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High frequency data and a weekly economic index during the pandemic

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Staff Reports

High Frequency Data and a Weekly Economic Index during the Pandemic

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Staff Report No. 954
December 2020

This paper presents preliminary findings and is being distributed to economists and other interested readers solely to stimulate discussion and elicit comments. The views expressed in this paper are those of the authors and do not necessarily reflect the position of the Federal Reserve Bank of New York or the Federal Reserve System. Any errors or omissions are the responsibility of the authors.

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Daniel J. Lewis, Karel Mertens, James H. Stock, and Mihir Trivedi

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Abstract

This paper describes a weekly economic index (WEI) developed to track the rapid economic developments associated with the onset of and policy response to the novel coronavirus in the United States. The WEI, with its ten component series, tracks the overall economy. Comparing the contributions of the WEI's components in the 2008 and 2020 recessions reveals differences in how the two events played out at a high frequency. During the 2020 collapse and recovery, it provides a benchmark to interpret similarities and differences of novel indicators with shorter samples and/or nonstationary coverage, such as mobility indexes or credit card spending.

Key words: weekly economic index, high frequency, measurement of economic activity, forecasting

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To view the authors' disclosure statements, visit https://www.newyorkfed.org/research/staff_reports/sr954.html.

High Frequency Data and a Weekly Economic Index During the Pandemic

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I. Introduction

The arrival of the SARS-COV-2 virus in the United States and subsequent restrictions on everyday activity wrought economic disruption at a rate unseen in recent history. The resulting changes in real economic activity occurred not on a monthly or quarterly timeline, but from week-to-week and day-to-day. Typically, economists study only financial developments at such frequency, waiting until monthly or quarterly data are available, sometimes over a month after the reference period has ended, to assess real activity. However, with the rapid deterioration of economic conditions in March it became urgent to measure changes in economic activity much closer to real time.

Motivated by this challenge, we developed a Weekly Economic Index (WEI) of US real economic activity, first published by the Federal Reserve Bank of New York on March 30th, 2020 (Lewis et al, 2020a). It has been updated twice a week since late April. The WEI is the first principal component of 10 weekly series capturing important dimensions of real activity. These include retail sales, consumer confidence, initial and continuing UI claims, a staffing index, federal income tax withholding, steel production, fuel sales, electricity output, and rail traffic. The index synthesizes the signal coming from weekly data sources that are individually too noisy to be informative about macroeconomic developments. The initial estimate of the WEI is available the Tuesday after the reference week (a 3-day delay), updates are available Thursday and the following Tuesday, and the value is finalized the next Thursday, 12 days after the end of the reference week. It thus provides a much timelier signal than monthly releases (available up to a month after the reference period ends), and details intra-month variation. The WEI is scaled to 4-quarter GDP growth: a value of -2% means that if the current week's conditions prevailed for a quarter, then we would expect GDP to be 2% lower at quarter's end than it was 4 quarters prior. Figure 1 plots the WEI from January 2008 to November 2020, with a

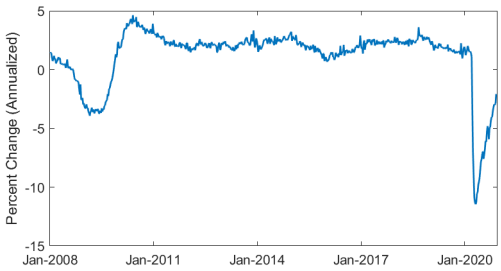

FIGURE 1. THE WEI, JANUARY 2008 TO NOVEMBER 2020

13-week moving average and 4-quarter GDP growth for reference. It tracks the cyclical variation in GDP growth over this period well.

The methodology of the WEI is documented in Lewis et al (2020b). We also describe its value as a forecasting tool for GDP and other variables. The WEI provided a very accurate forecast of Q1 and Q2 2020 GDP releases, but performed less well in Q3. This "nowcasting" ability compares favorably to other forecasts.

In this paper, we explore which variables are responsible for the rapid contraction in March and April, which have led the recovery, and how this compares to the 2008 Recession. We also compare the WEI to several alternative series widely followed during the pandemic.

II. Decomposing the 2020 Recession

The black line in the first panel of Figure 2 plots the WEI to date in 2020, and in the second, the week-on-week change. The index deteriorated noticeably in the week ending March 14th, the month the NBER-dated recession began. The decline followed the

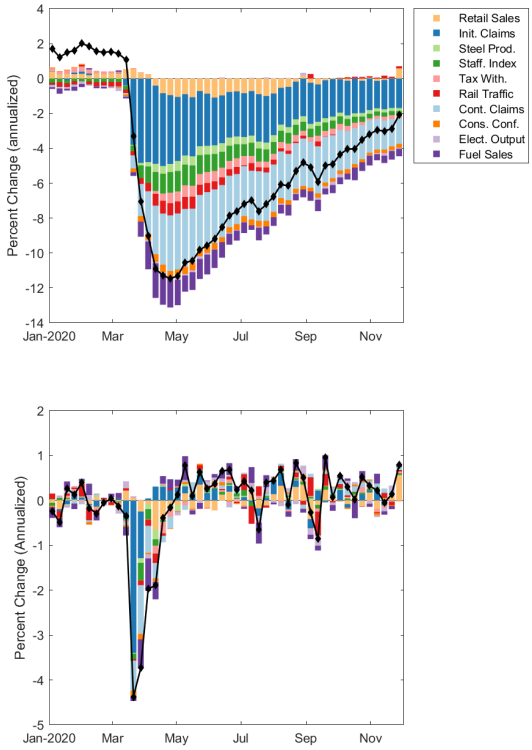

FIGURE 2. DECOMPOSITION OF THE WEI, JANUARY TO NOVEMBER 2020

Note: The top panel plots the level of the WEI (black line) and contributions by data series (colored bars). Contributions do not sum to the WEI path because an additive constant scales the index to GDP growth. The bottom panel plots the first-difference of the top panel.

WHO's March 11th declaration of a pandemic, and the President's March 13th declaration of a national emergency. California issued the first stay-at-home order on March 19th; that week, the WEI plummeted 4.38%, and another 3.73%, 1.97%, and 1.89% the next three weeks.

The WEI reached its nadir, -11.45%, the week of April 25th, as states began to reopen. Over the early recovery, the WEI increased by 0.41 percentage points per week until mid-July, when the first substantial decline occurs, coinciding with several states back-tracking on reopening plans due to a resurgent virus. The

recovery continued until early September, when the WEI declined for two consecutive weeks. This reversal coincides with pandemic assistance programs nearing expiry and the so-called "second wave" and renewed lockdowns in Europe. Subsequently, the WEI recovered gradually, with periods of flattening rather than decline. As yet, the WEI shows a plateau but no sign of a substantial slowdown in Fall 2020, despite surging virus cases. The most recent value suggests that year-over-year 2020 GDP growth will be -2.84%.

Figure 2 decomposes movements in the WEI into contributions from its 10 constituent series. Panel 1 illustrates each series' role in determining the index's level. It confirms perceived wisdom about the current recession. In particular, initial and UI continuing claims account for much of the decline since March. Through the summer, other labor market indicators, the staffing index and tax withholding, make smaller contributions. Early on, fuel sales also play a large role, as air travel ground to a halt and mobility declined more broadly (Atkinson et al, 2020). After initial increases, retail sales depress the WEI over the summer and have been neutral since.

Panel 2 decomposes the week-on-week change. As has been well-documented, the first highly negative signal came from weekly initial UI claims. When the WEI fell precipitously the week of March 21st, it did so due to the first ever report to exceed 1 million initial claims, coming in at nearly 3 million. This translated to a sharp increase in continuing claims in the next week. In the decline through April, retail sales made a notable contribution, as did fuel sales and the staffing index.

Recovery occurs following improved initial claims numbers and fuel sales, as mobility picked up. There is also a role for retail sales. The mid-July reversal occurs due to resurgent initial claims and a softening of fuel and retail sales. The 2-week slowdown in September is the result of a combination of retail, initial claims, rail traffic, and electricity output.

These decompositions describe a recession and recovery driven by labor market conditions and consumer activity. The role of indicators of industrial/manufacturing activity is relatively limited, reflecting the fact that the services sector, in particular contact-intensive areas, has been hardest hit. These areas are less well reflected in our index because of a lack of established high-frequency data, but labor market indicators capture activity indirectly.

Figure 3 highlights how different the 2008 and 2020 recessions were. In both, UI claims played a key role in the decline of the WEI, but in 2008 the initial contribution of consumer confidence was at least as important. As the 2008 recession deepened, steel production

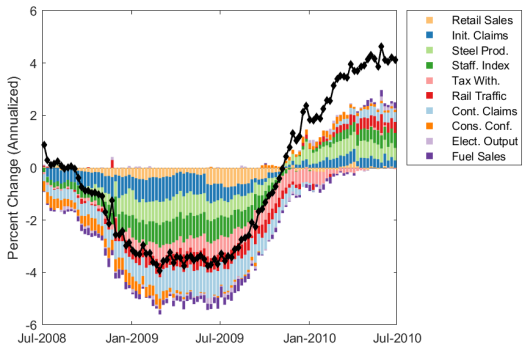

FIGURE 3. DECOMPOSITION OF THE WEI, JULY 2008 TO JULY 2010

Note: The black line plots the level of the WEI and the colored bars contributions by data series. Contributions do not sum to the WEI path because an additive constant scales the index to GDP growth.

became a key driver. Through 2009, the contributions of all four labor market series are comparable, with prominent roles for steel production and rail traffic as well. The role of consumer confidence is replaced by retail sales. In late 2009, steel production lead the recovery, followed by initial claims, then staffing, rail traffic, and continuing claims. In week-on-week changes (omitted for brevity), the WEI is much more volatile during the Great Recession. The contributions are highly variable, but initial claims and rail traffic appear most important, with fuel sales, which matters little in levels, playing a larger role.

Compared to 2008, the WEI has been smoother, declining sharply and then rising steadily with few reversals. Both recessions are characterized by a stark deterioration in the labor market, but the increase in claims was much sharper during the pandemic. The series reflecting industrial activity contribute relatively little to the decline (and recovery) in the pandemic compared to 2008-2010. The role of fuel sales in the 2020 decline also stands out. Both of these features illustrate that non-industrial sectors were worst hit, and mobility suffered greatly. The limited role of consumer confidence compared to 2008-2010 is surprising, possibly reflecting much more immediate and aggressive policy responses.

III. The WEI and Alternative Data Indicators

The inputs to the WEI are mostly well-established daily or weekly cyclical indicators. This ensures a satisfactory estimation sample and allows a wide range of sensitivity checks. However, digitization since 2008 has introduced new cyclical information. Moreover, the unusual nature of the pandemic downturn has highlighted blind spots, including activity of many smaller businesses in some of the most affected sectors. Since March, a wide range of novel high-frequency indicators have become publicly available (e.g., Chetty et al, 2020). Figure 4 compares the WEI to several new indicators and other widely reported sector-specific indicators.

The first panel of Figure 4 plots the WEI, measures of credit and debit card spending provided by Fiserv (a payments processor) and Affinity Solutions (a marketing services firm),

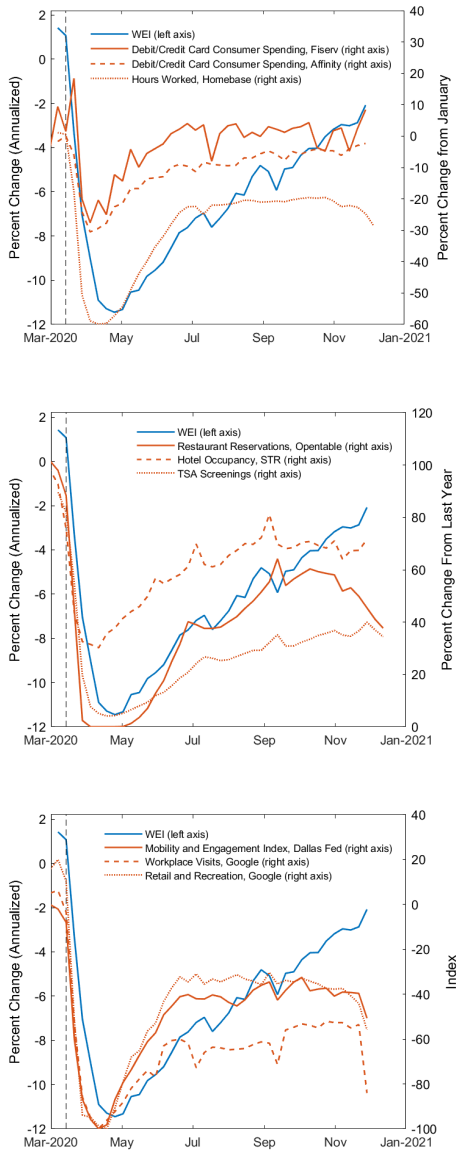

FIGURE 4. WEI AND ALTERNATIVE HIGH-FREQUENCY INDICATORS

Note: Source: Haver Analytics. The vertical line marks the week ending March 14th 2020

and a measure of hours worked from time clock software company Homebase, which services restaurants and small retailers. The next panel compares the WEI to indicators of activity in hard-hit sectors: counts of restaurant diners from OpenTable (an online reservation company), hotel occupancy rates from STR (a data provider to hotels), and TSA screenings at airports. The final panel shows indices of mobility, including the Dallas Fed Mobility and Engagement Index (based on mobile device location data from Safegraph, Atkinson et al, 2020) and Google metrics on visits to the workplace and retail and recreational locations.

Overall, there is strong agreement across the measures shown in Figure 4 on the timing of initial impact of the pandemic. As the WEI, virtually all measures decline in the week ending March 14th, followed by a sharp contraction the next week. The only exception is the credit/debit card data, which contract the following week. A likely reason for the delay is the precautionary stockpiling by consumers, which also appears in Google mobility and WEI retail data.

All alternative indicators, with the exception of restaurant reservations, begin to recover in mid-April, a week before the trough in the WEI. However, weekly changes in the WEI are relative to weekly changes a year prior, so flat WEI readings in mid-April correspond to weekly growth in economic activity roughly on par with the weekly growth in activity the previous year. Thus, the WEI and alternative indicators (except dining traffic) also agree that economic activity bottomed in mid-April.

There is more disagreement during the recovery. Credit/Debit card spending, travel

and dining, hours worked at small businesses, and mobility all recover more strongly than the WEI in May and June, before slowing over the summer and fall. The WEI's recovery instead occurs at a steadier pace. This is possibly because the WEI contains little direct information on contact-intensive service sectors, but likely also reflects persistently high levels of UI claims, in part due to elevated take-up rates relative to the past (Cajner et al 2020).

Into October and November, many alternative data have stalled or even begun to trend downwards alongside a deterioration of the public health situation. To date, there is little sign of similar slowdown in the WEI.

IV. Concluding Remarks

During the pandemic, the WEI has provided a useful tool for tracking rapid economic developments next to a variety of new high-frequency data. The proliferation of alternative data spurred by the pandemic will provide opportunities to augment future versions of the WEI and other real-time activity indicators.

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