Economic Insights
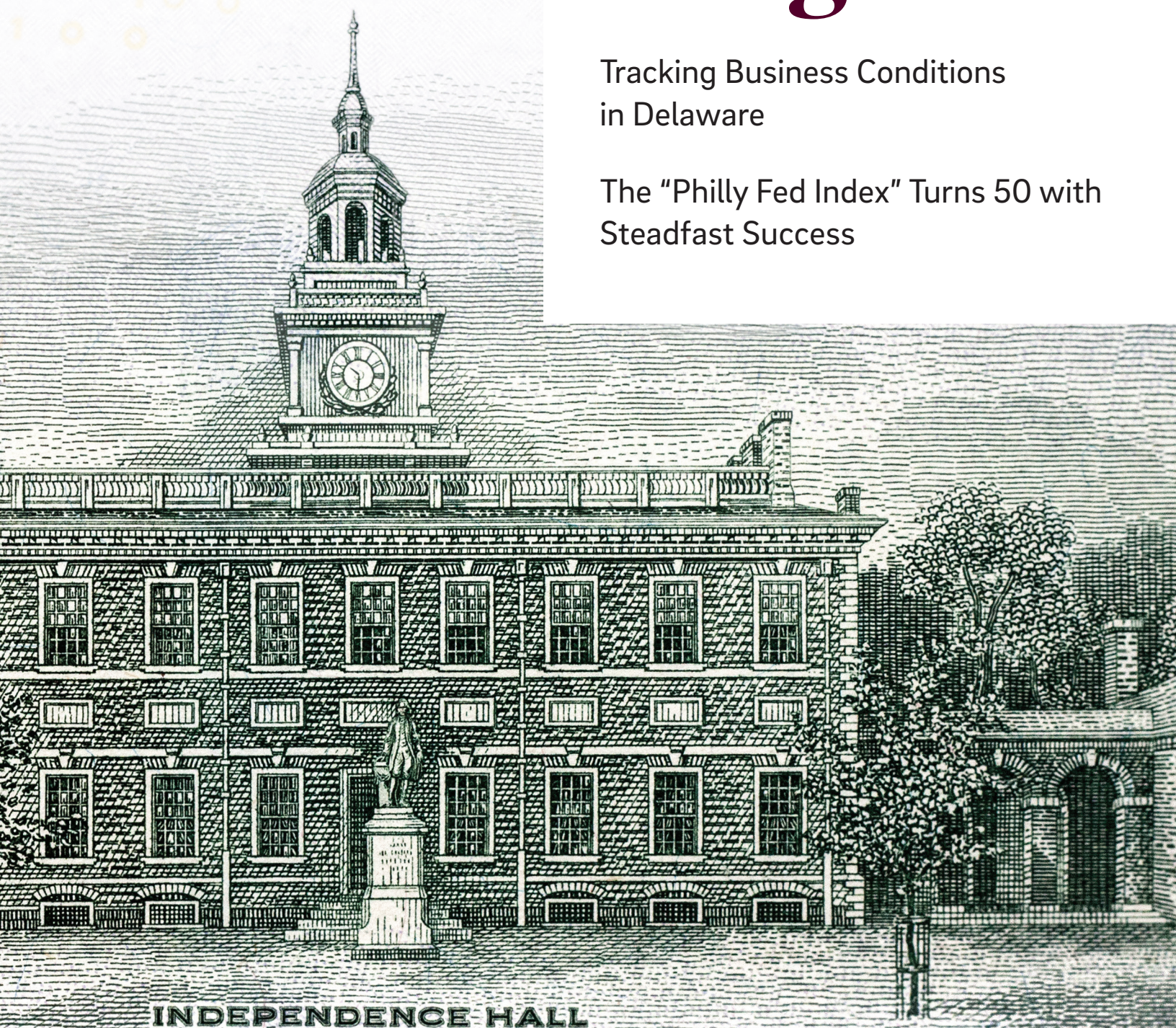
Tracking Business Conditions
in Delaware

The "Philly Fed Index" Turns 50 with
Steadfast Success

INDEPENDENCE HALL

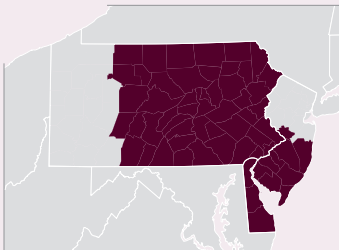# Contents

Economic Insights

About the Cover

The $100 bill is all about Philadelphia—and the founding of our nation. On its face is Benjamin Franklin, whose arrival in Philadelphia from Boston at age 17 helped change the course of history. On the reverse is the engraving adapted for our cover image of Independence Hall, where the Declaration of Independence and Constitution were debated and signed. Two blocks north on Sixth Street is the current home of the Federal Reserve Bank of Philadelphia, founded after the Federal Reserve Act of 1913 authorized the issuance of Federal Reserve notes such as the $100 bill. To see how the look of the $100 bill has evolved since 1914, go to: **https://www.uscurrency.gov/denominations/100**.

Photo by Rich Wood.

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Tracking Business Conditions in Delaware

To meet the need for a gauge of current regional conditions at high frequency, we have built a real-time daily index to monitor business conditions in Delaware. What are the current conditions in the First State? How have these conditions evolved since the 1990s?

Jonas E. Arias is a senior economist at the Federal Reserve Bank of Philadelphia and **Jesús Fernández-dez-Villaverde** is a visiting scholar from the University of Pennsylvania. The views expressed in this article are not necessarily those of the Federal Reserve.

BY JONAS E. ARIAS AND JESÚS FERNÁNDEZ-VILLAVERDE

Ever since the first official measure of the U.S. economy, prepared by Simon Kuznets, was submitted to Congress in 1934, substantial resources have been dedicated to developing more precise tools for systematically tracking economic conditions. A major breakthrough in this line of research came in the late 1980s with the development of monthly indexes for monitoring the current state of the economy using modern time series econometrics.[1]

These indexes have become an essential part of the toolkit of economists at policymaking institutions and in the private sector because they provide a systematic framework for extracting, in real time, a succinct summary of the state of the economy from the vast and continually evolving economic data. Prominent examples of such summary indexes include the Federal Reserve Bank of Chicago's National Activity Index and the Federal Reserve Bank of Philadelphia's State Coincident Indexes, which track the U.S. and state economies, respectively.

In recent years, the work on monthly indexes has been advanced by Borağan Aruoba, Francis X. Diebold, and Chiara Scotti's development of a methodology for monitoring the state of the economy at even higher frequencies–weekly and daily. This work has evolved into the Philadelphia Fed's Aruoba-Diebold-Scotti (ADS) Business Conditions Index.

To date, this high-frequency approach has been employed exclusively to provide timely information about the national economy. Yet, it has become increasingly clear that economic conditions in a particular region of the country can at times differ from the overall state of the U.S. economy.[2] Furthermore, state-level real GDP–one of the chief indicators of what is happening to the economy–is typically released with a lag of more than five months. In an attempt to meet the need for a gauge of current regional conditions at high frequency, we have built a real-time daily index to monitor business conditions in Delaware, which along with most of Pennsylvania and southern New Jersey, makes up the Third Federal Reserve District served by the Philadelphia Fed. While similar indexes could also be built for the other two states, the case of Delaware is interesting because of the high volatility of Delaware's real GDP growth–about twice that of New Jersey and nearly triple that of Pennsylvania, and one of the most volatile growth rates among the 50 U.S. states. This volatility presents a major challenge for households, firms, and policymakers alike when it comes to forming accurate views about what is happening to the economy in the First State.

With this backdrop in mind, we will describe how the index works, examine what it can contribute to our understanding of the evolution of Delaware's economy since the 1990s, and discuss the challenges and limitations of trying to measure the economy in real time.

The Making of a Real-Time Index for Delaware

The index is based on Delaware's readings for seven macroeconomic variables: initial claims for unemployment insurance benefits, nonfarm payroll employment growth, the unemployment rate, an electricity consumption index, new building permits, new car titles, and real personal income growth.[3] These economic variables, which are the index's input variables, provide snapshots of different aspects of the economy. Initial jobless claims, employment growth, and the unemployment rate are barometers of labor market conditions. Electricity consumption and the pace of building permit issuance contain information about the health of commerce, construction, and industrial production. New car titles and real personal income growth are reasonable indicators of households' purchasing power.

While the input variables depict economic conditions from different angles, they generally move with the underlying state of the economy, or *latent business conditions*. This underlying level of economic activity cannot be directly observed. Instead, it is inferred from the levels and movements of various relevant economic indicators. But different economic indicators can point in different directions at the same time, which suggests that factors other than intrinsic economic activity may be in play.

Real Time Business Conditions Index for Delaware

Standardized units; 1990–2018

■ Delaware Business Conditions Index   ■ PFED national ADS
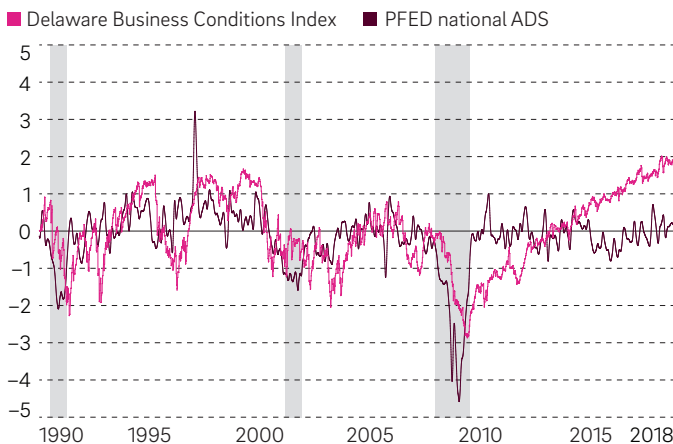
Note: The years shown on the x-axis correspond to the first day of the year; e.g., 2000 refers to January 1, 2000.

Delaware in the BEA Mideast
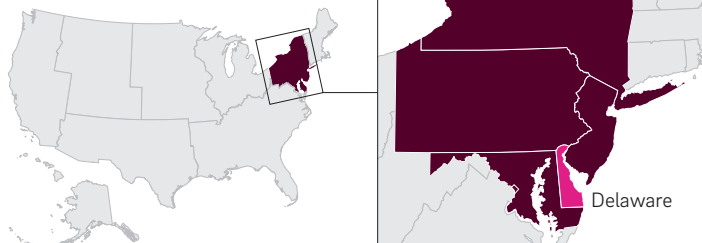
Delaware

Delaware's Real GDP Made a Slow Recovery

Millions of 2009 dollars, seasonally adjusted at annual rates; 2005–2017

Pre-recession peak

What we are after, though, is a measure of economic activity that firms and households can use in their daily decision-making. For example, when firms are deciding whether to expand production or households are deciding whether to purchase big-ticket items such as a house or a car, they often rely–explicitly or implicitly–on a concise summary about the state of the economy based on the information they absorb from the news or other sources.

The approach that firms and households use to extract this succinct measure of economic conditions will vary depending on their budget and experience. Central banks frequently rely on a class of statistical models from which it is possible to optimally extract a reading of what is happening to the economy given the information available this week or even today.

We will follow one of these statistical frameworks to assess the latent business conditions prevalent in Delaware in real time over the past 27 years. In particular, we will use the procedure developed by Aruoba, Diebold, and Scotti.[4]

Assessing Business Conditions in Delaware

By feeding the seven input variables into the statistical model, we obtain an estimate of the evolution of latent business conditions in Delaware since the 1990s (Figure 1).[5] An informative point of reference for evaluating these conditions is latent U.S. business conditions during the same timespan, as measured by the Philadelphia Fed's ADS index.[6] Three results stand out.

First, business conditions in Delaware corresponded reasonably closely with those of the nation from the beginning of our sample in January 1990 until the end of the Great Recession in June 2009.[7,8] The correlation between business conditions in Delaware and in the nation was nearly 0.6 over that period. This fairly close correlation is perhaps not surprising, given that Delaware is located within an important region of U.S. economic activity, the Bureau of Economic Analysis's (BEA's) Mideast Region (Figure 2).[9] Real GDP for that region equals nearly 20 percent of U.S. GDP, on average.

Second, business conditions in Delaware recovered from the Great Recession more slowly than national business conditions did. While the U.S. overall reached its historical average in July 2009, coinciding with the end of the Great Recession, business conditions in Delaware remained persistently under par, reaching their historical average more than three years later, in February 2013. This historical average corresponds to the normal situation of the economy as determined by the observations. Since in a typical month the U.S. and Delaware economies are growing, readings below average are still compatible with positive GDP growth (just at a slower pace).

The slow recovery documented by the index is consistent with Delaware's feeble real GDP readings in the aftermath of the financial crisis. It took more than four years after the end of the Great Recession for Delaware's GDP to exceed its precrisis peak (Figure 3). The cumulative growth rate of Delaware's real GDP from 2010 to 2013 (i.e., the change in real GDP from 2009 to 2013) was about -2 percent, a worrying performance when compared with the cumulative growth rate of U.S. real GDP over the same period of about 8 percent. In addition, there is narrative evidence

supporting the Delaware index's poor readings following the Great Recession.[10]

Third, business conditions in Delaware have hovered well above their historical average during the past four years, which is in line with the sharp increase in real GDP from 2013 to 2017 (Figure 4). Real GDP increased nearly 10 percent over that span, propelled by the strong growth in 2014, the largest increase in Delaware's real GDP since 1999.

Real GDP's dull performance from 2009 until 2013 and ensuing pickup were predominantly in sync with the Delaware index. But did this tight relationship between latent business conditions and real GDP hold over our full sample? Studying the longer-term relationship is challenging. To begin with, the earliest data point for real GDP for Delaware corresponds to 1997.[11] In addition, whereas directly comparing the index with real GDP over short periods such as 2007-2017 can be informative, to meaningfully compare the index with GDP over longer periods requires distinguishing fluctuations in GDP from its trend by transforming the GDP data into growth rates–which are more than twice as volatile as those of the nation. Despite these challenges, the Delaware index captures fairly well the big-picture patterns of real GDP growth (Figure 4).

More concretely, real GDP growth was remarkably high during 1998 and 1999, coinciding with strong latent business conditions. Afterward, GDP growth performed poorly until 2013. The mean rate of real GDP growth over 2000-2013 fluctuated somewhat below par, with pronounced declines in 2002 and 2008. Similarly, the index registered low readings over this period. Notably, business conditions were well into negative territory before the two largest declines in real GDP growth occurred and the index bottomed out in the subsequent year. Since 2014, the mean rate of real GDP growth has been about 0.1 percentage point above average. This latest period of four years of slightly higher than average growth is in tune with–though much more muted than–the values of the Delaware index, which have not been so high since 1999.

There are two main takeaways from our analysis. First, business conditions in Delaware recovered slowly from the Great Recession, reaching their historical average in February 2013, more than five years after the onset of the recession. Second, business conditions have been consistently above average since 2014. Altogether, the evidence suggests that the index can be a useful, timely benchmark for assessing economic conditions in Delaware.

The Relationship Between Index and Inputs

How do the index values compare with those of each of the seven variables used to construct it? Examining these relationships will help us determine whether the index is reliably picking up on key signals that are coming from different corners of the economy. Recall that the Delaware index is a summary indicator–that is, it is based on data about different parts of the economy. For the most part, a summary indicator will move in tandem with its input variables.

Indeed, examining the relationship between the Delaware business conditions index and its labor market components clearly shows this comovement. It is evident that, when viewed over a number of years, from January 1990 through September 2018, initial jobless claims have moved in line with the index (Figure 5). The correlation between the data points and the index is about 0.6, and there are definite similarities in the cyclical movements of the series. Notwithstanding, there were periods in which the index was clearly below or above the negative of initial claims, indicating that other forces were in play that were determining the state of Delaware's economy.

The method of extracting latent business conditions from the observation of several macroeconomic variables is a particular application of a class of techniques known as filtering. These techniques are widespread in the natural sciences and engineering and have become popular in economics since the 1970s.

Filtering consists of updating our knowledge about an unobserved variable in a system as new information arrives. To grasp a deeper notion of how it works, consider a two-equation linear system in which the first equation describes how an observed variable y relates to an unobserved variable α, and the second equation describes how the unobserved variable evolves. Applying filtering techniques to this system provides the best statistical guess of the value of the unobserved variable at each point in time given all the information available. Formally, such a best guess is the expected value of the unobserved variable at time t given the current and past observed variables, i.e., $E(\alpha \neg_t \mid y_1, y_2, ..., y_t)$.

Importantly, filtering is an objective procedure. Applying this methodology to infer Delaware's business conditions results in an indicator that complements heuristic judgments that one can make about what is occurring in the economy.

Business Conditions, Real GDP Growth Tell Broadly Similar Story

Standardized units; 1998–2017

■ Delaware Business Conditions Index   ■ Delaware real GDP growth
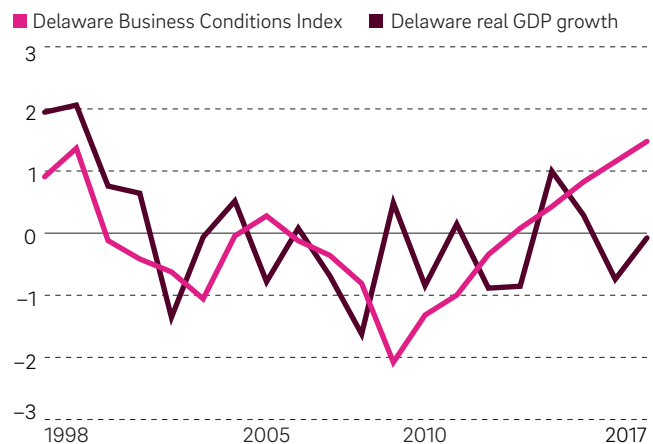
Note: The annual value for the Delaware Business Conditions Index is the average value of the index throughout the year.

FIGURE 5

The Index Tracks Most Input Variables

Standardized units   ■ Delaware Business Conditions Index   ■ Data

Negative of Initial Jobless Claims
13 January 1990–22 September 2018

Electricity Consumption Indicator
15 January 2000–15 September 2018

New Car Titles
31 August 1992–31 August 2018

Nonfarm Payroll Employment Growth
31 March 1990–31 August 2018

New Private Housing Units Authorized (Permits)
28 February 1990 – 31 August 2018

Real Personal Income Growth
30 September 1990–30 June 2018

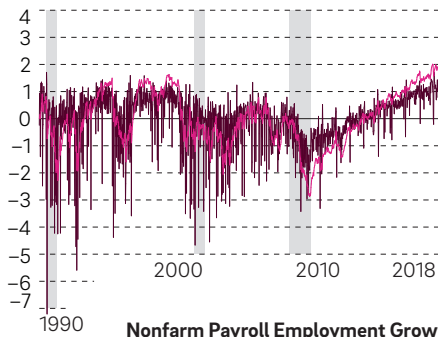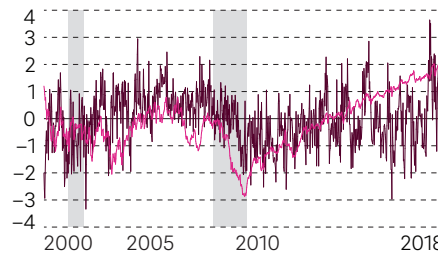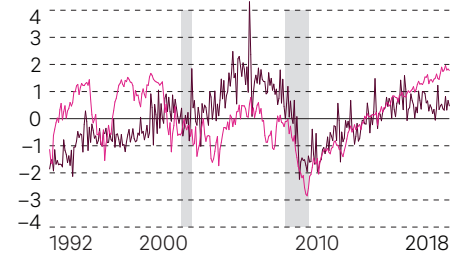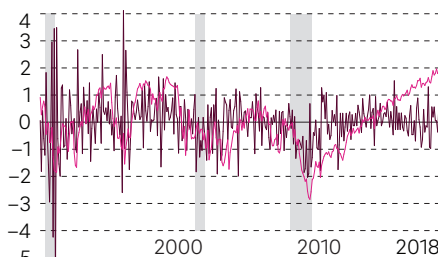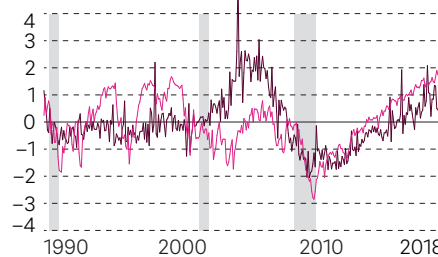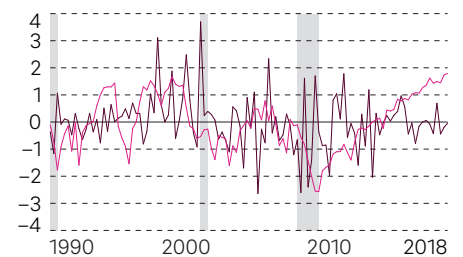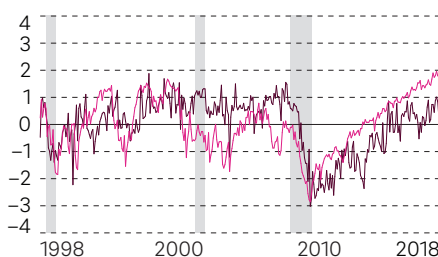**Negative of the Unemployment Rate**
28 February 1998–31 August 2018

Turning to another labor market component of the index, nonfarm payroll employment growth, we can see that despite the apparent comovement between employment growth and the index, these series have diverged since mid-2009. Following the Great Recession, employment growth reached its historical average earlier than the Delaware business conditions index did, suggesting that other variables (such as the unemployment rate) were exerting a drag on the economy during this period. More recently, nonfarm payroll employment growth has been moderate, but the remaining data convey positive signals about the economy. As a consequence, business conditions readings have scored above the growth rate of nonfarm payroll employment during the past two years.

The remaining labor market indicator, the negative of the unemployment rate, very visibly decoupled from business conditions during certain periods such as the mid-2000s. Yet, in the decade following the onset of the financial crisis, from 2007 to 2017, this variable plunged and recovered in tandem with business conditions.

Similarly, the Delaware index has moved in line with both electricity consumption and the issuance of building permits since the onset of the Great Recession (Figure 5). Electricity consumption dropped significantly around mid-2009 and recovered gradually thereafter. A similar view emerges when looking at new building permits. These patterns were in tune with the Delaware index, which bottomed out in June 2009 and regained strength at a sluggish pace. Interestingly, when looking at the period before the Great Recession, the comovement between the Delaware index and these two variables was less pronounced, especially for new building permits, which conspicuously decoupled from business conditions three times. The first two times–from March 1993 until March 1995 and from January 1997 until January 2000–correspond to periods during which the index indicated that latent business conditions were about

one standard deviation above average, but new building permits were nearly flat. The third occurred in the early and mid-2000s, when new building permits gradually increased, peaking at more than two standard deviations above their historical average. In hindsight, our indicator tells us that during this period new building permits were at their highest point with respect to our sample and had become disconnected from the overall state of Delaware's economy.

The relationship between the index and its input variables related to household purchasing power–new car titles and real personal income growth–exhibits some of the features that we have observed for the previous variables (Figure 5). The evolution of new car titles is remarkably similar to the evolution of new building permits. Accordingly, the index has closely tracked new car titles since the onset of the Great Recession but did not during the precrisis period. Real personal income growth is a volatile series, and it is the variable that has the lowest correlation with the Delaware index. Even so, the index broadly follows the patterns of real personal income growth, save for certain episodes such as that of the past few years, during which real personal income growth

has been somewhat below average while business conditions have been at their highest level since 1999.

Understanding the Main Drivers

We have just seen how the input variables relate to the index, but can we assess how much each variable is contributing to the index's value at a given point in time or to the change in the index's readings during a certain period? Are some variables more important for revealing underlying economic conditions than others?

The methodology behind the index implicitly assigns weights to current and past data points for each input variable in the underlying statistical model. These filtering weights answer the above questions by allowing us to compute a statistical decomposition that reveals the main drivers behind our assessment of latent business conditions at any point in time. The filtering weights also tell us about the (statistical) source of fluctuations in those conditions over time. To illustrate these points, we first compute each variable's contribution to the index readings throughout October 2005 and January 2018. Next, we compute each variable's cumulative contribution to the change in business conditions over the course of each month. The rationale behind the selection of these months is that they demonstrate an important feature of the index: Initial jobless claims were usually the chief determinant of the overall index value as well as a main driver of its fluctuations.

The central role that initial claims play for the value of the Delaware index can be seen in the average weekly contribution of the three input variables that contributed the most to the value of the index during January 2018 (Figure 6). Initial claims contributed nearly 100 percent of the value of the Delaware index between January 1 and January 5 (first column). The contribution of initial claims dropped slightly below 95 percent between January 6 and January 12 and remained at about that level for the remaining weeks (remaining four columns). Importantly, the contributions can be negative. For example, the average

contribution of nonfarm payroll employment growth to the index was -4 percent during January, indicating that payroll employment has been a moderate drag on the index.

Undoubtedly, initial claims were the overwhelming force behind the index values during January 2018. That is frequently the case throughout our sample, suggesting that initial claims contain crucial information about economic conditions in Delaware. This finding resonates with former Federal Reserve Chairman Alan Greenspan's view on the influential role of initial claims for understanding current economic conditions. He once referred to initial claims as "the earliest indicator of what's happening to the economy."

Moreover, even during periods in which the relevance of initial claims for the index's value declined significantly, claims explained most of the change in its readings. For example, consider the average weekly contribution of the three input variables that contributed the most to the index during October 2005 (Figure 6). Initial claims contributed about 65 percent of the value of the index between October 1 and October 7 (column 1). The contribution of initial claims to the index's values dropped to about 10 percent between October 8 and October 14 (second column), a period during which the electricity consumption index took over as the main factor behind the index's value. Payroll employment growth and the remaining input variables also contributed significantly to the index value throughout October. The large shifts in the contribution of initial claims during October 2005 can be attributed almost entirely to new data showing a slump in the readings for this variable. As will become clear below, the decrease in the contribution of claims reduced the index's value, which in turn increased the role played by the remaining variables.[12]

This decline in the contribution of claims to the index's value does not imply that this variable is unimportant for explaining fluctuations in business conditions. In fact, when decomposing the cumulative change in the value of the Delaware index throughout October 2005 (Figure 7), it becomes evident that by and large claims account for the weekly deterioration of business

FIGURE 6

With Exceptions, Initial Claims Central to Index Level...

Historical decomposition of contributions to the Delaware Business Conditions Index

Standardized units; January 2018 and October 2005

■ Initial claims ■ Payroll employment ■ Electricity consumption
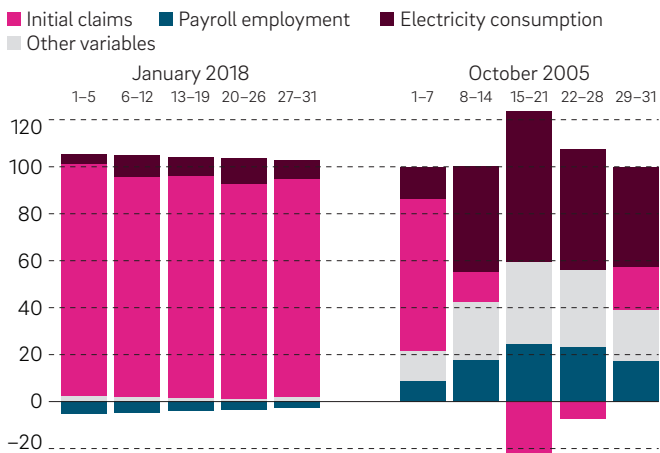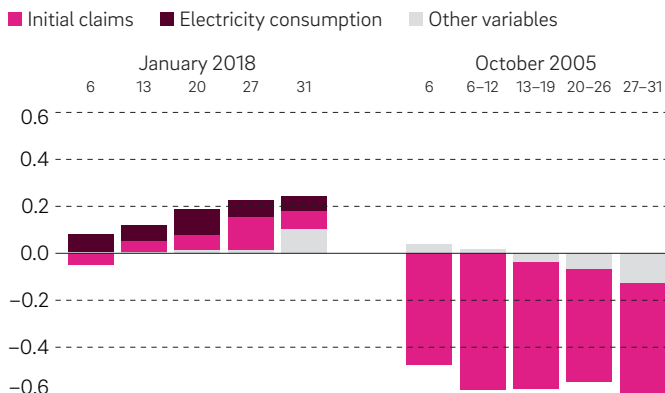■ Other variables

FIGURE 7

...As Well as to Its Changes

Cumulative changes in the Delaware Index

Standardized units ; throughout January 2018 and October 2005

■ Initial claims ■ Electricity consumption ■ Other variables

conditions over the course of the month. Likewise, simply that initial claims were the dominant determinant of the index's readings in January 2018 does not necessarily mean that claims were the overwhelming determinant of the changes in those readings. A decomposition of the cumulative changes in index values during January 2018 (Figure 7) shows that electricity consumption was the main driver of these changes, suggesting that our model was taking some positive economic signal from a rise in electricity consumption. Although this finding elucidates that variables other than initial claims can also shed light on how business conditions evolve, it should be regarded with caution given the extreme weather in early January.[13]

Concluding Remarks

Overall, our analysis attributes a major role to initial jobless claims in revealing business conditions in Delaware. Yet, it has also shown that, in order to grasp a deeper understanding of which facets of the economy are exerting a drag on or fostering business conditions, it is important to continuously update the contribution of the input variables to the index's value as well as to its changes.

Finally, as we mentioned, in small states such as Delaware, real GDP growth tends to be more volatile than for the rest of the nation, and economic indicators can point in different directions. These factors can complicate the task of measuring business conditions using summary indexes. In such an environment, readings of business conditions could be sensitive to several modeling choices. For example, just by removing or adding an input variable, one could reach a very different conclusion about what is happening to the economy during a particular period of time or about which variable reveals the most about current economic conditions. Therefore, it is crucial to complement the computation of the index value with a comprehensive analysis of all the available evidence, including plots of the input variables, statistical decompositions, traditional measures of the economy such as real GDP, and even the narrative evidence, as we have done in this article. ▣

Notes

1 These indexes were developed by James Stock and Mark Watson, building on pioneering work by John Geweke, as well as by Thomas Sargent and Christopher Sims.

2 Maria Arias, Charles Gascon, and David Rapach compute monthly economic activity indexes across metropolitan statistical areas (MSAs) in the U.S. and find differences in business cycles across these regions. James Hamilton and Michael Owyang find that in spite of a common national component across most recessions in the U.S., there is considerable geographic heterogeneity in the timing of recessions—i.e., when a recession started and ended. See also the research by Jason Brown.

3 All variables except for the unemployment rate, new car titles, and electricity consumption are downloaded from Haver Analytics. The unemployment rate series was computed using data from the Current Population Survey (CPS) that is conducted by the U.S. Census Bureau for the Bureau of Labor Statistics (BLS). Data on new car titles were provided by the Delaware Department of Transportation. The electricity consumption indicator is a measure of residential and nonresidential electricity consumption—net of weather conditions and technological progress—in the Delmarva Peninsula (the smallest geographic unit containing Delaware for which electricity consumption data are publically available) built using data from PJM and the National Oceanic and Atmospheric Administration (NOAA). The Delmarva Peninsula encompasses Delaware and parts of Maryland and Virginia, but the population of Delaware is about 70 percent of the Peninsula population. As a result, the bulk of the information contained in the electricity consumption index corresponds to the First State.

4 Such framework belongs to the class of dynamic factor models (DFMs) that constitute the backbone of index construction in macroeconomics. Even so, whereas most DFMs are based on a large number of variables (typically more than 100 variables) evolving at monthly frequency, Aruoba, Diebold, and Scotti's DFM focuses on a few variables evolving at different frequencies including weekly or even daily data. The performance of large-data monthly DFMs relative to small-data high-frequency DFMs has been unexplored in the literature, in part because of the fact that the true underlying state of the economy is never observed.

5 The Philadelphia Fed has no immediate plans to release monthly readings of Delaware business conditions but is exploring the possibility of doing so, including business conditions for the other states of the Third District, provided that data on industrial electricity consumption and new car titles are made available.

6 The latent business conditions in Delaware as measured by our index (which we often refer to as the Delaware Business Conditions Index) and the Philadelphia Fed's

ADS index are reported in standardized units. This means that the average value of each index is zero and that positive values indicate better-than-average conditions, whereas negative values indicate worse-than-average conditions. For example, a value of the Delaware Business Conditions Index equal to 2 indicates that business conditions in Delaware are two standard deviations above the historical average of the index.

7 The term Great Recession refers to the recession associated with the financial crisis of 2007 and 2008, the deepest recession since WWII. The National Bureau of Economic Research (NBER) estimates that the Great Recession began in December 2007 and ended in June 2009.

8 Occasional updates to the Delaware Business Conditions Index are available at https://sites.google.com/site/jonasarias/.

9 This region covers the District of Columbia, Delaware, Maryland, New Jersey, New York, and Pennsylvania.

10 See, for example, the article "The First State Comes Last" in *The Economist* magazine on April 4, 2015.

11 The BEA reports real GDP data for years before 1997. However, this time series cannot be combined with post-1997 GDP data to form a single time series. This is because while the former is consistent with the BEA's definition of U.S. gross domestic income, the latter is consistent with the BEA's definition of U.S. gross domestic product, which is a related but different time series.

12 Theoretically, the shifts in the contribution of the input variables to the index's value can be attributed to either new data or the filtering weights, or a combination of both. For instance, with respect to new data, a turning point in one of the variables affects the overall contribution of such variable to the index. Moreover, in some cases the reversal could be large enough to turn the variable in question into a drag for business conditions or vice versa. The filtering weights implicit in our methodology separate information that is pertinent to business conditions from noise or measurement error.

13 Even though our electricity consumption index is designed to be robust to weather fluctuations, it is possible that it does not fully capture the intricate relationship between electricity consumption and extreme weather.

References

Arias, Maria A., Charles S. Gascon, and David E. Rapach. "Metro Business Cycles," *Journal of Urban Economics*, 94 (2016), pp. 90–108. https://doi.org/10.1016/j.jue.2016.05.005.

Arubo, Boragan, Francis X. Diebold and Chiara Scotti. "Real-Time Measurement of Business Conditions," *Journal of Business and Economic Statistics*, 27:4 (October 2009), pp. 417–427. https://doi.org/10.1198/jbes.2009.07205.

Brown, Jason P. "Identifying State-Level Recessions," Federal Reserve Bank of Kansas City *Economic Review*, 102:1 (2017), pp. 85–108.

Geweke, John. "The Dynamic Factor Analysis of Economic Time Series Models," in Dennis J. Aigner and Arthur S. Goldberger, eds., *Latent Variables in Socio-Economic Models*. Amsterdam: North-Holland Pub. Co., 1977, pp. 365–383.

Greenspan, Alan. *The Age of Turbulence: Adventures in a New World*. New York: Penguin Press, 2007.

Hamilton, James D., and Michael T. Owyang. "The Propagation of Regional Recessions," *The Review of Economics and Statistics*, 94:4 (2012), pp. 935–947. https://doi.org/10.1162/REST_a_00197.

Kuznets, Simon. "National Income, 1929–32," Senate Document No. 124, 73rd Congress 2nd Session, Government Printing Office, Washington D.C. (1934).

Sargent, Thomas J., and Christopher A. Sims. "Business Cycle Modeling Without Pretending to Have Too Much a Priori Economic Theory," Federal Reserve Bank of Minneapolis Working Paper (1977).

Stock, James H., and Mark W. Watson. "New Indexes of Coincident and Leading Economic Indicators," NBER Macroeconomics Annual, 4 (1989), pp. 351–394. https://doi.org/10.1086/654119.

Stock, James H., and Mark W. Watson. "Dynamic Factor Models, Factor-Augmented Vector Autoregressions, and Structural Vector Autoregressions in Macroeconomics," in *Handbook of Macroeconomics*, 2. Elsevier (2016), pp. 415–525. https://doi.org/10.1016/bs.hesmac.2016.04.002.

The "Philly Fed Index" Turns 50 with Steadfast Success

What is so telling about the Philadelphia Fed's monthly manufacturing index? Explore why financial analysts, economists, and the press monitor it closely for clues about the overall U.S. economy.

BY MICHAEL TREBING AND CAROLINE BEETZ FENSKE

Michael Trebing is a senior economic analyst at the Federal Reserve Bank of Philadelphia, and has managed the survey for over 25 years, and **Caroline Beetz Fenske** is a PhD economist and certified editor with 20 years of experience with EconWriter International. The views expressed in this article are not necessarily those of the Federal Reserve.

This year, the Federal Reserve Bank of Philadelphia is celebrating the 50th anniversary of its monthly Manufacturing Business Outlook Survey (MBOS). The MBOS queries high-level business executives in the Third Federal Reserve District, covering eastern Pennsylvania, southern New Jersey, and Delaware, on the direction of change in business activity. It is the longest-running manufacturing survey compiled by a regional Federal Reserve Bank. Not only has the survey provided valuable information on business cycle swings regionally, it is quite sensitive to shifts in national activity. As such, it has been remarkably successful in providing current-period forecasts of key U.S. economic indicators before official quantitative statistics are published. Consequently, economists, investors, and the media carefully watch the survey. Historically, the MBOS has even moved markets, particularly in times of uncertainty when the stock market has been highly volatile.

The MBOS, formerly known as the Business Outlook Survey, began as a joint effort of economists in the Research Department of the Philadelphia Fed and the Bell Telephone Company of Pennsylvania in Philadelphia as a way to measure local economic activity.[1] Dr. Edward Boehne, a newly hired economist at the Philadelphia Fed, authored the early memos spelling out the objectives and planning of the survey. He was particularly insightful to plan the report release date to coincide with the month being surveyed. Boehne eventually became Research Director and later President of the Philadelphia Fed. In its early years, the survey was mailed out in the beginning of the month to regional manufacturing executives. The resulting report on expectations of business conditions was then mailed mid-month by the Philadelphia Fed to any interested parties. Over time, as the MBOS gained in popularity, the survey was conducted by phone, and a "hotline" was established with pre-recorded results. With technological advances, data gathering and release finally went online, with results of the survey typically published on the third Thursday of the month.

Since the survey's inception, the Philadelphia Fed has computed diffusion indexes using the data reported by respondents for overall business conditions and for specific indicators, such as new orders, working hours, employment, and prices paid and received. The longevity of the series, including spanning over seven recessions as reported by the National Bureau of Economic Research (NBER), allows us to measure the performance of the indexes as early indicators of recessions. A notable example occurred when the current general activity index moved from positive to significantly negative during the exact same month as the official start of the Great Recession in December 2007.

Early on, financial market participants began to recognize the MBOS's predictive value for other indicators of manufacturing activity, such as the Institute for Supply Management's Purchasing Managers' Index (PMI). The PMI is published with a lag of one-half month behind the release of the MBOS. Taking advantage of this lead time, the MBOS indexes have been used in many forecast models to predict short-term changes in the U.S. manufacturing industry, which is often a bellwether for other sectors in the economy. Also, the MBOS indexes on prices give early insight into our region's monthly price changes as well as national price changes that are not available otherwise for at least a month later, thereby providing predictive value ahead of other price data.

Indeed, the MBOS's timeliness gives it an edge over many other indicators. "This is hugely important," said Tom Porcelli, managing director and chief U.S. economist at RBC Capital Markets. "It is a 'live' index. You can look at what's going on in the month you are trying to analyze."

While the core questions in the MBOS have remained constant throughout its history, more recently, new questions have been added on price expectations on the part of manufacturing executives. In addition, timely special questions of interest to the Philadelphia Fed have been introduced. This new and unique survey information available to the public as well as policymakers only adds to the richness of the MBOS.

Given the success of the "Philly Fed Index," other Federal Reserve Banks have adopted similar surveys, which have also

been shown to generally correlate well with various national indicators, providing further current-period forecasts of regional and national economic activity. The predictive value provided by the MBOS and other Fed surveys factor into policy decisions and is used as an input into publications on regional activity. In light of its 50-year anniversary, it is fitting to provide here a longer view of the usefulness of the MBOS survey and how it has changed since 1968.

Manufacturing Business Outlook Survey: Purpose and Procedure

The original intent of the MBOS was to crudely measure business expectations in the Third District as a means to estimate turning points in the business cycle. According to a 1969 internal Federal Reserve memo by Dr. Edward Boehne, "the survey was modestly intended to provide a 'feel' for expectations in the manufacturing sector and a qualitative measure of them." Moreover, "individual indicators at least may provide some clues to alert us to impending turning points in business activity. Further, the frequency of a monthly survey allows for a faster confirmation (or disconfirmation) of turning point suspicions..."

The format of the MBOS questionnaire was designed to be easy to complete and include a cross-section of leading, coincident, and lagging indicators as well as a question on the general level of business conditions (see Figure 1). Another beneficial feature of the MBOS is that the data has always been reasonably quick to compile and publish. After a few months of experimentation, the survey form was finalized just as it is today. Not only have the questions remained constant but also the survey includes the same time periods, asking for changes from the previous month and expectations six months forward.

Since early on in its history, the MBOS has been considered unique because it asks leaders of manufacturing companies—

owners, CEOs, and plant managers—about changes in business activity.[2] This approach has been continuous now for 50 years and differs from many other published manufacturing surveys, which often direct questions to purchasing managers and other business contacts rather than high-level officers. Without question, there is substantial value in collecting information from the heads of firms about the direction of change in business activity within their own companies.

Over the past half-century, the Philly Fed has compiled the MBOS data on overall business activity along with data on employment, working hours, new and unfilled orders, shipments, delivery times, and prices of inputs and manufactured goods. In order to put the individual survey responses in a form that can be used to help track regional and national business cycles, the Philadelphia Fed constructs monthly diffusion indexes for overall business activity and for each of the subindicators. The MBOS diffusion indexes are calculated by subtracting the percentage of respondents reporting decreases from the percentage of those reporting increases for each indicator. Index values below zero normally occur during recessions, that is, when more respondents report declines than improvements. Index values above zero typically correlate with periods of economic expansion, that is, when positive responses on the direction of change in an indicator outweigh negative ones. Given the qualitative nature of survey data, it is important to note that a diffusion index does not gauge the magnitude of the change, but rather the scope of the change in economic activity. Using the survey indexes, it is possible to forecast and make inferences about potential changes in economic conditions in the near term that would not otherwise be known until official quantitative data have been published, with the potential to guide policy.

See **"Diffusion Indexes."** →

FIGURE 1

The MBOS Questionnaire

Core Questions

General Business Activity

September vs. August | Six months fro...

	No Response	Decrease	No Change	Increase	No Response	Decr...
What is your evaluation of the level of general business activity?	◉	○	○	○	◉	○

Company Indicators

September vs. August | Six months fro...

	No Response	Decrease	No Change	Increase	No Response	Decr...
New Orders	◉	○	○	○	◉	○
Shipments	◉	○	○	○	◉	○
Unfilled Orders	◉	○	○	○	◉	○

FIGURE 2

The MBOS Leads Other Indicators by Weeks and Correlates Strongly with the Lagging Indicators

Month of interest

Wk 1
2
3 — MBOS
Philadelphia Fed
4

Lagging month

1 — PMI
Institute for Supply Management
2 — Employment data
Bureau of Labor Statistics
3 — Industrial production data
Federal Reserve Board
4

Diffusion Indexes

The Manufacturing Business Outlook Survey (MBOS) asks participants in the Third Federal Reserve District—firm owners, CEOs, and other top executives—to report on the direction of monthly business activity at their plants. Specifically, they are asked to indicate the direction of change in overall business activity from the month prior, as well as monthly changes in specific indicators: employment, workweek, new and unfilled orders, inventories, shipments, and delivery times, along with prices paid and received.

The qualitative data derived from the MBOS is collected by asking participants if each indicator has increased, stayed the same, or decreased from the prior month (see Figure 1 for the actual survey questionnaire). Participants are also asked to indicate their expected direction of change for each indicator over the upcoming six-month period, which provides valuable feedback for economists. The individual survey responses are quantified to facilitate tracking of regional and national economic conditions by constructing monthly diffusion indexes, as described below. These are calculated separately for overall business activity and for the subindicators, such as shipments and employment, allowing for comparisons among economic indicators over time and in a given time period.

The current general activity index that tracks overall business activity and each of the subindexes are calculated by subtracting the percentage of respondents reporting a decrease in activity from the percentage of firms reporting an increase. Typically, there are numerous "no change" responses as well. It follows that the theoretical maximum value for the index is +100 while −100 is its minimum. Index values in this extreme range have yet to occur in the 50-year-old series and are unlikely in the future as it would require unanimous responses. The midpoint of zero indicates the percentage of firms reporting an increase equals the percentage reporting a decrease.

Hypothetically, if during a month at the beginning of a business cycle contraction, the percentage of firms reporting an increase in overall business activity is 20 percent and the percentage reporting a decrease is 40 percent, the index value for that month would be −20 (20 minus 40). If, on the other hand, in a month near the peak

of a business cycle expansion, the percentage of firms indicating an improvement in business outlook is 70 percent and those reporting a decline is 10 percent, the index would equal 60.[16] In general, the more disperse the index toward the extremes of 100 and −100, the more diffuse or widespread is the change in the monthly economic indicator.

In any given month, details from the survey can be gleaned on the breadth and composition of changes in the business cycle, both regionally and nationally. For instance, by examining the index for prices paid by consumers by type of firm, information can be derived on whether price pressures reported in the month are widespread in the region or isolated, which is useful information for policymakers monitoring inflation trends. By examining the spread or diffusion of survey responses over time, the indexes provide key information on how changes are propagated across firms over business cycles— typically this starts with just a few firms and then expands to other firms and industries. This process is well explained by Geoffrey Moore (1961), who was the former director of International Business Cycle Research: "One of the fundamental features of our economic system is that economic movements spread from one firm to another, from one industry to another, from one region to another and from one economic process to another. Moreover, these spreading movements cumulate over time. This being so, it is desirable to have measures showing how this spreading and cumulation goes on. A diffusion index is just such a measure."

The current general activity diffusion index successfully tracks changes in economic activity at the national level, as illustrated by Figure 3, which depicts how index values have moved over time. Index values below zero are typically associated with recessions, as indicated by the shaded gray bans, showing official recessions as determined by the NBER. Likewise, periods of U.S. economic expansion tend to be associated with index values above zero. The diffusion index is also successful as an early indicator of changes in the business cycle, both regionally and nationally, that is, before official quantitative data are published (see Figure 2).

The Current General Activity Diffusion Index over 50 Years
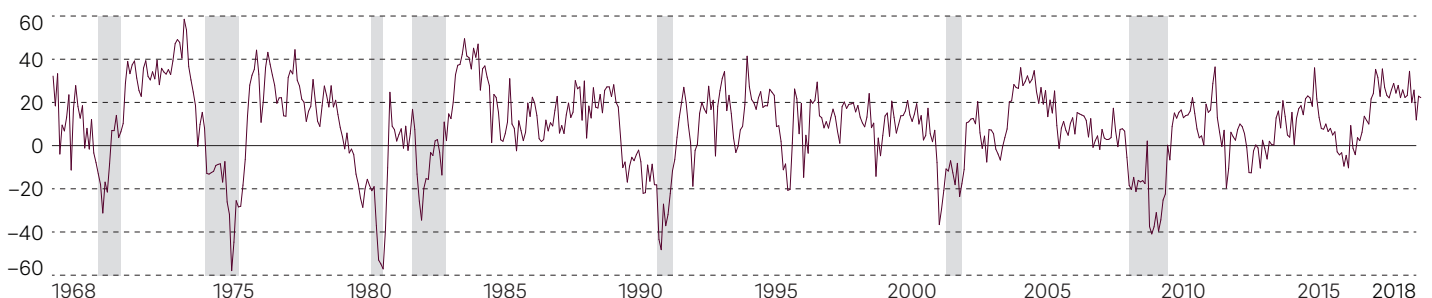
Value of Timely Qualitative Data

As Boehne understood early on, a valuable aspect of the MBOS is in its timing, as it precedes other published statistics by weeks (see Figure 2). An important benefit of collecting qualitative data is the ability to report the findings almost instantaneously. Given its timeliness, the survey results can be used to provide current-period forecasts of regional business activity, that is, to make a prediction in the present about published data that will eventually be available. Not only is the MBOS known to give early indications on regional indicators, it has become increasingly recognized as an early signal of business fluctuations nationally. This fact is not surprising given that turning points in manufacturing tend to lead overall business cycle movements. Furthermore, business conditions of many firms in the Third District mirror what is happening nationwide as they are often part of national companies or at least have extensive interregional business dealings.

See *"Current-Period Forecasting Explained."* →

Value of the MBOS as an Early Indicator of Regional Conditions

Quantitative data on regional conditions are generally scarce, published with a considerable lag, often collected only annually, and are normally from relatively small samples. For instance, data on regional employment, which are among the first available published data that are especially rich in detail, are available with a lag of a month or more. Employment data in the metro areas are not available until even later. Information on production, sales, or any other useful measure of economic change in the region's manufacturing sector is not available until years later.[3] Moreover, data on new orders, delivery times, and prices have not been available in any form at the regional level (except through the MBOS) and must otherwise be inferred from national samples. The qualitative data from the MBOS helps to fill in the data gaps in a particularly timely fashion.

Value of the MBOS as an Early Indicator of National Conditions

The availability of timely regional survey data from the MBOS is useful in appraising national conditions because of the combined feature that it is made available ahead of national estimates and it is correlated with national economic statistics. This can be seen by the relationship between the MBOS and its closest national equivalent, the ISM's Purchasing Managers' Index. Results from the PMI indicator are published at the beginning of the month following the month of interest. The MBOS, which is published about two weeks prior, is highly correlated with the PMI—a highly watched early

Current-Period Forecasting Explained

Those responsible for making policy have an interest in knowing the current state of economic conditions. Monetary policymakers in their published statements often refer to their deliberations and decisions as being driven by incoming data. Because official statistics are published with considerable lag, there is a need to utilize all available information coming from surveys and other more informal sources. "Current-period forecasting" refers to the methods of estimating current conditions, rather than predicting what hasn't happened yet. The need for current-period forecasting arises from the scarcity of immediate quantitative economic data, as most economic measurements are published in the next calendar period following the date of reference. For example, estimates of GDP for a given period are made in the month following the three months that comprise that quarter. Likewise, the monthly Industrial Production Index is published in the middle of the following month. The exercise of producing early forecasts of published statistics is referred to here as current-period forecasts because they are focused on the current time frame and fill a data gap until more comprehensive estimates and data are available.

In recent years, the academic literature has focused on developing models that consider various inflows of data that may rely on different sample methods or are based on staggered or overlapping collection periods. Current-period forecasting or nowcasting methods have been found to improve forecasts of yet-to-be-published economic variables and supply policymakers with timely and continuously updated real-time information to guide their decisions.[17] Moreover, these methods offer a formal process for evaluating incoming data that avoids hasty judgement that might be based on less formal techniques.

FIGURE 4

MBOS Current General Activity Index vs. PMI Over 50 Years
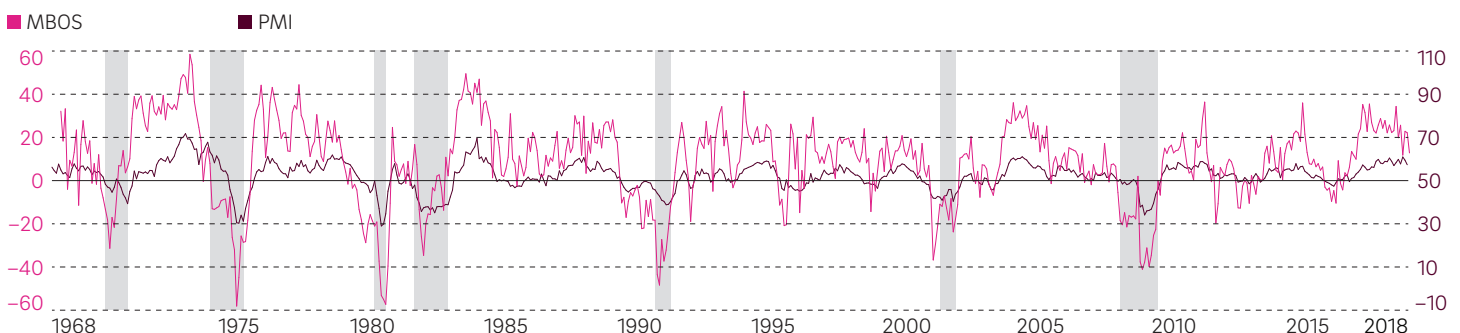
■ MBOS   ■ PMI

Note: MBOS ranges from −100 to 100, while PMI range is 0 to 100. Therefore, the charts in Figs. 4 & 9 are constructed with dual y-axes to align the graphs for comparison.

indicator of national economic conditions (see Figure 4). In addition, the MBOS is successful as an early indicator of employment in manufacturing, which is published by the Bureau of Labor Statistics (BLS) in the second week following the month of interest. Similarly, the MBOS tracks industrial production well, which is published by the Federal Reserve Board around the third week of the following month.

In addition to predicting changes in specific regional and national indicators, the MBOS is valuable in predicting turning points in the national business cycle. A survey of manufacturers such as the MBOS is particularly relevant when predicting turning points since changes in the manufacturing sector often precede overall economic cycle upticks and downturns. The MBOS has yielded some impressive results in predicting recessions, as discussed in the section on business cycle movements and the MBOS.

Value of the MBOS as an Early Indicator of Price Changes and Other Advantages

Given the importance of tracking inflation from a policy perspective, information from the MBOS on expected prices set by firms is also very relevant. The MBOS collects responses from firms on the direction of change for prices paid, that is, prices for inputs, as well as prices received, in other words, prices they set for their manufactured goods. Moreover, a new section was added to the MBOS in 2015 asking firm executives to forecast their expectations of inflation regionally and nationally, further adding an important source of information. The value in this type of price data is well expressed by former Fed Chairman Ben Bernanke (2007): "On which measure or combination of measures should central bankers focus to assess inflation developments and the degree to which expectations are anchored? Do we need new measures of expectations or new surveys? Information on the price expectations of businesses–who are, after all, the price setters in the first instance–as well as information on nominal wage expectations is particularly scarce."

Another advantage of the MBOS is that the core questionnaire can be supplemented with special questions on topics of interest to the Philadelphia Fed's understanding of regional and national economic conditions. The special questions section was added to the MBOS in 2001 by Loretta Mester, the former Director of Research, who is now president of the Cleveland Fed. Questions have included evaluating the impact of strictly regional events such as Hurricane Sandy and, more recently, broader questions about the impact of tax policy changes on capital spending and the effects of trade tariffs on business activity. Often the questions are coordinated with other Federal Reserve Banks, providing a wider coverage geographically and across industry sectors.

The Importance of Longevity, Persistent Reporting, and Technology

Sustaining a survey in the same basic structure over a long period offers distinct advantages. One advantage is that it facilitates analysis of economic statistics over distinct business cycle phases and turning points. It also provides a consistent and lengthy time series for forecasting and economic modeling.

Looking more in-depth at the survey respondents themselves and their reporting frequency can shed light on why the MBOS has high predictive value. Large manufacturing firms had dominated the survey sample early on, but this concentration has since declined. Further, the region's overall manufacturing sector has diminished over the last 50 years.[4] Research at the national level on this downward trend reveals that the largest manufacturing firms have drastically cut employment over time, particularly in industries that compete with cheaper unskilled labor overseas, such as apparel and furniture.[5] Nevertheless, on a percentage basis, manufacturing output has fallen less than manufacturing employment over time due to productivity improvements and technological advances, with a greater number of firms–somewhat smaller in size now–specializing in products that require higher-skilled labor. As a result of this downsizing, the size threshold for participation in the MBOS has been reduced. Having a greater share of smaller manufacturing firms represented in the sample provides further "on the ground" information on business conditions and provides a more diverse base of firms representing the current manufacturing environment.

The current reporting panel of manufacturing firms for the MBOS has had a very high rate of continuous reporting as shown by the share of firms reporting in consecutive months (see Figure 5). The existence of a stable and persistent group of reporters allows for monitoring overall trends of various subgroups over time. While these samples of subgroups are small, they sometimes provide clues of developing trends, such as price pressures or capital spending shifts.[6] To help identify trends on a more micro level, respondents are categorized and tracked in terms of whether they are durable or nondurable goods producers. Additionally, firms are grouped according to six product types: final products for the consumer goods market, final products for the business equipment market, equipment parts and components, materials (metals, textiles, chemicals, paper, lumber, energy, etc.), intermediate products (construction supplies or business supplies, etc.), and "other."

MBOS Firms Exhibit a High Degree of Continuous Reporting

Over 83 percent of firms report in consecutive months.

■ 2 consecutive months ■ 3 consecutive months
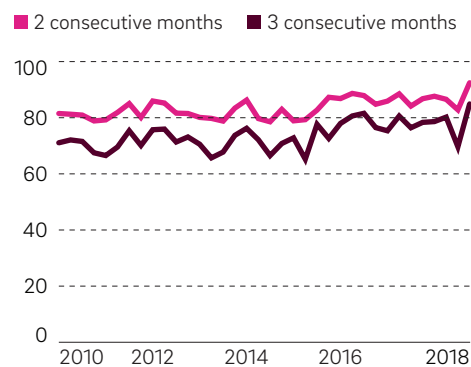
Over the course of the 50-year run of the MBOS, one other important feature is the impact of evolving technology, both on the manufacturng survey itself and on how the survey is published. Surveys are now collected electronically using web forms and e-mail notifications, so that the speed of processing is much faster. Furthermore, since the survey began being

FIGURE 6

Current General Activity Index Performance as a Predictive Tool for Recession and Expansion Periods
Index 1968–2018

■ False recession prediction   ■ False expansion prediction
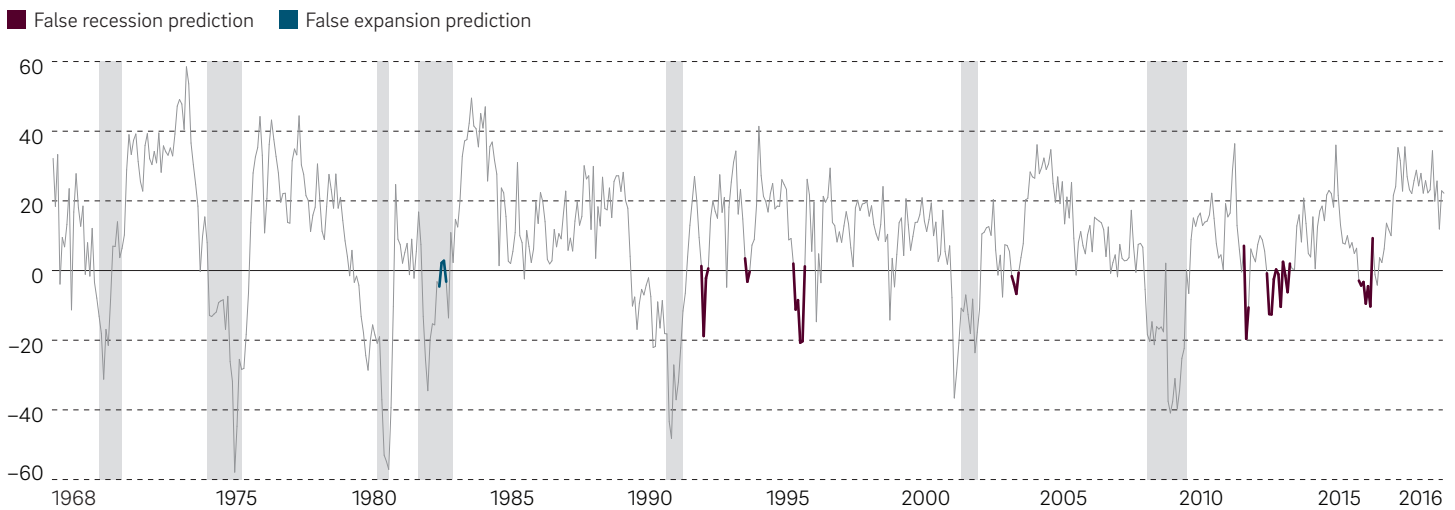
published over the Internet, it has vastly improved the survey's usefulness by facilitating delivery to larger audiences. Early access to the MBOS over the web can be attributed to Jack Siler, a former Philly Fed research employee and an avid Perl and HTML coder, who was instrumental in getting the survey online in 1995. In recent years, thousands of users of the data have downloaded the information, which can be accomplished in a rapid fashion.

Thanks to technological improvements, firms are now also able to capture information within their own organizations much quicker and with greater accuracy. Based on focus groups chosen from the reporting firms, we learned that many of the businesses have access to a "dashboard" real-time picture of their firms, thus allowing them to report more timely information. For example, firms know in real time the current status of their order books, their inventories, and the prices they are paying in their input markets. In many cases, the survey data they are reporting reflect actual data rather than forecasts because a greater portion of the month for which the survey asks about has already been recorded by the firms.

Business Cycle Movements and the MBOS
The survey's 50-year history has spanned seven recessions of varying duration and severity. In the passages below, a review of the survey's current general activity, new orders, and employment indexes provides an indication of the survey's significance in tracking the overall economy with respect to official recessions and expansion periods.

The survey's current general activity index, which is considered its headline statistic because it provides the most comprehensive information on overall conditions, has often coincided with official U.S. recession dates. The National Bureau of Economic Research (NBER) is the final arbiter that dates the peaks and troughs of the U.S. business cycle. A recession is defined as "a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real

GDP, real income, employment, industrial production, and wholesale-retail sales" (NBER 2008). Conversely, a business cycle expansion, which represents an upturn in overall economic activity, is the period between the trough and the peak.

The current general activity index's movement, in tandem with official recession dates, is a valuable characteristic inasmuch as a negative reading, by definition, indicates that more firms report declines than those that report increases. During the Great Recession, the current general activity index was very successful in predicting turning points in the economy. The index moved into negative territory in December 2007, which was eventually marked by the NBER as the beginning of the Great Recession. Likewise, the current general activity index turned positive in June 2009 for the first time in essentially 18 months, receded one month, and then returned to sustained positive readings by August 2009. According to the NBER, the recovery period began in June 2009, which indicates that the current general activity index was highly successful in predicting the end of the Great Recession, as well as its start. Of course, in real time the beginning and end of a recession is not known as it is determined with considerable lag by the NBER. Considering the delay in reporting of official business-cycle fluctuations, timely survey data such that the MBOS can provide may have significant value as an indicator of turning points in the economy.

Gauging Turning Points
The historical chart (Figure 3) shows the current general activity index with official recessions (shown as shaded gray bands). As can be seen from the graph, business downturns as reported by firms for the MBOS often coincide with official recessions, especially the most recent one. The severity of the Great Recession is evident in both the duration and the magnitude of its decline. Overall, the MBOS has a mixed record of pinpointing recessions and recoveries over all of the business cycles of the past 50 years. For example, in the shorter recession starting in April 2001, the

MBOS's current general activity index led the beginning of the recession by four months and lagged the beginning of the recovery by one month. One problem with the use of MBOS indicators to forecast turning points is the presence of false signals, defined for recessions as the index changing from positive to negative one month then returning to positive territory. For recoveries, a false signal is defined as the index changing from negative to positive one month then returning to negative territory.[7]

Figure 6 displays the general activity index over the 50-year history of the MBOS; the seven official recession periods during that time are shown by the shaded gray bands on the chart. In each of those seven recessions, the activity index corresponds with significant and sustained negative readings. A return to positive indicators was seen in the recovery, or expansion, period following the recession. The current general activity index gave seven false signals for recessions, but only one for recoveries, as noted on the chart. To compare the predictive ability, only signals that arise from two consecutive months of sign changes were designated as relevant, and the behavior of these readings was compiled for three indexes: current general activity, new orders, and employment. Using this definition, each index was tracked to determine the lead or lag of the indicator with respect to the official recession/expansion periods. The results demonstrated that the current general activity index led the official recession period by an average of four months and the new orders index led by an average of two months, although both indicators predicted the most recent recession nearly correctly. Both of these indicators have been more accurate in pinpointing recoveries, with an average lag of zero months for the current general activity index and one month for new orders. The lead/lag analysis also clearly confirms that employment is a lagging indicator, especially for recoveries, lagging the beginning of a recovery period by an average of 7 months.

It is noteworthy to consider that there are, at times, underlying reasons for false signals of recessions (or expansions), that is, they might represent downturns (or upturns) just in certain sectors. As has been noted by various analysts, there was slow but positive GDP growth in 2015 and 2016, although subsector-level data eventually revealed a significant decline in agriculture- and oil-related manufacturing. Remarkably, the timing of the 2015-16 downturn in these industries coincided with the MBOS false recession signal that started in September 2015 and lasted nine months (with negative readings in the index in eight out of the nine months). Indeed, the MBOS index mirrored data from the Bureau of Economic Analysis on the percentage change in U.S. nonresidential structures and equipment during this period. This scenario gives strength to the argument that consistent monthly negative readings in the MBOS and other Fed manufacturing survey indexes could in fact signal subsector weakness that might eventually have broader implications for the U.S. economy.

While Figure 6 clearly demonstrates the cyclical pattern of the current general activity index, Figure 7 shows how average values of the current general activity, new orders, shipments, prices paid, prices received, and employment indexes have differed between periods of recession and nonrecession. For the seven U.S. recessions, the average reading of the current general activity index was -17.9, compared with an average reading of 13.3 during nonrecession periods. The current general activity index has the largest difference between recession and nonrecession averages, followed by new orders, shipments, and employment.

Information Gleaned on Business Cycle Trends by Dissecting the Diffusion Indexes

The statistics underlying the diffusion indexes provide a more detailed story of business cycle patterns. Knowing the share and type of firms that reported an increase, decrease, or no change tells us a great deal about the breadth and composition of economic change across the region. For example, employment, which is a lagging indicator, can be evaluated by reviewing what types of firms cut their payrolls and by how much over time. During the 18 months that the Great Recession lasted, for example, an average of 30 percent of the firms reported cutting employment, with a high of 52 percent in March 2009. Similarly, price declines are associated with business downturns. During those 18 months, an average of 20 percent of firms reported cutting their prices, and in one month (December 2008), 42 percent reported price decreases.

Imitation as the Sincerest Form of Flattery

The success of the MBOS as an early indicator of trends in the manufacturing sector has spawned similar surveys across the Federal Reserve System over the years that have achieved usefulness for monitoring their respective regions (see Figure 8). A total of five manufacturing surveys are now being conducted. The second oldest survey, the Richmond Fed's Fifth District Survey of Manufacturing Activity, is in its 25th year. Although similar to the MBOS, the Fifth District Survey utilizes a composite index and has quantitative questions for prices paid and received. The New York, Kansas City, and Dallas Fed surveys are similar to the MBOS such that the diffusion indexes can be compared and combined. The newest arrival, the Texas Manufacturing Outlook Survey, is now in its 14th year. All of the surveys are conducted monthly and results are available before the end of the reference month. The New York Fed publishes their survey on the 15th of the month, while our MBOS is published on the third Thursday of each month. The Dallas Fed survey is published last, on the final Monday of each month.

In addition, since March 2013, the Chicago Fed has produced a Survey of Business Conditions (CFSBC), available eight times

Difference in Recession and Nonrecession Years
All 50 years index averages; May 1968–April 2018

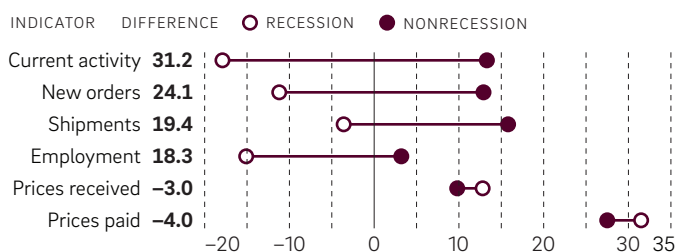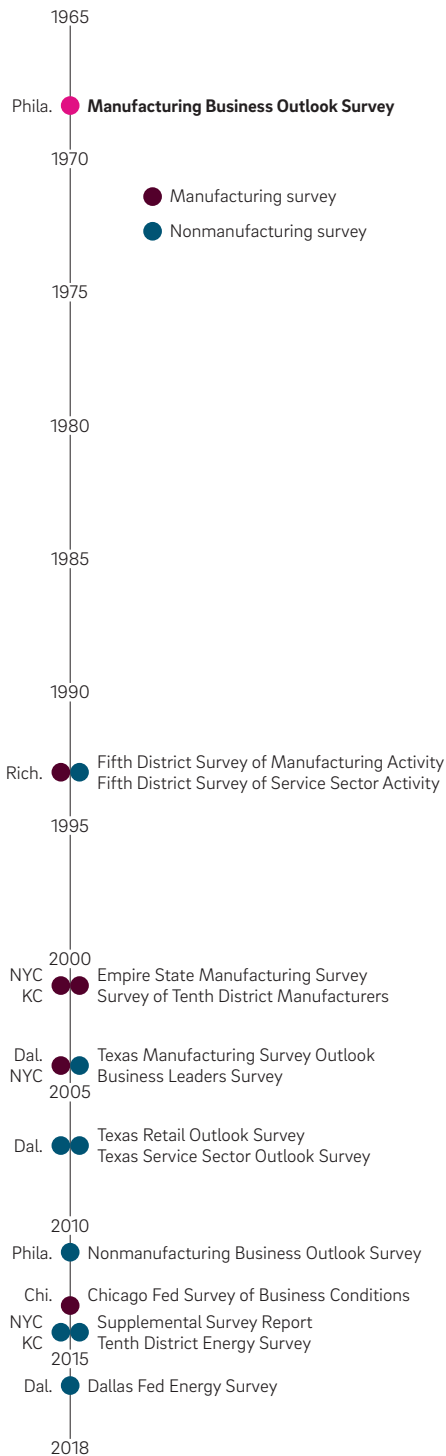INDICATOR DIFFERENCE ○ RECESSION ● NONRECESSION

Current activity	**31.2**
New orders	**24.1**
Shipments	**19.4**
Employment	**18.3**
Prices received	**−3.0**
Prices paid	**−4.0**

−20 −10 0 10 20 30 35

Timeline of Introductions

1965

Phila. ● **Manufacturing Business Outlook Survey**

1970

● Manufacturing survey
● Nonmanufacturing survey

1975

1980

1985

1990

Rich. ● Fifth District Survey of Manufacturing Activity
Fifth District Survey of Service Sector Activity

1995

2000
NYC ● ● Empire State Manufacturing Survey
KC Survey of Tenth District Manufacturers

Dal. ● ● Texas Manufacturing Survey Outlook
NYC Business Leaders Survey
2005

Dal. ● Texas Retail Outlook Survey
Texas Service Sector Outlook Survey

2010
Phila. ● Nonmanufacturing Business Outlook Survey

Chi. ● Chicago Fed Survey of Business Conditions
NYC ● Supplemental Survey Report
KC ● Tenth District Energy Survey
2015
Dal. ● Dallas Fed Energy Survey

2018

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per year to coincide with the Fed's policy calendar. The CFSBC, which covers a wide range of industries, includes a diffusion subindex for manufacturing. While it is designed to capture changes in manufacturing activity and is on the same scale as other Fed manufacturing survey indexes, including the MBOS, there are differences with respect to how the index is computed in an effort to correct for survey bias.[8] Another distinction is that the Chicago survey asks for current business conditions within a 4- to 6-week time frame rather than monthly.

Since the share of total employment and output in the manufacturing sector has been in decline, qualitative surveys have also been introduced to cover the expanding share of the service sector.[9] Our own South Jersey Business Survey has been conducted quarterly for 25 years and was one of the first to cover service companies, albeit for a narrow geographic area. A total of nine regional business surveys covering various nonmanufacturing sectors are now in place across the Federal Reserve System. The Philly Fed's Nonmanufacturing Business Outlook Survey was first published in March 2011 and uses nearly the same methodology as the MBOS but with slightly different questions tailored to the service sector. Recently, other new surveys have been introduced that focus on specific sectors prominent within the Federal Reserve region (for example, energy surveys were introduced by the Kansas City and Dallas Feds).

The timing of the surveys in most cases supply useful information for each Reserve Bank's Beige Book, which is a compilation of business conditions in each District, produced eight times a year and published near the dates of the meeting of the Federal Open Market Committee. Each Federal Reserve Bank gathers anecdotal information on current economic conditions in its District through reports from businesses and interviews with key business contacts, economists, market experts, and other sources (including surveys). Following the 50-year legacy of the MBOS, the expanding use of surveys across the Federal Reserve has led to more widespread availability of qualitative data that is timely, continuous, and consistently reported over time.

Uses of the MBOS in Current-Period Forecasting

The importance of the manufacturing sector in providing signals about the health of the economy is well established. The industrial sector, together with construction, account for the bulk of the variation in national output over the course of the business cycle. The cyclical variability of the manufacturing sector has prompted efforts to develop measures to record movements in manufacturing that would give frequent and timely indicators of change in overall economic activity. Discussed in this section are three of these important manufacturing measures and how they tie into current-period forecasts of sector activity.

Industrial Production Index for Manufacturing (IPM) and the MBOS

The most comprehensive data effort for the manufacturing sector is the Federal Reserve's Industrial Production Index for Manufacturing (IPM), which is constructed to reflect the physical volume of production for the manufacturing sector as a whole.[10] One shortcoming of the IPM is that the estimates are only for the U.S. in the aggregate, and, additionally, the data are not available until around the 15th of the month following the month of reference (see Figure 2). Although there are no quantitative regional data on manufacturing output, the MBOS and other regional qualitative surveys provide measures of local trends and have been found to be useful in producing current-period forecasts of U.S. industrial output (Trebing 2003, Kerr et al. 2014, Dietz and Steindel 2005). These studies have shown that the various regional indexes have statistical significance in forecasting monthly changes in the IPM beyond what is included with other available information. Since the various surveys are all produced before the end of the reference month, it is possible to include an average of all the surveys into a single variable and produce forecasts of the IPM on a monthly basis.

FIGURE 9

Historical Relationship Between MBOS Indexes and ISM Subcomponents of the PMI

Correlation coefficients for both levels and one-month changes.

■ MBOS   ■ ISM

Employment   R **0.81**

New orders   R **0.73**

Shipments/production   R **0.69**

Inventories   R **0.57**

Delivery times/vendor deliveries   R **0.56**

Note: MBOS ranges from −100 to 100, while PMI range is 0 to 100. Therefore, the charts in Figs. 4 & 9 are constructed with dual y-axes to align the graphs for comparison.

Purchasing Managers' Index (PMI) and the MBOS
Forecasting national manufacturing production is also possible using one of the most widely followed measures of manufacturing activity compiled by the Institute for Supply Management (ISM).[11] Its Purchasing Managers' Index (PMI) is published on the first business day following the reference month and is also based on a qualitative survey, like the MBOS. In its current form, the PMI is a composite index that comprises five equally weighted indexes: new orders, production, employment, delivery times, and inventories. The PMI has a reputation for being a comprehensive measure of trends in the U.S. manufacturing sector but also for the U.S. economy generally. For example, Koenig (2002) and Lahiri (2013) have demonstrated the use of the PMI for forecasting U.S. GDP growth. The PMI, along with the regional Fed manufacturing survey indexes, have been incorporated into current-period forecast models of

FIGURE 10

ISM–Man Price Index and MBOS Prices Paid
Same diffusion index scale; 1968–2018

■ MBOS prices paid   ■ ISM
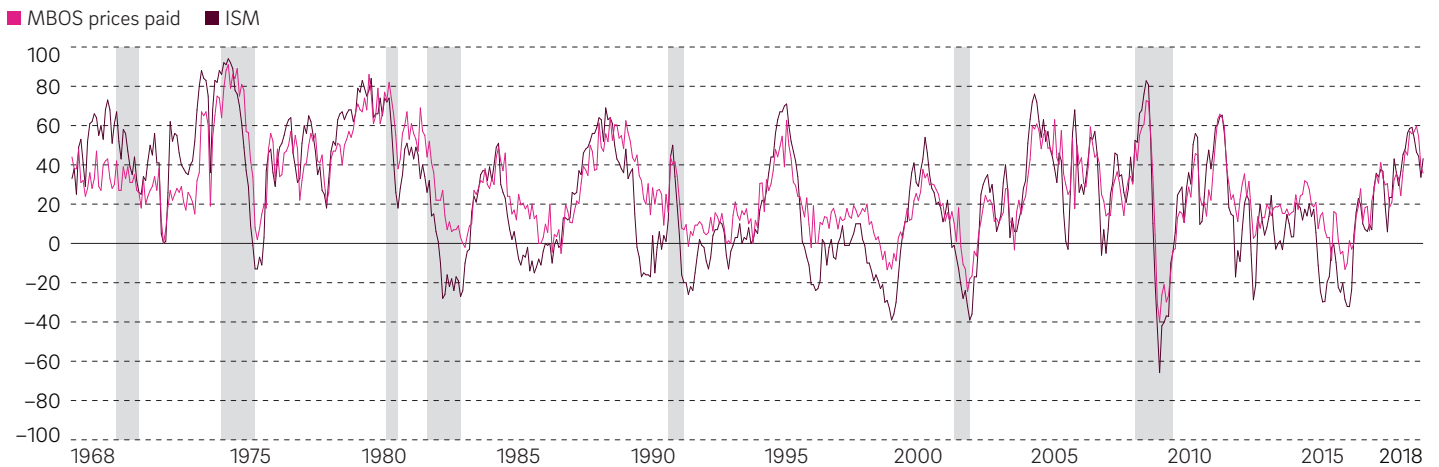
the U.S. economy. Notably, both the New York Fed and Atlanta Fed currently produce nowcasts for quarterly GDP using the most available data as inputs, including the PMI and regional survey data (see Higgins 2014, and Bok et al. 2017).

There is a remarkably high correlation between the subcomponents of the PMI and counterpart statistics of the MBOS over a common 50-year period (see Figure 9). These charts display the counterpart indicators for the MBOS with the PMI (note that a substitution was made so that the MBOS shipments index corresponds to the PMI production index since the PMI does not have a shipments question). The correlations between the MBOS and the PMI in levels range from a high of 0.81 for employment to a low of 0.56 for delivery times. Given that the MBOS is available ahead of the two big measures of U.S. manufacturing activity, it is used to produce current-period forecasts of both the PMI and the IPM.[12]

Manufacturing Employment and the MBOS
Data on employment in the manufacturing sector from the BLS is one of the few solid sources of information on the regional manufacturing sector. Current Employment Statistics (CES) from the BLS provide detailed industry estimates of manufacturing employment in the U.S. that are typically published in the first week following the reference month as part of the Employment Situation report, along with estimates of U.S. total nonfarm employment, hours, and earnings of workers on payrolls. State industry data from the CES are available in the month following the reference month, while metro area industry data are released about two months after the reference month. The MBOS's employment diffusion index has been shown to be useful in evaluating short-term changes in the labor market for manufacturing workers in both the region and the nation. The availability of CES manufacturing employment data, along with survey data on employment, provide additional useful information in forecasting monthly IPM because the data are available for the reference month about one week before the publication of the IPM.[13]

Current-Period Forecasting of Inflation Using Manufacturing Survey Data
Questions about firm pricing are a novel feature of the MBOS and other Fed manufacturing surveys. Price indexes like the CPI, GDP deflator, PCE, and PPI are watched by analysts and policymakers for signs of inflation.[14] Recent research has suggested that business survey measures of price change are potentially useful not only for monitoring short-run changes in price pressures in the manufacturing sector, but also for current-period forecasts of inflation measures.

The ISM's prices paid index is a closely followed indicator of price pressures in the manufacturing sector. The price indexes for the MBOS and ISM are highly correlated. As Figure 10 shows, the indicators (when placed on a common scale) have tracked each other very closely (correlation coefficient of 0.85 in levels and 0.41 in monthly change) over the common 50 years. This is remarkable even though the respondents are different inasmuch as ISM respondents are primarily purchasing managers from a sample of companies across the U.S., while the MBOS respondents are primarily CEOs or top managers from a much smaller region. The advantage of the MBOS, however, is its availability in the middle of the month in question, while the ISM price index is available at the beginning of the next month, covering the prior month.

Several recent papers have demonstrated the usefulness of various business survey price measures in forecasting inflation. For example, Bognanni and Young (2018) find that the ISM's price index has had value in predicting the producer price index (PPI). Armen and Koenig (2017) demonstrated the usefulness of the Federal Reserve's manufacturing survey price indexes when considered together in predicting PCE inflation. Because results for the Federal Reserve Bank manufacturing surveys are available early, the authors found not only evidence of value in forecasting monthly PCE but also in forecasting subsequent revisions of the PCE index.

Surveying Inflation Expectations Using the MBOS

In 2015, the Philadelphia Fed began asking quantitative special questions once a quarter about firms' price and wage expectations. While there are a number of well-known surveys of consumer expectations, surveys of firms about their inflation expectations are few.[15] The Philadelphia Fed has long been associated with two prominent surveys that measure inflation expectations: the Survey of Professional Forecasters (SPF) and the Livingston Survey. They are the longest running continuous surveys of macroeconomic forecasts in the U.S. The Livingston Survey is the oldest uninterrupted survey of economists' expectations, commencing in 1946 as a biannual survey, while the SPF began as a quarterly survey in 1968. Coincidentally, the SPF is also celebrating its 50-year anniversary this year.

The Philadelphia Inflation Expectations Survey (PIES) special questions commenced in the fourth quarter of 2015 as a new section of the MBOS form. For this new quantitative expectations section, a set of five questions was added (see Figure 11). The questions were designed to pair with SPF expectations data collected quarterly as well as to match in term of months when the information is collected, that is, in the middle of each quarter (February, May, August, and November). Two questions ask about the firms' own business forecast–one question about the expected change in their own manufactured goods prices and the second question asking for a forecast of compensation per employee (wage and benefit cost). The inflation questions follow: one question asks about firms' expectations for U.S consumer prices, and another is about expected prices of regional consumer goods. This latter question is intended to measure any perceived differences between a concept of regional and national inflation. The final question asks for a 10-year average inflation rate forecast for U.S. consumer prices.

The Philadelphia Fed's PIES data collection project has now been in progress for 13 quarters and has generated interesting data on inflation expectations of firms. For example, among the firms surveyed, one-year national inflation expectations and own price change forecasts have tended to parallel each other, and only in more recent quarters have average forecasts for own prices exceeded their overall average inflation expectations (see Figure 12). Presumably, firms' inflation expectations play a role when making decisions about pricing of their own products. Expectations about inflation are also monitored by central banks and are often mentioned in their policy deliberations. Surveying executives of firms fills an important gap in research on inflation expectations behavior and, when combined with other information from the same firms about business conditions, it sheds light on the relationship between expectations, pricing, and also wages.

MBOS Supplemental Questions
Quarterly; 2015Q4–2018Q4

Quarterly PIES Questions

For the next year (2018:Q3 to 2019:Q3), please list your expected annual percent change with respect

1. For your firm:
   ● Only numbers may be entered in these fields.

   Prices your firm will receive (for its own goods and services sold)

   Compensation your firm will pay per employee (for wages and benefits)

2. For your employees:
   Only numbers may be entered in these fields.

   Prices your employees will pay (for goods and services where they live)

3. For U.S. consumers:
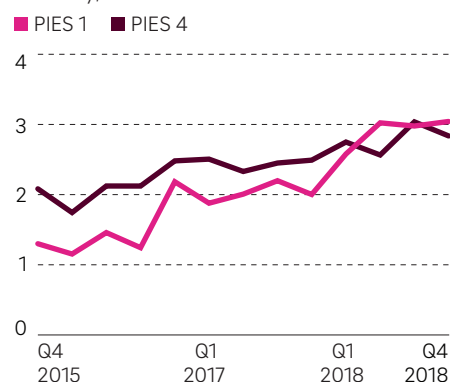   Only numbers may be entered in these fields.

   Prices U.S. consumers will pay (for goods and services)

For the next 10 years (2018 through 2027), what is your expected <u>annual average</u> percent change with
following (for example, if you think prices will increase 10 percent <u>every year</u> for the next 10 years, the

Summary

The 50th anniversary of the MBOS is an opportune time to reflect on its long history and its success as an early indicator of regional business activity and an early signal of U.S. business cycle fluctuations. It is because of the interrelationships between manufacturing firms in the Third District and across the nation that trends regionally track closely to those nationally. Further, it is a result of the timeliness of the survey data–published on the third Thursday of every month to predict activity for that same month–that these qualitative indicators can be used for current-period forecasts of various measures of regional and national economic activity.

Thanks to the continuity and stability of the questions asked of high-level executives, the MBOS's lengthy time series can be used to test its predictive value across numerous economic indicators–providing a field day for macro-econometricians. Notably, the MBOS is highly associated with the ISM's Purchasing Managers' Index, which is widely regarded as the premier early measure of U.S. manufacturing trends. It makes sense then that financial analysts and the press pay close attention to the monthly MBOS diffusion indexes, as they provide an early read of trends later supported by the PMI, early in the following month. Quantitative data on various economic indicators, arriving much later, allow for the predictive power of the MBOS to be reaffirmed.

It is indeed the foundation upon which the MBOS is structured, relying on top management at firms across the Third District, that makes the survey results so beneficial in understanding trends in the manufacturing sector. Not only is detailed information provided on the direction of change in new orders, shipments, and employment, among other indicators, the survey data also include the direction of change for prices for inputs and final prices as reported by many of the very firms that set them. No doubt, it is the success of the MBOS, in terms of its early predictive value of trends locally and nationally, that has led to its replication widely across the Federal Reserve System.

Survey innovations have included recent efforts to measure and monitor changes in inflation expectations of business firms, providing further insights into the theory and practice of firm-level pricing relationships and firm predictions of aggregate price variations across the economy. While it has proven advantageous for the MBOS to maintain its consistency over time, the new special questions initiative also keeps the MBOS dynamic and responsive to changing economic conditions and circumstances facing the Third District and the nation. The consistent feed of new data on the manufacturing sector via the diffusion indexes, new information on expected prices both at the firm level and nationwide, and feedback from business leaders on timely economic issues are all important inputs into Federal Reserve reports on regional business activity. At this notable historic moment for the MBOS, we can say with certainty that the MBOS and the other Fed surveys that have followed in its path have greatly advanced efforts to provide more timely and better-quality data in support of Federal Reserve policymaking. ⊟

Notes

1 For a short period of time, the Cleveland Fed constructed a similar survey for the western portion of Pennsylvania.

2 The current sample comprises 140 manufacturing firms and is broadly representative, encompassing all NAICS and 2-digit SIC industries in the Third District. For analysis purposes, we divide the reporting firms into similar categories that are used for the Industrial Production Index: final business equipment producers (18%), final consumer goods producers (26%), materials producers (20%), equipment parts and components producers (18%), intermediate goods producers (11%), and the remaining firms unclassified (7%).

3 Also, manufacturing value-added data based on the Census Bureau's Census of Manufactures are available only every five years, and data from the Annual Survey of Manufactures are only available with a one-year lag.

4 Nationally, the manufacturing sector has dropped as a share of total nominal GDP from 25 percent in 1968 to about 11 percent in 2017 (Bureau of Economic Analysis). Nevertheless, prices of manufactured goods have risen at a slower rate than those for U.S. goods overall, so shares of real (price-adjusted) manufacturing output have declined only slightly over the last 50 years (currently amounting to about 12 percent of GDP).

Manufacturing employment, however, has declined from 25 percent of total employment in 1968 to below 9 percent currently (Bureau of Labor Statistics).

5 The number of U.S. manufacturing plants with 1,000 or more employees dropped from 2,061 in 1977 to 1,014 in 2007 (51 percent decline), while manufacturing employment across all plant sizes dropped 28 percent over this period. For more on this topic, see Holmes, 2011.

6 Data on individual responders is for internal use only, but the general information filters into Fed policy discussions. Firm-level data can provide interesting insights, for example, into leads and lags between intermediate and final producers, suggesting price pass-through relationships. This type of data can facilitate the testing and validation of correlations, for instance, between prices paid for inputs and final prices of manufactured goods.

7 The choice of a reading of zero as the predictive threshold is based upon both the definition of the diffusion index and empirical findings. Regression analysis allows us to calculate a break-even point, that is, a value for the diffusion index that is consistent with no change in the official statistic. It is equivalent to the negative of the ratio of the estimated intercept and slope coefficients. The break-even point between the

Industrial Production Index and the current general activity index is close to zero, as would be suggested by the analytic model described in the Diffusion Indexes box.

8 The Chicago Fed's diffusion indexes are computed as the difference between the number of respondents with responses above their respective average responses and those with responses below their respective average responses divided by the number of respondents. The value is then multiplied by 100 so that its range is −100 to +100. By definition, respondents without a history of responding are not included in this calculation.

9 In 1998, the ISM began publishing a nonmanufacturing survey, the Non-Manufacturing ISM Report on Business.

10 The Industrial Production Index for manufacturing (IPM) is a separate index from the total Industrial Production Index, which also includes the output of mining and utilities. Manufacturing represents 75.4 percent of total industrial production. (https://www.federalreserve.gov/releases/G17/SandDesc/table1.02.htm)

11 Prior to 2002, the Institute for Supply Management was called the National Association of Purchasing Management.

12 The Dallas Fed has reported that the MBOS is the best predictor of the PMI using their model for the time period studied (Kerr et al. 2014). Nevertheless, using information from all of the Fed manufacturing surveys to predict the PMI generally outperforms individual survey measures (see Trebing, "Notes on the Value of the MBOS in Current-Period Forecasting," forthcoming).

13 The first estimate of this manufacturing production data by the Federal Reserve is based on only about 75 percent of available production data, and the remaining portion relies on model estimates using the most recent data on employment and work hours.

14 While all of these measures of inflation are considered useful, the Federal Reserve's favored price index is the PCE, the Implicit Price Deflator for Personal Consumption Expenditures constructed by the Department of Commerce, Bureau of Economic Analysis. (https://www.federalreserve.gov/faqs/economy_14419.htm)

15 In the U.S., the Federal Reserve Bank of Atlanta has been surveying business firms since 2011, but that survey focuses on firms' unit costs rather than a measure of inflation per se. The two most prominent surveys of consumer inflation are the Michigan Survey and the Federal Reserve Bank of New York's Survey of Consumer Expectations.

16 There are cases when the diffusion index might have the same value and yet represent two very different sets of responses by firms. For instance, if 50 percent of respondents had positive responses and the same percentage had negative responses, the outcome would be an index value of zero; this would have the same index value as if 5 percent gave positive and negative readings and 90 percent reported no change. To address this possible scenario, the Philadelphia Fed publishes information on the distribution of responses as well as index values.

17 The academic literature commonly refers to current-period forecasting as nowcasting. For more on these methods by specific economic indicator, see Schreyer and Emery (1996) for production; Higgins (2014) and Giannone et al. (2008) for GDP; and Lahiri (2013) for GDP and the PMI.

References

Armen, Allen; Koenig, Evan F., "Getting a Jump on Inflation," Federal Reserve Bank of Dallas *Economic Letter*, August 2017.

Bernanke, Ben S. "Inflation Expectations and Inflation Forecasting," speech given at the Monetary Economics Workshop of the National Bureau of Economic Research Summer Institute, Cambridge, MA, July 10, 2007.

Bognanni, Mark; Young, Tristan, "An Assessment of the ISM Manufacturing Price Index for Inflation Forecasting," Federal Reserve Bank of Cleveland *Economic Commentary*, May 2018.

Bok, Brandyn; Caratelli, Daniele; Giannone, Domenico, et al., "Macroeconomic Nowcasting and Forecasting with Big Data," Federal Reserve Bank of New York *Staff Reports*, November 2017.

Deitz, Richard; Charles Steindel, "The Predictive Abilities of the New York Fed's Empire State Manufacturing Survey," Federal Reserve Bank of New York *Current Issues in Economics and Finance, Second District Highlights*, January 2005.

Giannone, Domenico; Reichlin, Lucrezia; Small, David. "Nowcasting: The Real-Time Informational Content of Macroeconomic Data," *Journal of Monetary Economics*, 55 (2008) pp. 665–76.

Higgins, Pat. "GDPNow: A Model for GDP 'Nowcasting,'" Federal Reserve Bank of Atlanta Working Paper (2014).

Holmes, Thomas J., "The Case of the Disappearing Large-Employer Manufacturing Plants: Not Much of a Mystery After All," Federal Reserve Bank of Minneapolis *Economic Policy Paper* 11-4, July 2011.

Irwin, Neil. "The Most Important Least-Noticed Economic Event of the Decade: A Localized Recession in Manufacturing-Heavy Areas Can Explain a lot of Things." *New York Times*, September 29, 2018.

Kerr, Emily; Orrenius, Pia; Wang, Jack; Cañas, Jesús, "Fed Manufacturing Surveys Provide Insight into National Economy," Federal Reserve Bank of Dallas *Economic Letter*, October 2014.

Koenig, Evan F., "Using the Purchasing Managers' Index to Assess the Economy's Strength and the Likely Direction of Monetary Policy," Federal Reserve Bank of Dallas *Economic and Financial Policy Review*, Vol. 1 No. 6, 2002.

Lahiri, Kajal; Monokroussos, George. "Nowcasting US GDP: The Role of ISM Business Surveys," *International Journal of Forecasting*, October/December 2013.

Moore, Geoffrey H. "Diffusion Indexes, Rates of Change, and Forecasting," in *Business Cycle Indicators*, Volume 1. Princeton: National Bureau of Economic Research, 1961. pp. 282–93.

Pinto, Santiago; Ravindranath Waddell, Sonya; Sarte, Pierre-Daniel, "Monitoring Economic Activity in Real Time Using Diffusion Indices: Evidence from the Fifth District," Federal Reserve Bank of Richmond *Economic Quarterly*, Fourth Quarter 2015, pp. 275–301.

Schiller, Tim; Trebing, Michael, "Taking the Measure of Manufacturing," Federal Reserve Bank of Philadelphia *Business Review*, Fourth Quarter 2003.

Schreyer, P.; Emery, C. "Short-Term Indictors: Using Qualitative Indicators to Update Production Indices," OECD Science, Technology and Industry Working Papers, No. 1996/03.

Trebing, Michael, "Regional Spotlight: Surveying the South Jersey Economy," Federal Reserve Bank of Philadelphia *Economic Insights*, Second Quarter 2017.

Trebing, Michael, "What's Happening in Manufacturing: 'Survey Says…'," Federal Reserve Bank of Philadelphia *Business Review*, September/October, 1998.

Trebing, Michael; Nakamura, Leonard, "What Does the Philadelphia Fed's Business Outlook Survey Say About Local Activity," Federal Research Bank of Philadelphia *Research Rap*, December 2008.

Research Update

These papers by Philadelphia Fed economists, analysts, and visiting scholars represent preliminary research that is being circulated for discussion purposes.

"Free" Internet Content: Web 1.0, Web 2.0, and the Sources of Economic Growth

The Internet has evolved from Web 1.0, with static web pages and limited interactivity, to Web 2.0, with dynamic content that relies on user engagement. This change increased production costs significantly, but the price charged for Internet content has generally remained the same: zero. Because no transaction records the "purchase" of this content, its value is not reflected in measured growth and productivity. To capture the contribution of the "free" Internet, we model the provision of "free" content as a barter transaction between the content users and the content creators, and we value this transaction at production cost. When we incorporate this implicit transaction into U.S. gross domestic product (GDP), productivity, and household accounts, we find that including "free" content raises estimates of growth, but not nearly enough to reverse the recent slowdown.

How Important Are Local Community Banks to Small-Business Lending? Evidence from Mergers and Acquisitions

The authors investigate the shrinking community-banking sector and the impact on local small-business lending (SBL) in the context of mergers and acquisitions. From all mergers that involved community banks, they examine the varying impact on SBL depending on the local presence of the acquirers' and the targets' operations prior to acquisitions. Our results indicate that, relative to counties where the acquirer had operations before the merger, local SBL declined significantly more in counties where only the target had operations before the merger. This result holds even after controlling for the general local SBL market or local economic trends. These findings are consistent with an argument that SBL funding has been directed (after the mergers) toward the acquirers' counties. The authors find even stronger evidence during and after the financial crisis. Overall, the authors find evidence that local community banks have continued to play an important role in providing funding to local small businesses. The absence of local community banks that became a target of a merger or acquisition by nonlocal acquirers has, on average, led to local SBL credit gaps that were not filled by the rest of the banking sector.

Inflation and Real Activity with Firm-Level Productivity Shocks

In the last fifteen 15 years there has been an explosion of empirical work examining price-setting behavior at the micro level. The work has in turn challenged existing macro models that attempt to explain monetary nonneutrality, because these models are generally at odds with much of the microprice data. A second generation of models, with fixed costs of price adjustment and idiosyncratic shocks, is more consistent with this microdata. Nonetheless, ambiguity remains about the extent of nonneutrality that can be attributed to costly price adjustment. Using a model that matches many features of the microdata, our paper takes a step toward eliminating that ambiguity, at the same time highlighting the challenges that remain.

Working Paper 18-19. Michael Dotsey, Federal Reserve Bank of Philadelphia Research Department; Alexander L. Wolman, Federal Reserve Bank of Richmond.

Market-making with Search and Information Frictions

We develop a dynamic model of trading through market-makers that incorporates two canonical sources of illiquidity: trading (or search) frictions, which imply that market-makers have some amount of market power; and information frictions, which imply that market-makers face some degree of adverse selection. We use this model to study the effects of various technological innovations and regulatory initiatives that have reduced trading frictions in over-the-counter markets. Our main result is that reducing trading frictions can lead to less liquidity, as measured by bid-ask spreads. The key insight is that more frequent trading—or more competition among dealers—makes traders' behavior less dependent on asset quality. As a result, dealers learn about asset quality more slowly and set wider bid-ask spreads to compensate for this increase in uncertainty.

Working Paper 18-20. Benjamin Lester, Federal Reserve Bank of Philadelphia Research Department; Ali Shourideh, Carnegie Mellon University; Venky Venkateswaran, NYU Stern School of Business; Ariel Zetlin-Jones, Carnegie Mellon University.

Accounting for Growth in the Age of the Internet: The Importance of Output-Saving Technical Change

We extend the conventional neoclassical production and growth framework, with its emphasis on total factor productivity as the primary macroeconomic mechanism of innovation, to allow for technical change that affects consumer welfare directly. Our model is based on Lancaster's "New Approach to Consumer Theory," in which there is a separate consumption technology that transforms goods, measured at production cost, into utility. This technology can shift over time, allowing consumers to make more efficient use of each dollar of income. This is an output-saving technical change, in contrast to the resource-saving technical change of the TFP residual. The output-saving formulation is a natural way to think about the free information goods available over the Internet, which bypass GDP and go directly to the consumer. It also leads to the concept of expanded GDP (EGDP), the sum of conventional supply-side GDP and a willingness-to-pay metric of the value of output-saving innovation to consumers. This alternative concept of GDP is linked to output-saving technical change and incorporates the value of those technology goods that have eluded the traditional concept. It thus provides a potentially more accurate representation of the economic progress occurring during the digital revolution. One implication of our model is that living standards, as measured by EGDP, can rise at a faster rate than real GDP growth, which may shed light on the question of how the latter can decline in an era of rapid innovation.

Working Paper 17-24 Revised. Charles Hulten, University of Maryland and NBER; Leonard Nakamura, Federal Reserve Bank of Philadelphia Research Department.

Relative Price Dispersion: Evidence and Theory

Relative price dispersion is defined as persistent differences in the price that retailers set for the same good relative to the price they set for their other goods. Using a large-scale dataset on prices in the U.S. retail market, we document that relative price dispersion accounts for about 30 percent of the variance of prices for the same good, in the same market, during the same week. Using a search-theoretic model of the retail market, we show that relative price dispersion can be rationalized as the equilibrium consequence of a pricing strategy used by sellers to discriminate between high-valuation buyers who need to make all of their purchases in one store, and low-valuation buyers who are able to purchase different items in different stores.

Working Paper 16-06 Revised. Greg Kaplan, University of Chicago and NBER; Guido Menzio, New York University and NBER; Leena Rudanko, Federal Reserve Bank of Philadelphia Research Department; Nicholas Trachter, Federal Reserve Bank of Richmond.

Peers' Income and Financial Distress: Evidence from Lottery Winners and Neighboring Bankruptcies

We examine whether relative income differences among peers can generate financial distress. Using lottery winnings as plausibly exogenous variations in the relative income of peers, we find that the dollar magnitude of a lottery win of one neighbor increases subsequent borrowing and bankruptcies among other neighbors. We also examine which factors may mitigate lenders' bankruptcy risk in these neighborhoods. We show that bankruptcy filers obtain more secured but not unsecured debt, and lenders provide additional credit to low-risk but not high-risk debtors. In addition, we find evidence consistent with local lenders taking advantage of soft information to mitigate credit risk.

Working Paper 18-22. Sumit Agarwal, National University of Singapore; Vyacheslav Mikhed, Federal Reserve Bank of Philadelphia; Barry Scholnick, University of Alberta.

Financial Contracting with Enforcement Externalities

We study the negative feedback loop between the aggregate default rate and the efficacy of enforcement in a model of debt-financed entrepreneurial activity. The novel feature of our model is that enforcement capacity is accumulated ex ante and thus subject to depletion ex post. We characterize the effect of shocks that deplete enforcement resources on the aggregate default rate and credit supply. In the model, default decisions by entrepreneurs are strategic complements, leading to multiple equilibria. We propose a global game selection to overcome equilibrium indeterminacy and show how shocks that deplete enforcement capacity can lead to a spike in the aggregate default rate and trigger credit rationing.

Working Paper 18-21. Lukasz A. Drozd, Federal Reserve Bank of Philadelphia Research Department; Ricardo Serrano-Padial, Drexel University.

The Economics of Debt Collection: Enforcement of Consumer Credit Contracts

Creditors often outsource the task of obtaining repayment from defaulting borrowers to third-party debt collectors. We argue that by hiring third-party debt collectors, creditors can avoid competing in terms of their debt collection practices. This explanation fits several empirical facts about third-party debt collection and is consistent with the evidence that third-party debt collectors use harsher debt collection practices than the original creditors. Our model shows that the impact of third-party debt collectors on consumer welfare depends on the riskiness of the pool of borrowers and provides insights into which policy interventions may improve the functioning of the debt collection market.

Working Paper 18-04 Revised. Viktar Fedaseyeu, Bocconi University; Robert Hunt, Federal Reserve Bank of Philadelphia Consumer Finance Institute.

Dynamic Pricing of Credit Cards and the Effects of Regulation

We construct a two-period model of revolving credit with asymmetric information and adverse selection. In the second period, lenders exploit an informational advantage with respect to their own customers. Those rents stimulate competition for customers in the first period. The informational advantage the current lender enjoys relative to its competitors determines interest rates, credit supply, and switching behavior. We evaluate the consequences of limiting the repricing of existing balances as implemented by recent legislation. Such restrictions increase deadweight losses and reduce ex ante consumer surplus. The model suggests novel approaches to identify empirically the effects of this law.

Working Paper 18-23. Suting Hong, Shanghai Tech University; Robert M. Hunt, Federal Reserve Bank of Philadelphia Consumer Finance Institute; Konstantinos Serfes, Drexel University.

The Effects of Competition in Consumer Credit Markets

Using changes in financial regulation that create exogenous entry in some consumer credit markets, we find that increased competition induces banks to become more specialized and efficient, while deposit rates increase and borrowing costs for riskier collateral decline. However, shadow banks change their credit policy when faced with more competition and aggressively expand credit to riskier borrowers at the extensive margin, resulting in higher default rates. These results show how the form of intermediation can shape economic fluctuations. They also suggest that increased competition can lead to large changes in credit policy at institutions outside the traditional supervisory umbrella, possibly creating a less stable financial system.

Working Paper 18-24. Stefan Gissler, Board of Governors of the Federal Reserve System; Rodney Ramcharan, University of Southern California; Edison Yu, Federal Reserve Bank of Philadelphia Research Department.

Inference in Bayesian Proxy-SVARs

Motivated by the increasing use of external instruments to identify structural vector autoregressions (SVARs), we develop algorithms for exact finite sample inference in this class of time time-series models, commonly known as proxy-SVARs. Our algorithms make independent draws from the normal-generalized-normal family of conjugate posterior distributions over the structural parameterization of a proxy-SVAR. Importantly, our techniques can handle the case of set identification and hence they can be used to relax the additional exclusion restrictions unrelated to the external instruments often imposed to facilitate inference when more than one instrument is used to identify more than one equation as in Mertens and Montiel-Olea (2018).

Working Paper 18-25. Jonas E. Arias, Federal Reserve Bank of Philadelphia Research Department; Juan F. Rubio-Ramírez, Emory University, Federal Reserve Bank of Atlanta, and BBVA Research; Daniel F. Waggoner, Federal Reserve Bank of Atlanta.

Redefault Risk in the Aftermath of the Mortgage Crisis: Why Did Modifications Improve More Than Self-Cures?

This paper examines changes in the redefault rate of mortgages that were selected for modification during 2008–2011, compared with that of similarly situated self-cured mortgages. We find a large decline in the redefault rate of both modified and self-cured mortgages over this period, but the improvement was greatest for modifications. Our analysis has identified several important factors contributing to the greater improvement for modified loans, including an increasing share of principal-reduction modifications, which appear to be more effective than other types of modification and increasingly generous modification terms (larger payment reductions). The favorable impacts of principal and payment reductions on household finances were enhanced by improving economic conditions, resulting in more effective modifications. Even after accounting for these factors, we still observe a larger decline in the redefault rate for modifications compared with similarly situated self-cured loans. This residual effect may reflect servicer "learning-by-doing"; that is, servicers gained knowledge as modification activity ramped up, resulting in more successful modification programs for later cohorts.

Working Paper 18-26. Paul Calem, Federal Reserve Bank of Philadelphia Supervision, Regulation, and Credit; Julapa Jagtiani, Federal Reserve Bank of Philadelphia Supervision, Regulation, and Credit; Raman Maingi, Federal Reserve Bank of Philadelphia Supervision, Regulation, and Credit.

Effects of the Community Reinvestment Act (CRA) on Small-Business Lending

This study provides new evidence on the effectiveness of the Community Reinvestment Act (CRA) on small-business lending by focusing on a sample of neighborhoods with changed CRA eligibility status across the country because of an exogenous policy shock in 2013. The results of difference-in-differences analysis provide consistent evidence that the CRA promotes small-business lending, especially in terms of number of loan originations, in lower-income neighborhoods. The generally positive effects of the CRA are sensitive to the types of CRA treatment. Losing CRA eligibility status has a relatively larger effect on small-business lending activities, while the effects of newly gaining CRA eligibility are less pronounced. The results are fairly robust when alternative sample periods and control groups are used.

Working Paper 18-27. Lei Ding, Federal Reserve Bank of Philadelphia; Hyojung Lee, Harvard University; Raphael W. Bostic, Federal Reserve Bank of Atlanta.

Appraising Home Purchase Appraisals

Home appraisals are produced for millions of residential mortgage transactions each year, but appraised values are rarely below the purchase contract price: Some 30% of appraisals in our sample are exactly at the home price (with less than 10% of them below it). We lay out a basic theoretical framework to explain how appraisers' incentives within the institutional framework that governs mortgage lending lead to information loss in appraisals (that is, appraisals set equal to the contract price). Consistent with the theory, we observe a higher frequency of appraisal equal to contract price and a higher incidence of mortgage default at loan-to-value boundaries (notches) above which mortgage insurance rates increase. Appraisals appear to be less informative for default risk measurement compared with automated valuation models.

Working Paper 18-28. Paul S. Calem, Federal Reserve Bank of Philadelphia; Lauren Lambie-Hanson, Federal Reserve Bank of Philadelphia; Leonard I. Nakamura, Federal Reserve Bank of Philadelphia; Jeanna H. Kenney, the Wharton School of the University of Pennsylvania.

Leaving Households Behind: Institutional Investors and the U.S. Housing Recovery

Ten years after the mortgage crisis, the U.S. housing market has rebounded significantly with house prices now near the peak achieved during the boom. Homeownership rates, on the other hand, have continued to decline. We reconcile the two phenomena by documenting the rising presence of institutional investors in this market. Our analysis makes use of housing transaction data. By exploiting heterogeneity in zip codes' exposure to the First Look program instituted by Fannie Mae and Freddie Mac that affected investors' access to foreclosed properties, we establish the causal relationship between the increasing presence of institutions in the housing market and the subsequent recovery in house prices and decline in homeownership rates between 2007 and 2014. We further demonstrate that institutional investors contributed to the improvement in the local labor market by reducing overall unemployment rate and by increasing total employment, construction employment in particular. Local housing rents also rose.

Working Paper 19-01. Lauren Lambie-Hanson, Federal Reserve Bank of Philadelphia; Wenli Li, Federal Reserve Bank of Philadelphia; Michael Slonkosky, Federal Reserve Bank of Philadelphia.

Financial Consequences of Identity Theft: Evidence from Consumer Credit Bureau Records

This paper examines how a negative shock to the security of personal finances due to severe identity theft changes consumer credit behavior. Using a unique data set of consumer credit records and alerts indicating identity theft and the exogenous timing of victimization, we show that the immediate effects of fraud on credit files are typically negative, small, and transitory. After those immediate effects fade, identity theft victims experience persistent, positive changes in credit characteristics, including improved Risk Scores. Consumers also exhibit caution with credit by having fewer open revolving accounts while maintaining total balances and credit limits. Our results are consistent with consumer inattention to credit reports prior to identity theft and reduced trust in credit card markets after identity theft.

Working Paper 19-02. Nathan Blascak, Federal Reserve Bank of Philadelphia; Julia Cheney, Federal Reserve Bank of Philadelphia; Robert Hunt, Federal Reserve Bank of Philadelphia; Vyacheslav Mikhed, Federal Reserve Bank of Philadelphia; Dubravka Ritter, Federal Reserve Bank of Philadelphia; Michael Vogan, Moody's Analytics.

Elasticities of Labor Supply and Labor Force Participation Flows

Using a representative-household search and matching model with endogenous labor force participation, we study the interactions between extensive-margin labor supply elasticities and the cyclicality of labor force participation flows. Our model successfully replicates salient business-cycle features of all transition rates between three labor market states, the unemployment rate, and the labor force participation rate, while using values of elasticities consistent with micro evidence. Our results underscore the importance of the procyclical opportunity cost of employment, together with wage rigidity, in understanding the cyclicality of labor market flows and stocks.

Working Paper 19-03. Isabel Cairó, Board of Governors of the Federal Reserve System; Shigeru Fujita, Federal Reserve Bank of Philadelphia; Camilo Morales-Jiménez, Board of Governors of the Federal Reserve System.

Bank Size and Household Financial Sentiment: Surprising Evidence from the University of Michigan Surveys of Consumers

We analyze comparative advantages/disadvantages of small and large banks in improving household sentiment regarding financial conditions. We match sentiment data from the University of Michigan Surveys of Consumers with local banking market data from 2000 to 2014. Surprisingly, the evidence suggests that large rather than small banks have significant comparative advantages in boosting household sentiment. Findings are robust to instrumental variables and other econometric methods. Additional analyses are consistent with both scale economies and the superior safety of large banks as channels behind the main findings. These channels appear to more than offset stronger relationships with and greater trust in small banks.

Working Paper 19-04. Allen N. Berger, University of South Carolina, Wharton Financial Institutions Center, European Banking Center; Felix Irresberger, University of Leeds; Raluca A. Roman, Federal Reserve Bank of Philadelphia.

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Forthcoming

Why Are Recessions So Hard to Predict? Random Shocks and Business Cycles

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