2020



Two Relapsed Before Full Recovery Dec 2019–Sep 2022



Two Fell into Recession After Full Recovery Dec 2019–Sep 2022



Resuming Our Algorithm

Although we reinstated our algorithm after we had identified each state’s pandemic recession, we recommend that researchers continue to use discretion.

In the wake of the severe pandemic contraction, the recoveries in two states failed to attain a new, higher peak before lapsing into another recession. The economies in Delaware and Maine had partially recovered by November 2020, establishing a local peak, before experiencing a mild relapse starting in December 2020. Delaware’s recession lasted four months through March 2021; the duration in Maine was five months, ending in April 2021. In light of the ongoing pandemic, one might characterize these two recessions as a resurgence of the pandemic shock. The path of COVID-19 cases in Maine seems to support this interpretation; Delaware may require further explanation.¹⁷

By September 2022, the coincident indexes for all 50 states had recovered and risen above their prepandemic levels. However, our algorithm identified two states that fell back into a recession after attaining a new peak: our two coal-dependent states.

The West Virginia economy attained a new peak in March 2022, followed by a recession that appears to have ended in August. Likewise, Wyoming’s economy peaked in April 2022, followed by an August 2022 trough.

In addition, the Iowa, Kansas, and Vermont economies appear to have peaked in April or May. The subsequent declines in their coincident indexes have been deep and long enough to constitute a recession. However, their declines continued through September 2022. We recommend caution until the BLS revises the initial data underlying the indexes and we have re-estimated our coincident indexes with that new data.¹⁸

Conclusion

COVID-19 was bad for the economy and challenging for economic analysis. Although the NBER called the resulting downturn a recession, it had to break with convention to do so. We agree with the NBER that this was a contraction. And it was certainly costly in lives and money. But a typical business cycle? No.

When applied to the pandemic period, our algorithm identified only 13 states as being in recession. Just two or three of those states would have been in a recession were it not for the pandemic. To reflect the reality of the atypical pandemic downturn, we, like the NBER, broke from convention and suspended our algorithm for the pandemic-induced contraction.

However, researchers can decide what information in our spreadsheet is appropriate for their own work—whether to treat these deep but brief one- or two-month contractions as recessions followed by relatively quick recoveries, or as a series of shocks that attenuated over time.

We agree with Goolsbee. We shouldn’t treat what happened in 2020 like just another recession, which means we should be cautious when drawing comparisons between the pandemic period and past recessions and recoveries. A corollary is that we should not expect future business cycles to behave like the pandemic’s contraction and recovery.

Now that all 50 states have resumed a more conventional economic path, there is no compelling reason to alter our algorithm for future state business cycle dating. However, we reserve the right to once again exercise discretion if another pandemic occurs.

From now on, we will annually publish our latest state business cycle dates for all 50 states. This research tool will enable researchers to explain and interpret a state’s business cycle as they see fit.¹⁹

Determining State Peaks and Troughs

We start by identifying all peaks and troughs with the general understanding that the period following a peak through the subsequent trough is a recession, while the period following a trough through the subsequent peak is an expansion. But we use two additional criteria to qualify a period as a recession or expansion: duration and intensity. More specifically, a recession or expansion must extend for at least four months, and the absolute value of the sum of the period's monthly changes must equal or exceed the variance for that state's coincident index. (We define the variance as the average of the absolute value of the monthly percent changes [calculated as a log difference] in a state's coincident index.)²⁰

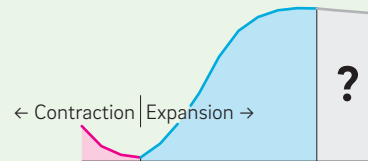
Thus, we identify a recession (after a peak) if the sum of at least four consecutive monthly changes is negative and if the absolute value of the sum equals or exceeds the variance for that state's coincident index. If the decline following a peak is too short or too shallow, then that period fails to constitute a recession (and that peak is discarded). Instead, the period becomes an extension of the ongoing expansion, which will end after a subsequent peak followed by a qualifiable recession (Figure 9).

And we identify an expansion (after a trough) if the sum of at least four consecutive monthly changes is positive and if the sum equals or exceeds the variance for that state's coincident index. If the increase following a trough is too short or too shallow, then that period fails to constitute an expansion (and that trough is discarded). Instead, the period becomes an extension of the ongoing recession, which will end after a subsequent trough followed by a qualifiable expansion.

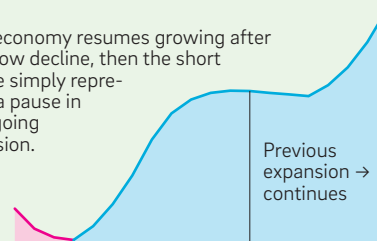
FIGURE 9

A Shallow Decline in Our Index Does Not Always Denote a Recession

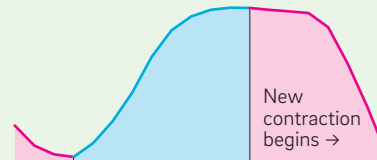
Brief, shallow swings in the data present a challenge: Whether a shallow decline becomes a recession is determined by the economic path that follows.



If the economy resumes growing after a shallow decline, then the short decline simply represents a pause in an ongoing expansion.



If the economy's decline deepens after a shallow decline, then the initial short decline becomes part of a new contraction.



Notes

1 See Flora (2016). Our algorithm relies on our state coincident indicators. For details on technical changes to the state coincident index model since 2016, see Changes to Methodology: State Coincident Indexes at <https://www.philadelphiafed.org/-/media/frbp/assets/surveys-and-data/coincident/methodology.pdf>.

2 See added explanations in our State Coincident Indexes releases, March 2020 through January 2022—especially May 2022. For technical changes by the BLS, see "SAE Methods Overview" and "LAUS Methods Overview."

3 See NBER (2020).

4 See the Congressional Research Service (2023) for a useful primer on business cycles.

5 The NBER began publishing business cycle dates in 1929. The U.S. Department of Commerce began to reference the NBER's business cycle peaks and troughs in 1961; the U.S. government does not produce an alternative. For more information, see NBER (2022).

6 See Owyang, et al. (2005).

7 Our coincident indexes are retrended to reflect the long-term growth rate of each state's gross state product. See the Federal Reserve Bank of Philadelphia's State Coincident Indexes page.

8 See NBER (2022).

9 See Flora (2016).

10 Hurricane Katrina, which made landfall in Louisiana in late August 2005, is a notable exception. Our algorithm flags a deep, four-month recession in Louisiana, concentrated

in September. There's also a sharp decline in neighboring Mississippi's coincident index, but that decline is limited to just September.

11 See Goolsbee (2021).

12 See NBER (2020).

13 See NBER (2021).

14 We revised our state coincident indexes in late March, after the BLS released its annual benchmark revisions of key state data and we had time to re-estimate each state's model. As we did in the prior two years, we excluded the extreme, pandemic data from after December 2019 during our re-estimation. We made a similar decision in applying our algorithm: When estimating the variance for each state, we excluded data from after December 2019.

15 Although the coincident index fell somewhat in March across most states, it continued its steady growth path in 14 states.

16 Because the data underlying our state coincident indexes are subject to annual revisions, the state business cycle results can change, so future state business cycle dates will vary from the results accompanying this article.

17 Maine's relative isolation in the northeast corner of the U.S. helped delay the state's first significant wave of infections until the winter of 2020–2021. As of May 15, 2023, Maine had the third-lowest all-time incidence of cases among all 50 states and the fourth-highest percentage of fully vaccinated residents, and it was tied with Massachusetts for the second-highest rate of seniors boosted with the bivalent vaccine (*New York Times*, accessed May 25, 2023, last updated May 15, 2023).

18 Although we have data through the end of 2022 and into 2023, September 2022 is the most recent month to have passed through the BLS's annual benchmark revision process. Subsequent months are subject to additional significant revisions. Like the NBER, we choose to wait until the data has been revised (at least once) before assigning business cycle peaks and troughs.

19 We re-estimate and update our coincident indexes each spring following the BLS's release of annual benchmark revisions of payroll employment and unemployment rates. Our annual state business cycle dating results will follow soon after.

20 A state-specific variance measure is used to acknowledge that a state's business cycle may have a smaller or greater amplitude than the nation's cycle. We excluded months following December 2019 to avoid the extreme values of the pandemic period.

References

- Bureau of Labor Statistics. "Local Area Unemployment Statistics: LAUS Methods Overview," <https://www.bls.gov/lau/methods-overview.htm>, accessed May 8, 2023.
- Bureau of Labor Statistics. "State and Metro Area Employment, Hours, & Earnings: SAE Methods Overview Page," <https://www.bls.gov/sae/methods-overview.htm>, accessed May 8, 2023.
- Congressional Research Service. "Introduction to U.S. Economy: The Business Cycle and Growth," *In Focus* (January 3, 2023).
- Federal Reserve Bank of Philadelphia. "State Coincident Indexes," <https://www.philadelphiafed.org/surveys-and-data/regional-economic-analysis/state-coincident-indexes>, accessed May 8, 2023.
- Flora, Paul R. "Regional Spotlight: The State of the States," Federal Reserve Bank of Philadelphia *Economic Insights* (Fourth Quarter 2016), pp. 8–15, <https://www.philadelphiafed.org/the-economy/regional-economics/regional-spotlight-the-state-of-the-states>.
- Goolsbee, Austan. "How to Think About the Covid Recession," *New York Times* (November 8, 2021).
- National Bureau of Economic Research. "Determination of the February 2020 Peak in Economic Activity" (June 8, 2020).
- National Bureau of Economic Research. "Determination of the April 2020 Trough in U.S. Economic Activity" (July 19, 2021).
- National Bureau of Economic Research. "Business Cycle Dating Procedure: Frequently Asked Questions" (Revised August 15, 2022).
- New York Times*. Track Covid-19 in Maine: Latest Data and Maps, <https://www.nytimes.com/interactive/2023/us/maine-covid-cases.html>, accessed May 25, 2023.
- New York Times*. Track Covid-19 in the U.S.: Latest Data and Maps, <https://www.nytimes.com/interactive/2023/us/covid-cases.html>, accessed May 25, 2023.
- Owyang, Michael, Jeremy Piger, and Howard Wall. "Business Cycle Phases in U.S. States," *Review of Economics and Statistics*, 87:4 (2005), pp. 604–616, <https://doi.org/10.1162/003465305775098198>.