Fourth Quarter 2016 Volume 1, Issue 4

ECONOMIC INSIGHTS

FEDERAL RESERVE BANK OF PHILADELPHIA

Just How Important Are New Businesses? Regional Spotlight Banking Policy Review Research Update

INSIDE

ISSN: 0007-7011

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FOURTH QUARTER 2016

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On the cover: The art of foiling counterfeiters can be seen by tilting a new \$100 bill to reveal the Liberty Bell inside Ben Franklin's inkwell. Learn more about currency security features at https://uscurrency.gov/. Photo by Peter Samulis.

ECONOMIC INSIGHTS

Just How Important Are New Businesses?

New firms are the job engines of the economy, but firm formation has diminished. Should we worry?

BY THORSTEN DRAUTZBURG

New businesses create most of the new jobs in the U.S. economy each year — not small businesses, as popular wisdom holds. It may thus seem troubling that business formation has not kept up with overall growth in the U.S. economy over the last 35 years. And while counting jobs is just one way to quantify the success of new businesses, their relative decline matters not only for their owners and employees. That's because even though many new businesses fail, some survivors are innovators and grow rapidly, raising wage growth and productivity across the economy.

But we should be careful not to read too much into the drop in the headline numbers. The economic theory of creative destruction suggests that the success of new businesses comes at a cost to existing businesses.¹ Also, as I will show, Americans seem as entrepreneurial today as they were 20 years ago. Much of the fluctuation in the success of new businesses may actually have been driven by economywide forces such as demographics or technological opportunities, and not necessarily vice versa. So, even though it would be good to reverse the relative trend decline in business formation, it might not be as consequential as some believe.

What do I mean by "new" businesses? And why do they matter disproportionately for employment? Here I follow the Census Bureau's definition and define a new business's first, or *birth*, year to be the year it paid payroll taxes for an employee for the first time.² New businesses punch above their weight in terms of job creation. As Figure 1 illustrates, if new firms were to disappear and all else equal, employment in the U.S. would have fallen in every five-year period since 1977. That's because if the number of jobs created each year is calculated as a share of all jobs in the economy, the share created by new firms exceeds the share created by the U.S. economy as a whole — partly reflecting the fact

FIGURE 1

Share of Jobs at New Businesses Declining

Private nonfarm jobs created by new firms versus by all firms each year as shares of total jobs.



Sources: Census Bureau and author's calculations.

that each year many once-new businesses fail and destroy jobs.³ Startup firms created an average of 3.6 million jobs per year between 1978 and 2013, but because aging startups and older firms shed jobs, only 2.1 million jobs a year on average were created in the economy as a whole during that period.⁴ Even so, as Figure 1 also makes clear, the share of jobs created by startup firms has been falling since the mid-1980s, and the decline relative to the whole economy accelerated again during the Great Recession of 2007–2009.

Before going into details, it is worth emphasizing that

the decline is relative to the growing U.S. economy. Between March 1982 and March 2007, just before the Great Recession, employment at firms up to three years of age had increased

Thorsten Drautzburg is an economist at the Federal Reserve Bank of Philadelphia. The views expressed in this article are not necessarily those of the Federal Reserve. 17 percent, and the number of firms up to age three had increased 14 percent. But overall employment had increased 61 percent, and the overall number of firms had increased 47 percent. Startups have failed to keep up.⁵

Until fairly recently, the role of young businesses in job creation had gone largely unnoticed, with much emphasis being placed instead on small businesses.⁶ In 2013, John Haltiwanger and his coauthors pioneered the recent wave of U.S. research on the subject by compiling a data set that also tabulates the universe of U.S. firms by age. The researchers used the underlying firm-level data to argue "that once we control for firm age there is no systematic relationship between firm size and growth." This crucial role of newly formed businesses is consistent with data from other countries, such as Germany. Back in 1992, Tito Boeri and Ulrich Cramer had concluded that the opening of new businesses "is the driving force of trend employment growth."

Why had previous research focused on small rather than young firms? Since young firms tend to be small, it looks as if small firms per se are adding the most jobs unless one accounts for how long the firms have been in business.⁷ Crucially, smaller firms do not grow any faster than larger firms of the same age. But new firms that survive their first year do grow faster than more established firms do. The average one-year-old firm increases its workforce by about 15 percent a year. Upon reaching five years of age, firms on average are adding about 3 percent more workers to their payrolls, while firms that have been around for more than 10 years are typically growing about 2 percent a year.

The high average growth rates for new businesses

FIGURE 2

New Firms Used to Have Larger Share of Jobs Starting share of employment and average growth during

first five years by starting year.



Sources: Census Bureau and author's calculations.

since the late 1970s mask the significant slowdown in new firm activity that has taken place. Figure 2 illustrates this slowdown by comparing the contribution to overall employment that new firms made in 1982 versus 2007 — both their initial share of total jobs in the economy and the growth of that share over the ensuing five years. Both the initial contribution and the growth were markedly lower in 2007 than in 1982. Firms that were started in 1982 employed 4.1 percent of private nonfarm workers and increased that share by an average of 3.2 percentage points over the next five years. The 2007 cohort, in contrast, initially employed only 2.6 percent of workers and increased that already-smaller share at the slower rate of 1.8 percentage points per year.

This slowdown has not been limited to the two years I illustrate here — Figure 3 provides the comprehensive picture and shows that the two cohorts displayed in Figure 2 are representative of the trend since the early 1980s.

Despite their diminishing contribution, new firms remain important employers in the U.S. For example, Figure 3 shows that in 1982, one out of five U.S. workers was employed at a firm that belonged to the 1977 cohort — and that was, therefore, up to six years old. By 2012, the ratio for the corresponding 2007 cohort had fallen to one out of 11, where it stayed in 2013.⁸ In 2002, about 50 percent of employees worked at companies that had been started 25 years earlier. In 2013, that number had fallen to 39 percent.⁹ This smaller role of new businesses is due both to the lower starting shares evident in Figure 2 (visible as increasingly lower starting points in Figure 3) and slower growth (visible in the ever-flatter slopes in Figure 3).

FIGURE 3

New Firms' Share of Jobs Is Shrinking

Cumulative share of private nonfarm employment of firms by starting year, 1977–2013.



Sources: Census Bureau and author's calculations. Note: The data on firm ages top out at 25 years. What are the economic implications of this decline in young companies' share of total employment? By one estimate, if the U.S. economy had maintained the startup dynamics that had prevailed in the late 1970s and early 1980s, and if established businesses had still been able to create the same number of jobs as they did without the added competition, the U.S. would have 15 million to 20 million more private sector jobs today.¹⁰ Amid this trend decline in new

Some of the most prominent new businesses of the past few decades have become transformative technology companies such as Amazon, Google, and Facebook.

firms' share of employment, the Great Recession accelerated the decline in firm formation: Thirty percent fewer businesses were created in the recession compared with the previous peak.¹¹ A decline of this magnitude is unprecedented in the data, which start in 1977. Worse, according to one study, those businesses that were created during the recession were, on average, smaller — and we should expect them to remain smaller throughout their existence.¹²

WHY CARE?

While these developments seem disconcerting, they do not tell us if we should care more about the fate of young firms than about established ones. After all, what difference does it make whether a job is created by an established business or a new one? Yet, clearly, startups have gone on to play an outsize role in today's economy — not only in terms of job counts. Some of the most prominent new businesses of the past few decades have become transformative technology companies such as Amazon, Google, and Facebook. These companies have gone on to create tens of thousands of mostly well-paying jobs and have certainly contributed to a more productive economy.

But it is hard to move beyond anecdotes to establish whether new businesses in general increase productivity and employment more than other expanding businesses do. Looking only at the stars among new businesses is misleading because of *survivor bias*: Naturally, the top startups were the successful ones. So we have to look at the job-generating effects of all the businesses formed within a given period. But even once we turn to young businesses as a whole, it becomes hard to tell whether, say, their productivity pushed overall productivity higher or whether they were pulled along by a general rise in productivity. And the more important new businesses are for the economy, the more difficult it is to quantify those benefits because of feedback effects — whether a productivity boom originated among the new businesses or was simply adapted by them.

So, to isolate the effects of new businesses, researchers have to find ways to construct a comparison with a counterfactual model of an otherwise identical economy with fewer or no new businesses. Consider new businesses in France, as a starting point. In the French data, new firms tend to have a productivity rate about 15 percent higher than that of older firms that are shrinking.¹³ However, this might be because new firms use better technology that incumbents could also invest in. Interpreting the observed higher productivity is, therefore, hard. One creative study compared U.S. counties where large factories, called "million dollar plants" in the study, had chosen to locate with the runner-up counties.¹⁴ The new plants made other businesses in the county 3 to 5 percent more productive. But no such increase occurred among businesses in the runner-up counties. New plants, like new firms, have access to the latest technologies or can introduce new product varieties. This difference in the counties' productivity thus supports the notion that new businesses are both more productive themselves and, unlike older businesses, make other local businesses more productive.

LIMITS TO THE ROLE OF NEW BUSINESSES

Despite the benefits that new businesses bring, the headline numbers for employment or productivity may overstate their economic impact for two reasons: First, increases or decreases in the importance of new businesses might just reflect other forces at work in the economy. Second, what is good for new businesses may be bad for old businesses.

One concern is that fluctuations or trends in the number and size of new firms might just be transmitting fluctuations originating elsewhere in the economy. If that were the case, any remedies would also likely have to address the underlying cause, and not firm creation, which would merely be a symptom. For example, one study suggests that supply shocks from demographic changes largely explain the trend decline of new businesses.¹⁵ Another suggests that changes in monetary policy barely affect financing conditions for large firms but have a big impact on the ability of small firms (which, as we saw, are more likely to be young) to get loans — often critical for starting a business and keeping a young firm going. ¹⁶ In these cases, policymakers might want to address demographics through immigration reform or credit supply through targeted loan programs.

Are Americans becoming less entrepreneurial and simply less inclined to start businesses? Even though new businesses as we have defined them — having an employer plus at least one employee — have diminished, the same cannot be said of self-employment in general. Working for oneself apparently has not declined. On average, around 0.3 percent of Americans reported becoming self-employed as their primary occupation from 1996 to 2014 (Figure 4). While the fraction of the newly self-employed fluctuates, it does so within a fairly narrow range, in contrast with the trend decline we have seen in the number of new employers. Figure 4 also shows that a stable fraction of Americans give up a job to start a business, suggesting that entrepreneurship is a choice and not due to a lack of jobs.

New technologies also affect the creation and growth of

Tech Startups in History: Not All Gazelles

General Electric's founding in 1878 represents the start of the electrification era. It had its breakthrough innovation in 1880, grew rapidly during the electrification era of the late 1800s, incorporated, and went public in 1892. American Telephone & Telegraph was founded in 1885, had its breakthrough innovation in 1892, incorporated in 1895, and had its initial public listing in 1901.

In contrast, major chemical and pharmaceutical companies were founded in the same era as GE and AT&T but had their breakthrough innovations and went public at much later ages. It took Pfizer 51 years to incorporate, in 1900, and almost 100 years until it achieved its breakthrough innovation in 1944. Merck progressed a little faster but still took 43 years to incorporate and 53 years to reach its breakthrough innovation, also in the chemicalpharmaceutical era of the mid-20th century. These companies went public in 1944 and 1946, respectively.

The information technology era has been characterized by an even faster rise to prominence by major firms than during the electrification era. The advent of computerization is represented by the rapid incorporation, breakthrough innovation, and initial public offering of Intel — all within four years of its founding in 1968. Microsoft reached the same milestones within 11 years of its incorporation in 1975.¹⁸ new businesses. An analysis of different technological eras from the 1870s to the 1990s that examined the leading new firms in different sectors found that new firms rose to importance faster during the electrification era in the late 19th century and in the information technology era of the second half of the 20th century than during the chemical-pharmaceutical era in the middle of the 20th century.¹⁷

The stock market provides a way to quantify the role of new firms over time. During eras when new firms rose rapidly, they quickly commanded a large share of the total stock market valuation. By this metric, today's startup slump no longer appears unprecedented. In both the 1890s and 1990s, new firms' stock market valuation and the growth of their share were both relatively high — only to be followed by slowdowns.¹⁹ Yet, the slowdown in the mid-20th century was subsequently reversed with the commercial success of computers (Figure 5).

FIGURE 4

Americans as Entrepreneurial as in Late 1990s

Share of U.S. adults age 20–64 switching their main occupation to self-employed, by year.



Sources: Kauffman Foundation and author's calculations.

FIGURE 5

Tech Waves? New Public Firms Slow After Roaring '90s... Starting share and average growth of stock market capitalization by firm starting year, 1890–2015.



Sources: Jovanovic and Rousseau, 2002; Compustat*; and author's calculations.

FIGURE 6

...But History Shows Big Swings in Value

Cumulative share of U.S. stock market capitalization by firm starting year, 1890–2000.



Source: Jovanovic and Rousseau, 2002.

Figure 6 shows in more detail how the contribution of new firms to the U.S. stock market has fluctuated over the course of 110 years. Firms that got started before 1930 grew rapidly in market value, with cohorts achieving 20 percent market capitalization shares within 10 years, reflecting the rapid growth of firms during the electrification era. During the pharmaceutical and chemical era of the 1930s, 1940s, and 1950s, the share of young firms declined markedly. Yet, it recovered in the subsequent computerization era — before slowing again in the 2000s (Figure 5). If history is a good guide, we can hope for another rebound.

Are publicly traded firms a good indicator of new firms' success through history? They might not be. Which firms go public is not random, and the decisions underlying public offerings may change for reasons unrelated to startup formation. However, looking at the census data on all firms, public as well as privately held, shows that the recent decline in the total number of firms is not unprecedented. True, these totals do not tell us how much of an observed fall in the total number of firms is due to fewer startups and how much is due to more failures of existing firms. Yet, the fluctuations in the number of firms are consistent with the fluctuations in stock valuations over time, suggesting that the recent declines may very well reverse themselves. The decline in the Great Recession has precedents in the Great Depression and in the slowdowns in the 1950s and 1960s, all of which were subsequently reversed (Figure 7). A historical view thus suggests not reading too much into the decline of new firms because of technological underpinnings.

From a macroeconomic view, we do not care about the

rate of startup creation or startup employment shares per se. For example, competition in the labor market from new businesses drives up wages so that more or bigger new businesses might lead to fewer or smaller existing businesses. Standard economic models²⁰ and recent empirical estimates suggest that this effect is sizeable. By one estimate, the crowding-out effect of increased competition can destroy jobs at established firms equal to anywhere from one-third to 90 percent of the jobs created by new firms.²¹

However, even if the crowding-out were complete and employment at new businesses came completely at the cost of old businesses, this reallocation of workers might still be beneficial for the economy. New firms are able to crowd out old firms only because they are more productive. This higher productivity may raise wages more than employment — my model implies precisely that the stronger the crowding out, the faster the wage growth. In the French study mentioned earlier, even a complete reallocation from old to young businesses

SHOULD WE BE WORRIED?

was estimated to raise wages about 10 percent.

The pace at which businesses are started matters — but less so than their impressive job creation numbers would suggest. The reason is that ups and downs in the number of new businesses reflect other economic forces such as demographics and technology. New businesses contribute to productivity and employment growth, but partly at the cost of existing businesses. The current slowdown in business

FIGURE 7

Firm Formation Has Fluctuated Greatly over Time Changes in the number of new U.S. firms, 1900–2012.



Sources: Census Bureau and author's calculations.

Notes: Data for 1900–1983 are Census Bureau firm births and deaths statistics. Data for 1978–2012 are Census Bureau Business Dynamics Statistics. Data around World War I and World War II are averages.

formation is therefore serious, but the underlying causes may well lie outside the realm of policies tailored at nurturing startups — such as offering new entrepreneurs insurance against risk or tax incentives. The slowdown in business formation, particularly in the Great Recession, likely reflected the overall economic slowdown more than it contributed to it. The experience of the U.S. economy over the 20th century gives reasons to hope that as technology evolves, a new entrepreneurial boom may well emerge. That is not to say that policymakers can only stand by and wait. There is at least limited potential for policy. French legislation that provided some insurance against entrepreneurial earnings risk has increased business formation and employment without diminishing the quality of new firms.²² Even if the employment effects were small, similar legislation in the U.S. might raise productivity and wage growth.

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NOTES

¹ Shigeru Fujita's *Business Review* article provides an overview of studies quantifying economist Joseph Schumpeter's famous insight that the continual churn of firm formations and failures is the "essential fact about capitalism."

² Formally, a new business has been in existence for no more than a year, has at least one paid employee, and is not owned by another business. Excluded are the self-employed who have no employees; private households that employ domestic help; and railroads, agricultural producers, and most government entities.

³ The Business Dynamics Statistics data set assembled by John Haltiwanger and his coauthors and provided by the U.S. Census Bureau underlies this article.

⁴ This difference partly reflects how business-level job creation is calculated: as the change from the size of the firm's workforce in the prior year. Since by definition a new firm has no prior year, it can only add jobs, while an older firm can shed them. For details on how the Bureau of Labor Statistics measures net changes in employment at the business level, see its Business Employment Dynamics FAQs, in particular question No. 9: http://www.bls. gov/bdm/bdmfaq.htm#9. To calculate these annual averages, I adjusted for changes in the working-age population by dividing by the ratio of the working-age population in a given year relative to 2013. I dropped 1977, which was a (positive) outlier. Note that gross job creation averaged 19.63 million jobs per year, adjusted for changes in the working-age population.

⁵ The Census Bureau's Business Dynamics Statistics also charts the decline in absolute terms: http://www.census.gov/ces/dataproducts/bds/.

⁶ David Birch's 1981 work actually emphasizes both the role of being a young firm and of being a small firm but does not address the correlation of young with small.

⁷ Haltiwanger and his coauthors pointed out this misperception.

⁸ Data for 2013 are not shown.

⁹ This trend holds true within industries and across regions in the U.S. See also the research by Ryan Decker and his colleagues and by Benjamin Pugsley and Aysegul Sahin.

¹⁰ Pugsley and Sahin, 2015. Such a high number exceeds the number of people unemployed in the U.S., which peaked at 15.2 million in 2009, and would thus imply an increase in labor force participation.

¹¹ See the discussion paper by Michael Siemer.

¹² See the paper by Petr Sedlacek and Vincent Sterk.

¹³ See the paper by Johan Hombert and others. Ideally, one should compare entering with exiting firms. Because we do not observe the hypothetical productivity of firms that exited, Hombert and his coauthors instead compare the productivity of new and existing shrinking firms.

¹⁴ The article by Michael Greenstone and his coauthors details the comparisons. Note that winning counties could also just have better productivity to start with than losing counties, but Greenstone and his coauthors find that "compared to losing counties in the years before the opening of the new plant, winning counties have similar trends in most economic variables," (p. 539).

¹⁵ Fatih Karahan and his colleagues argue that the trend decline of new businesses that Pugsley and Sahin documented is, in fact, largely attributable to supply shocks arising from demographics.

¹⁶ See Mark Gertler and Simon Gilchrist's study of monetary policy's effects on financing conditions for large versus small firms. Martin Schmalz and his coauthors and Manuel Adelino and his coauthors argue that because collateralized loans matter for entrepreneurs, startups transmit events in the housing market. They claim that 15 to 25 percent of the employment growth between 2002 and 2007 can be attributed to the U.S. housing boom's benefit to entrepreneurs.

¹⁷ Boyan Jovanovic and Peter Rousseau's account of U.S. history shows how firm formation has reflected technological opportunities.

¹⁸ Jovanovic and Rousseau, 2002.

¹⁹ Because the data in Jovanovic and Rousseau end in 2000, I supplement calculations based on their data with data from Compustat in Figure 5. When the two data sets overlap in the 1990s, the implied starting share and growth rate are very similar.

²⁰ For example, a "span of control" model as calibrated in my 2013 paper.

²¹ See the paper by Johan Hombert and his coauthors.

²² Hombert and coauthors.



Even if the U.S. economy is thriving, some states can be in recession, and vice versa. But identifying state cycles is not so easy.

BY PAUL R. FLORA

Moi

Of the five U.S. recessions since 1979, Florida's economy continued to expand throughout three of them. In contrast, Alaska has had eight recessions since 1979, but only three of them occurred during a national recession. In fact, over the past 37 years, only eight states have been in recession during — and only during — all five of those U.S. recessions.¹ Whether a state's economy hews closely to the expansions and contractions of the U.S. business cycle depends on a variety of factors, including the state's industry mix and demographic trends. Florida's economy, for instance, has been propelled by rapid population growth as one of the main Sun Belt destinations for domestic migration and as a gateway state for tens of thousands of Latin American immigrants each year. Energy price shocks have frequently buffeted Alaska's economy, which relies heavily on the volatile and risk-prone oil industry.

Understanding a state's unique trends as well as the geographic distribution of state recessions is of great interest to households, firms, and policymakers. Tracking state cycles helps clarify the underlying causes of national recessions,² informs policymakers regarding appropriate monetary policy,³ and aids in recognizing in real time an emerging national recession.⁴

However, as this article will show, the greater volatility of state data and other complications make determining business cycles for an individual state more difficult than for the U.S. economy. Since 2005, the Federal Reserve Bank of Philadelphia has facilitated state business cycle research by producing coincident indexes of economic activity for all 50 states and the nation. Over the past decade, researchers have used the indexes to identify individual state business cycles.

With an additional 11 years of data since the indexes

were first published, and with the Great Recession behind us, I explore a method for using our indexes to pinpoint the onset and end dates of state business cycles and assess its results: What do the state coincident indexes now tell us about state cycles? And have any states entered a recession lately?

HOW ARE BUSINESS CYCLES DETERMINED?

Unfortunately, no official entity exists for dating the peaks and troughs of economic activity for each of the 50 states. For the overall U.S. economy, however, the National Bureau of Economic Research (NBER), a private organization, began publishing its determination of the timing of peaks and troughs in economic activity in 1929, becoming the unofficial but widely accepted arbiter of the nation's business cycles.

Within the NBER framework of alternating peaks and troughs in economic activity, "a recession is a period between a peak and a trough, and an expansion is a period between a trough and a peak." A recession is marked by a "significant decline in economic activity" lasting at least a few months, while an expansion is a typically longer period of increasing economic activity.⁵

Using judgment rather than a rule, the NBER's Business

Cycle Dating Committee decides when the last turning point in a cycle occurred by examining an assortment of quarterly and monthly data, but only after waiting until the risk of significant data revisions has abated. The

Paul R. Flora is a research and policy support manager and senior economic analyst in the Research Department of the Federal Reserve Bank of Philadelphia. The views expressed in this article are not necessarily those of the Federal Reserve. NBER waited 15 months before pronouncing that June 2009 was the trough month in which the Great Recession ended.⁶

For the states, a lack of comparable data represents the greatest challenge for determining individual state business cycles. Most critically, quarterly state GDP has been available only since 2015 and is still considered an experimental measure. When it is released, state GDP lags the comparable national data by three months. Of the 10 monthly indicators recently used by the NBER, only three are available for the states on a monthly basis: employment as measured by Bureau of Labor Statistics payroll and household surveys, and aggregate hours worked. All three are employment-related, so potential signals from other economic factors that are typically included in national aggregates of economic activity such as corporate profits are missed.

Our state coincident indexes were designed to compensate for the lack of comparable data by modeling the overall underlying growth of a state's economy using available data. Three monthly variables (nonfarm payroll employment, average hours worked in manufacturing, and the unemployment rate) plus one quarterly variable (real wages and salaries) are used to estimate an underlying (sometimes called a hidden) fifth variable that represents a state's gross domestic product.⁷ However, divining state business cycles is further complicated by two additional challenges.

First, the smaller size of state economies and the smaller sample sizes used to estimate state economic indicators generate greater data volatility and noisier trends, making it more difficult to discern true peaks and troughs. The second problem results from the longer lags in reporting state variables and the greater revisions to state estimates, which allow any false signals to persist until annual revisions are conducted to update the data. Thus, just as the NBER does in declaring national cycle dates, it is better to wait before pronouncing state peaks and troughs. Still, studies have demonstrated that examining state business cycles in real time is a potential — though not risk-free — way to assess the probability that the nation is currently in recession an assessment that is beyond the scope of this article.⁸

BUT HOW TO DETERMINE A STATE CYCLE?

Undertaking the task of identifying peaks and troughs for 50 individual states over a 37-year period calls for establishing a set of simple, straightforward criteria that capture the spirit of the NBER dating committee.

Criteria for the states are established by first examining how our national coincident index has performed relative to

FIGURE 1

U.S. Index Aligns Well with NBER Recessions Pennsylvania's as well, but state indexes are inherently more volatile.



Sources: Federal Reserve Bank of Philadelphia; National Bureau of Economic Research.

NBER-determined cycles.⁹ Our national coincident index, which was created at the same time as the state indexes for comparison purposes, is relatively well behaved, capturing all five NBER recessions as uninterrupted declines in activity, interspersed with uninterrupted increases in activity, or expansions (Figure 1).¹⁰ The durations of the declines range in length from four months in the 1980 recession to 18 months in the Great Recession. The depths of the recessions (calculated as the simple sum of the monthly percent changes during each recession period) ranged from -0.24 in the 1980 recession to -4.55 in the Great Recession.¹¹

As the 1980 recession was the shortest and shallowest national recession since 1979, its characteristics were used as the minimum criteria for determining state recessions: a minimum duration of four months and a minimum decline equal to or exceeding a simple variance measure computed for each state. Brief, one-time economic shocks that may result from a labor strike, factory closing, or natural disaster are less likely to be labeled a recession because a duration threshold is applied. Similarly, longer patches of slight declines avoid a recession label by virtue of a variance threshold.

For the nation, the average absolute value of the monthly percent changes in the national index was 0.24, the same as the aggregate change during the nation's smallest recession. Thus, the minimum decline for a state recession and minimum increase for a state expansion are established as the average absolute value of the monthly percent changes in each state index. Using a state-specific variance acknowledges the potential for state business cycles to have smaller or greater amplitudes than the nation's cycle.¹² (See the accompanying notes on *Determining State Peaks and Troughs* for examples of how the criteria are applied.)

Determining State Peaks and Troughs

Criteria

A state business cycle peak is determined as the last month in which the index has a positive monthly change prior to a period of at least four months in which the sum of the monthly changes is negative and its absolute value equals or exceeds the simple variance in that state's coincident index.

A state business cycle trough is determined as the last month of a qualifying recession (and one with a negative monthly change) prior to a period of at least four months in which the sum of the monthly changes is positive and its absolute value equals or exceeds the simple variance.

A period with offsetting monthly changes (a net change of zero for two or more months) at the start of a qualifying recession is treated as part of the prior expansion. Likewise, a period of two or more months of no net change at the end of a qualifying recession is treated as part of the subsequent expansion.

Examples

The very different experiences of five states and the U.S. during the double-dip U.S. recessions of the early 1980s are representative.

- Connecticut avoided both recessions. It did experience a seven-month decline (shaded yellow) during the second U.S. recession that was too shallow to qualify as a recession.
- Florida avoided both recessions. Although its growth rate was well below its norm, the state economy continued to expand.
- Illinois experienced one long recession. While the U.S. enjoyed a brief intervening expansion, Illinois was one of two states that declined throughout. Three other states escaped that fate by virtue of a bare minimum fourmonth expansion.
- New Hampshire avoided the first recession because of an insufficient duration, although it had a sufficiently deep decline (shaded yellow). Eight other states avoided the first recession with little or no decline, but not the second, while Alaska experienced the first and avoided the second.
- Pennsylvania followed the nation into and out of both recessions one of 36 states to do so.

It is important to note that peaks also represent the maximum for that cycle. For example, June 1981 was a peak month for Pennsylvania, with a subsequent trough in February 1983. June 1981 is the cycle maximum, not February or April, because the cumulative change from March 1981 through June 1981 is positive. Likewise, troughs represent a minimum for that cycle.

There were seven instances in which the depth was sufficient to qualify as a recession, but the duration was too short. Only the New Hampshire episode fell within a national recession. In addition, a 2006 bank merger in Delaware generated a three-month decline, a 1998 General Motors strike in Michigan caused a deep, two-month decline, and Florida's index declined sharply for one month following 9/11. The remaining three cases involved the energy states of Alaska, South Dakota, and West Virginia.

A spreadsheet showing onsets and end dates of all recessions since 1979 for all 50 states can be viewed at: https://www.philadelphiafed.org/-/media/research-and-data/publications/regional-spotlight/2016/Q4-state-peaks-and-troughs.xlsx.

TABLE 1 **Results**

Monthly percent change in each coincident index

	СТ	FL	IL	NH	PA	US
State Absolute Average	0.29	0.36	0.29	0.35	0.25	0.24
Feb-79	0.39	0.57	0.06	0.54	0.20	0.33
Mar-79	0.40	0.59	0.18	0.61	0.17	0.32
Apr-79	0.41	0.60	0.39	0.55	0.17	0.31
May-79	0.42	0.62	0.04	0.39	0.09	0.30
Jun-79	0.41	0.47	0.14	0.37	0.09	0.28
Jul-79	0.41	0.65	(0.04)	0.19	0.02	0.25
Aug-79	0.39	0.50	(0.13)	0.32	0.04	0.23
Sep-79	0.37	0.68	(0.42)	0.36	0.08	0.21
Oct-79	0.35	0.68	(0.18)	0.44	(0.01)	0.19
Nov-79	0.33	0.69	(0.42)	0.54	0.04	0.17
Dec-79	0.29	0.70	(0.18)	0.41	(0.06)	0.15
NBER Peak Jan-80	0.24	0.57	(0.30)	0.33	(0.11)	0.12
Feb-80	0.18	0.61	(0.55)	0.30	(0.36)	0.06
Mar-80	0.12	0.30	(0.53)	0.15	(0.52)	(0.00)
Apr-80	0.07	0.32	(0.85)	(0.16)	(0.69)	(0.07)
May-80	0.04	0.31	(0.55)	(0.22)	(0.64)	(0.10)
Jun-80	0.03	0.47	(0.67)	(0.02)	(0.55)	(0.07)
NBER Trough Jul-80	0.05	0.30	(0.59)	0.09	(0.50)	0.00
Aug-80	0.09	0.60	(0.25)	0.35	0.11	0.09
Sep-80	0.13	0.56	(0.30)	0.45	0.02	0.16
Oct-80	0.17	0.56	(0.25)	0.60	0.48	0.22
Nov-80	0.20	0.55	(0.28)	0.51	0.20	0.25
Dec-80	0.21	0.54	(0.10)	0.55	0.38	0.24
Jan-81	0.22	0.52	(0.18)	0.32	0.03	0.22
Feb-81	0.21	0.51	0.04	0.37	0.11	0.23
Mar-81	0.19	0.48	(0.12)	0.40	(0.06)	0.24
Apr-81	0.18	0.46	(0.06)	0.40	0.06	0.24
May-81	0.16	0.43	0.01	0.43	(0.11)	0.21

Monthly percent change in each coincident index

	СТ	FL	IL	NH	PA	US
Jun-81	0.13	0.41	(0.04)	0.44	0.20	0.16
NBER Peak Jul-81	0.11	0.23	(0.22)	0.33	(0.25)	0.11
Aug-81	0.07	0.23	(0.15)	0.31	(0.12)	0.04
Sep-81	0.04	0.08	(0.23)	0.15	(0.48)	(0.00)
Oct-81	0.00	0.07	(0.43)	0.12	(0.35)	(0.05)
Nov-81	(0.02)	0.05	(0.26)	0.04	(0.56)	(0.10)
Dec-81	(0.04)	0.04	(0.50)	(0.09)	(0.58)	(0.13)
Jan-82	(0.05)	0.03	(0.46)	(0.04)	(0.47)	(0.14)
Feb-82	(0.05)	0.02	(0.62)	(0.18)	(0.37)	(0.13)
Mar-82	(0.04)	(0.00)	(0.58)	(0.07)	(0.44)	(0.13)
Apr-82	(0.03)	0.13	(0.60)	(0.01)	(0.40)	(0.11)
May-82	(0.01)	0.11	(0.59)	0.11	(0.42)	(0.10)
Jun-82	0.01	0.13	(0.63)	0.23	(0.50)	(0.11)
Jul-82	0.04	0.16	(0.48)	0.26	(0.53)	(0.13)
Aug-82	0.06	0.04	(0.47)	0.20	(0.51)	(0.13)
Sep-82	0.08	0.09	(0.49)	0.13	(0.52)	(0.12)
Oct-82	0.12	0.12	(0.34)	0.04	(0.68)	(0.07)
NBER Trough Nov-82	0.18	0.16	(0.35)	0.11	(0.32)	(0.01)
Dec-82	0.25	0.18	(0.18)	0.29	(0.22)	0.07
Jan-83	0.33	0.31	(0.05)	0.46	(0.11)	0.14
Feb-83	0.42	0.61	0.12	0.67	(0.05)	0.21
Mar-83	0.52	0.61	0.24	0.83	0.35	0.28
Apr-83	0.60	0.64	0.43	1.05	0.44	0.34
May-83	0.68	0.78	0.43	1.12	0.57	0.40
Jun-83	0.74	0.93	0.61	1.01	0.44	0.45

Sources: Federal Reserve Bank of Philadelphia; National Bureau of Economic Research. Notes: Declines are shown in parentheses. The NBER indicates the months in which peaks and troughs occur and the duration (in

The NBER indicates the months in which peaks and troughs occur and the duration (in months) of recessions and expansions. It makes no determination of exactly when during the month a recession or expansion starts or ends.

A spreadsheet showing onsets and end dates of all recessions since 1979 for all 50 states can be viewed at: https://www.philadelphiafed.org/-/media/research-and-data/publications/regional-spotlight/2016/Q4-state-peaks-and-troughs.xlsx.

ASSESSING STATE CYCLES SINCE 1979

panying link. The most notable find-

Using these criteria, I determined the peaks and troughs for all 50 states, five of which are highlighted, along with the United States, in *Determining State Peaks and Troughs* and all of which are viewable through the accomWhile the 1990–1991 recession was much shorter, the distribution of its impact among the states was much more uneven. Of the 31 states in recession, Alaska and Wisconsin began to recover after just six months, while Connecticut and New Jersey endured 37 months of contraction. Sometimes referred to as the bicoastal recession, the 1990–1991

ing is that the Great Recession was so severe that no state economy avoided a recession. The all-encompassing nature of that downturn stands in contrast to the prior four national recessions. In particular, 19 states avoided a contraction during the 1990–1991 recession (Figures 2 and 3). During the double-dip recessions, 11 states avoided the brief 1980 recession, while only three states avoided the deeper, longer recession that followed in 1981–1982. Connecticut and Florida avoided both, while Alaska avoided the second. Eight states avoided the 2001 national recession.

The national economy endured the Great Recession for 18 months, according to the NBER. Our national index also indicated an 18-month duration. However, the peak and trough indicated by our index lag the NBER's dates by four months. For the other four recessions, all peaks and troughs for the U.S. economy had been indicated within two months or less of the NBER determinations.

The durations of those state recessions that accompanied the Great Recession ranged from five months in North Dakota to 64 months in Michigan. However, the latter was mired in a long-term structural change (more on that later). The more representative extreme during the Great Recession was Nevada, which endured 52 months of economic decline as its housing market collapsed. On average, recessions lasted a full year longer in the sand states of Arizona, California, Florida, and Nevada than in the other 46 states: 36 months as opposed to 24 months.

FIGURE 2





Source: Federal Reserve Bank of Philadelphia.

Note: The duration of a recession is the number of months from the peak to the trough. The Great Recession was 18 months long for the nation as a whole.

FIGURE 3

19 States Avoided the 1990–1991 Recession

Length of each state's recession, in months.



Source: Federal Reserve Bank of Philadelphia.

Note: The duration of a recession is the number of months from the peak to the trough. The 1990–1991 recession was eight months long for the nation as a whole.

recession hit New England and the Mid-Atlantic states especially hard. The average duration of recessions in the nine states in those two regions was 30 months; the average in the other 22 states was just 12 months.

Many of the 19 states that avoided the 1990–1991 national recession had hit bottom just a few years earlier as part of a series of mid-1980s state recessions that struck 14 farm and energy states, predominately located in the nation's heartland. The farm states suffered early in the 1980s as increased planting and greater yields collided with trade disruptions and a stronger dollar. Farmland values followed agricultural prices and profits in a downward spiral, and many farms went bankrupt. *Rolling recessions* became a popular descriptor, as 10 of those 14 states would later avoid the 1990–1991 U.S. recession, while Alaska, Mississippi, Montana, and West Virginia would succumb a second time.

The timing and duration of the farm and energy state recessions were somewhat idiosyncratic. Farm states tended to be hit earlier but adjust more quickly, such as Iowa, with a

Hawaii and Michigan have had recessionary periods lasting in excess of five years that may be more accurately described as secular declines due to long-term structural change.

July 1984 peak and a February 1985 trough. With a dependence on agriculture, metal mining, and energy extraction, Montana was the first state to enter a recession during this period, with a February 1984 peak, and it was the last to emerge, with a September 1987 trough.

The sense many people had of a "jobless" recovery following the eight-month 2001 national recession gains credence after examining state recessions rather than just the U.S. Of the 42 states that experienced a recession, only 15 had a single, relatively brief recession like the national one. Recessions extended 12 to 18 months longer in 14 states. During that same postrecession period, a dozen more states experienced a second recession following a brief interlude of expansion. Often the anomaly, West Virginia did not begin its 18-month recession until the national recession had ended.

When is a recession not a recession? Following our criteria, Hawaii and Michigan have had recessionary periods

lasting in excess of five years that may be more accurately described as secular declines due to long-term structural change.

Hawaii, which avoided the 1990–1991 recession, peaked instead in December 1991. An 81-month recession ensued that corresponded to the massive asset bubble burst and recession that enveloped Japan. The nearly seven years it took for Hawaii to hit bottom represents the painful adjustment as business and personal investment from Japan dropped sharply.

While the nation underwent the relatively shallow eight-month recession of 2001, Michigan was in the midst of a much deeper 21-month recession. Michigan's economic activity had peaked in April 2000 and hit bottom in January 2002. Like many other states during the jobless recovery, Michigan experienced a short, shallow expansion of seven months then entered another 11-month recession — hitting a second trough in July 2003. However, unlike other states, Michigan's next expansion was equally short and shallow, again lasting just seven months and peaking in February 2004. Michigan did not hit bottom again until June 2009, when the Great Recession ended. Essentially, Michigan gained little from the six-year national expansion. Rather, the state suffered significant employment losses as its manufacturing sector restructured and retooled over more than a decade.

HOW HAVE STATES FARED SINCE THE GREAT RECESSION?

Aside from a few late echoes following the Great Recession — as in the jobless recovery in the wake of the 2001 recession — six energy states were in recession for at least part of 2015: Alaska, Louisiana, North Dakota, Oklahoma, West Virginia, and Wyoming. For Alaska and West Virginia, these were their second recessions since the Great Recession. Most of these state economies have been severely hurt by the fall in oil prices. West Texas crude dropped 75 percent (annualized) from \$105.80 per barrel in June 2014 to \$47.50 per barrel in January 2015. West Virginia's economy, which expanded again in the latter half of 2015, has suffered due to coal industry conditions.

These six states are among the top eight states in terms of the share of total wages attributable to the natural resources and mining sectors. Wyoming leads the pack, with Louisiana eighth. New Mexico and Texas are sixth and seventh (Table 2).

The current energy state downturn resembles the previously discussed farm and energy slump that sent 14 states into recession at some point from 1984 to 1987 (Figure 4). Back then, West Texas crude oil had dropped 93 percent

TABLE 2

Recession States in 2015 Highly Dependent on Energy

Location quotients* for state natural resources and mining sectors. Recession states are shaded.

	Total annual wages	Annual average employment
Wyoming	10.53	6.52
Alaska	8.17	3.84
North Dakota	7.26	4.41
Oklahoma	5.26	2.82
West Virginia	4.41	2.69
New Mexico	4.11	3.19
Texas	3.58	1.97
Louisiana	3.31	1.97
Montana	3.04	2.02
Idaho	2.35	2.80
U.S.	1.00	1.00

Source: Bureau of Labor Statistics Quarterly Census of Employment and Wages. *A location quotient represents the proportionate contribution that wages or employment from a given economic sector makes to a state's total economy relative to that sector's contribution within the nation's economy. (annualized) from \$30.80 in November 1985 to \$12.60 in March 1986. Besides the current six, Colorado, Idaho, Iowa, Mississippi, Montana, Nebraska, New Mexico, and Texas had also been in recession.

As with the nation's mid-1980s experience with an energy recession, the current state recessions in six energy states do not indicate a nationwide problem. The misfortunes of businesses and households from those six states are linked to significantly lower energy prices, which represent a substantial consumer benefit for everyone else. Thus, the nation's economy typically grows faster, even as regions tied to energy production retrench. Similarly, we can draw distinctions within our Third District between those manufacturing firms that supply the energy sector and those that supply consumers, either directly or indirectly. Producers of food products and building materials, such as windows for new homes, have enjoyed lower input prices and lower production costs. Conversely, producers of heavy industrial equipment used by shale gas firms in Pennsylvania and by energy firms worldwide have suffered a sharp decline in orders.

FINAL OBSERVATIONS

Based on my analysis of the 50 state coincident indexes, just six energy states were in recession during 2015, and as

FIGURE 4

Latest Energy State Recession Less Widespread Instances of state recession, by recession period.



Source: Federal Reserve Bank of Philadelphia.

was the case in the mid-1980s, this energy state recession posed no risk to the national expansion.

However, as new data continually arrive and previous data are revised, our indexes may reveal somewhat different trends. Nevertheless, the economic data we've seen through most of 2016, and our knowledge of the direction and extent of potential data revisions, do not alter the conclusion that the nation's economic expansion continues unabated. And most states are following along.

NOTES

¹ These states are Georgia, Kansas, Missouri, New Jersey, Ohio, South Carolina, Vermont, and Virginia.

² See the research by Michael Owyang and his colleagues.

³ See the article by Gerald Carlino and Robert DeFina.

⁴ Ted Crone's 2006 Business Review article goes into detail.

⁵ The NBER's Business Cycle Dating Committee defines a recession as a "significant decline in economic activity" lasting a few months to more than a year, but it uses a variety of indicators as well as its members' judgment to decide what constitutes significant: "The Committee does not have a fixed definition of economic activity. It examines and compares the behavior of various measures of broad activity: real GDP measured on the product and income sides, economy-wide employment, and real income. The Committee also may consider indicators that do not cover the entire economy, such as real sales and the Federal Reserve's index of industrial production (IP). The Committee's use of these indicators in conjunction with the broad measures recognizes the issue of double-counting of sectors included in both those indicators and the broad measures. Still, a well-defined peak or trough in real sales or IP might help to determine the overall peak or trough dates, particularly if the economy-wide indicators are in conflict or do not have well-defined peaks or troughs." For more details on the NBER's approach to determining national business cycles, see its Business Cycle Dating Committee website, including its frequently asked questions at www.nber. org/cycles/recessions_faq.html.

⁶ To establish the June 2009 recession trough, the NBER reviewed quarterly estimates of real gross domestic product (GDP) and real gross domestic income (GDI) issued by the Bureau of Economic Analysis to determine the quarter. Then they examined 10 monthly indicators to set the month. These included: Macroeconomic Advisers' monthly GDP, the Stock-Watson index of monthly GDP, the Stock-Watson index of monthly GDI, the average of Stock-Watson indexes of monthly GDP and GDI, real manufacturing and trade

sales, the index of industrial production, real personal income less transfer payments, aggregate hours of work in the total economy, payroll survey employment, and household survey employment.

⁷ For more details on the construction of the state coincident indexes, see Ted Crone's 2006 paper or our website at: www.philadelphiafed.org/researchand-data/regional-economy/indexes/coincident.

⁸ See the 2006 article by Ted Crone and the 2008 report by Jason Novak.

⁹ Although we used the state coincident indexes as of June 2016, we did not consider the data beyond December 2015 for the purpose of determining business cycles. In the June 2016 vintage, state employment data after September 2015 are subject to significant potential revisions. However, this vintage also includes first quarter personal income data, which itself incorporates some of the employment data revisions through December 2015.

¹⁰ As such, peaks and troughs from the national index are easily determined. A peak occurs in the last month of growth prior to a sequence of declines in the index, and a trough occurs in the last month of decline prior to a sequence of growth in the index.

¹¹ For a spreadsheet of the underlying data of these results for all 50 states and the nation over the entire 37 years, see https://www.philadelphiafed. org/-/media/research-and-data/publications/regional-spotlight/2016/Q4state-peaks-and-troughs.xlsx.

¹² Using a state-specific variance as a threshold rather than the nation's variance is the main conceptual change from the approach used in Ted Crone's 1994 and 2006 articles. This change also accommodates the fact that our state coincident index approach can introduce greater variance. In particular, our process standardizes the input variables to have a mean of 0 and a standard deviation of 1. After estimating, we retrend the result to match the growth of state GDP. However, we do not revariance the indexes; thus, they may fluctuate more or less than their underlying data.

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BANKING POLICY REVIEW

Did Dodd–Frank End 'Too Big to Fail'?

Despite reforms, do big banks still benefit from market perceptions that the government will bail them out if they falter?

BY RYAN JOHNSTON

During the financial crisis in 2008, the U.S. government bailed out some very large banks for fear the collapse of any bank that large would profoundly harm the U.S. economy and destabilize the global financial system.¹ That is, they were too big to be allowed to fail. Passage of the Dodd-Frank Act two years later was intended to rule out future bailouts through tighter safety-and-soundness requirements, among other measures. Yet, some worry that investors may still view certain banks as "too big to fail," a perception that would confer an arguably unfair and potentially risky funding advantage over smaller banks. If a bank's uninsured depositors or bondholders expect to be protected against losses, they will accept lower interest rates. So, in principle, we should be able to compare the rates paid by the largest banks with those paid by smaller banks for evidence of whether Dodd-Frank was successful in eliminating markets' bailout expectations. But as this review will explain, the many differences between large and small banks make it hard to know whether we are comparing apples with apples. We review studies that address this apples-to-apples problem and help determine whether large banks still receive what is, in effect, a government subsidy.

A primary stated goal of Dodd–Frank is to get rid of the perception that the largest banks are too big to fail (TBTF).² It aims to do so through a number of mechanisms. An annual stress test is required for banks with assets greater than \$50 billion. The test uses hypothetical economic and financial market scenarios of varying severity to measure the impact on the value of banks' capital. If the test indicates that a bank's capital levels would fall below regulatory requirements under the severe stress scenario, the bank might be prohibited from making any dividend payments or other capital distributions.³ The results of banks' stress tests are posted on the Federal Reserve Board of Governors website and widely reported. Maintaining capital levels that internally absorb economic shocks strengthens public confidence that big banks will not need to be bailed out during an economic or financial downturn.⁴

Title II of Dodd–Frank gives the Federal Deposit Insurance Corporation (FDIC) authority to resolve a large, complex financial institution that is close to failing. Among other things, it prohibits the use of taxpayer funds and imposes losses on shareholders and creditors.⁵

Furthermore, in 2015 the Federal Reserve Board approved a rule requiring firms it deems global systemically important banks (GSIBs) to maintain a larger capital cushion — more than that required of smaller banks — in order to increase their resiliency against financial distress. This so-called capital surcharge is based on the amount of risk a GSIB poses to financial stability, or its "systemic footprint," and provides a stronger buffer against capital shortfalls that a large bank may experience.⁶

Although Dodd–Frank has made significant progress toward strengthening the financial system, some analysts and policymakers have argued that markets still perceive the largest banks as TBTF. In particular, they have argued that the largest banks have a funding advantage over smaller banks because of this perception.

Lingering perceptions that some banks remain TBTF might be a concern for a few notable reasons. First, depositors, bondholders, and other creditors that perceive large

Ryan Johnston is a banking structure associate in the Research Department of the Federal Reserve Bank of Philadelphia. The views expressed in this review are not necessarily those of the Federal Reserve. banks as TBTF may not monitor the banks' activities as closely as they normally would. They may also accept lower returns from large banks. In turn, this advantage may encourage too much risk-taking by large banks. TBTF funding advantages may also encourage banks to become too large or promote other inefficiencies such as monopoly profits or too little lending. Apart from these inefficiencies, policymakers might be concerned that a funding advantage for large banks could create unfair competition for smaller banks.

On the face of it, determining whether some banks have a funding advantage should be easy. Banks fund themselves with a mixture of deposits, bonds, and equity. Why not just compare the funding costs of large banks versus smaller banks? But as former Federal Reserve Governor

Although Dodd—Frank has made significant progress toward strengthening the financial system, some analysts and policymakers have argued that markets still perceive the largest banks as TBTF.

Randall Kroszner has said, to know whether any funding difference is due to TBTF perceptions, we need to be comparing apples with apples.⁷ There is a lot of evidence that large banks have advantages from economies of scale.⁸ In addition, their funding mix and business models differ from those of small banks.

How can we solve the apples-to-apples question? What evidence is there for the existence of a TBTF subsidy prior to the financial crisis? What about post-Dodd–Frank? In this article, we focus on the evidence from two rigorous approaches to the apples-to-apples issue. We are most interested in results for the post-Dodd–Frank period.

ARE BIG BANKS DIFFERENT FROM OTHER BIG FIRMS?

The first approach aims to get around the apples-to-apples issue by examining the differences in size-related funding costs for financial and nonfinancial institutions. This approach asks whether large banks have a greater funding advantage over small banks than other large firms have over small firms in their industries. The underlying idea of this comparison is that many of the factors that give large banks a funding advantage over smaller banks — such as broader access to public debt markets — also give large nonfinancial firms a funding advantage over smaller nonfinancial firms. However, there is no reason to expect government bailouts in most nonfinancial industries because they do not have the extensive interconnectedness and systemic footprint that the financial industry has. So, this comparison helps isolate any TBTF subsidy. Since nonfinancial firms do not take deposits, these studies focus on the costs of bond financing.

Javed Ahmed, Christopher Anderson, and Rebecca Zarutskie compare bond funding costs for commercial banks and investment banks with bond funding costs for 14 other nonfinancial industries. ⁹ They examine three periods: before (2004 Q1–2008 Q2), during (2008 Q3–2009 Q2), and after (2009 Q3–2013 Q2) the financial crisis. They find that there is a size-related funding advantage in all industries, including commercial banks and investment banks. But they do not find a size-related bond-funding advantage for commercial and investment banks when compared with other industries in any period.¹⁰

They also compare the size effect separately for commercial banks, investment banks, and 12 other industries. Out of those 14 industries, commercial banks and investment banks rank only ninth and 10th in size-related bond funding advantage — below, for example, business equipment and chemicals. Interestingly, they find that the category of "other financial" industries, which includes insurance and asset management firms, ranks high in size-related funding advantage.

While the comparison of larger and smaller firms across industries is designed to control for a wide range of sizerelated differences that would affect bondholders' perceived risk of default, the authors of this study — and all the other studies I discuss — also seek to control for default risk more directly. In this study, they include a measure of the default risk on a firm's bonds from Moody's Analytics. So, for example, regulatory factors such as higher capital requirements for larger banks will reduce the likelihood that bondholders will bear losses, and this lower likelihood will be reflected in Moody's measure of default risk.

A different study seeks to compare apples with apples through a variation on that same approach: Viral Acharya, Deniz Anginer, and Joseph Warburton ask whether the sensitivity of bond spreads to various measures of credit risk differs for large financial firms compared with large nonfinancial firms. Note that unlike in the study by Ahmed and his colleagues, financial firms in this study include insurance companies and asset management companies. Their idea is that a TBTF subsidy would make bond yields for the largest financial firms less sensitive to measures of credit risk compared with smaller financial firms, while this would not be true for nonfinancial firms.¹¹

Their main finding is that while a decrease in risk leads to a large reduction in yields for banks below the 90th percentile in size, banks above the 90th percentile have much less sensitivity to credit risk. Meanwhile, there is no such change in the risk sensitivity of yields for the largest nonfinancial firms. They calculate a subsidy of around 20 basis points before the crisis, rising above 100 basis points in 2009, and falling to around 30 basis points in 2012. So unlike the prior study, they estimate that there is a significant TBTF subsidy, even following the passage of Dodd–Frank.

Why do the results of these two studies differ? There are a few possibilities. First, the sample period in the first study ends one year later, so perceptions about TBTF could have evolved as regulatory changes continued after Dodd– Frank. Another reason could be that the two studies divide the financial and nonfinancial firms differently. The first study separates commercial banks and investment banks from other financial institutions, while the second study includes all financial firms as one group. And it was precisely the other financial firms in the first study that appeared to have a size-related funding advantage.

The difference in results is illuminated by another analysis, which uses a substantially similar methodology to the one by Acharya and his coauthors. A study by John Lester and Aditi Kumar focuses on only the very largest commercial and investment banks, and the sample period extends through 2013. They find a 36 basis point funding benefit for the largest banks in 2012 — not so different from Acharya and his coauthors — but essentially no funding benefit to being a very large bank in 2013.

DO LARGE BANKS PAY LESS FOR UNINSURED DEPOSITS?

The second approach analyzes deposit rates to compare the differences in funding advantages between large and small banks. If large banks have a funding advantage because of TBTF perceptions, it should show up as a smaller differential between rates on uninsured deposits compared with insured deposits. Unfortunately, only one study uses this approach to measure the subsidy in the postcrisis period, although a second study is helpful for putting the results in perspective.

William Bassett compares the interest rate differential paid by large and small banks on small time deposits — which are fully insured — and interest-bearing transactions and saving accounts — which are not fully insured.¹² The main comparison is between the largest banks and large regional banks. Bassett argues that this comparison is more relevant than comparing large and small banks if we are interested in TBTF versus other reasons why we might observe a size-related funding differential.

Bassett compares the funding differential for banks with assets of more than \$125 billion and banks with assets of \$20 billion to \$125 billion. First, he demonstrates that the interest rates on small time deposits are not sensitive to measures of bank risk for either large or smaller banks, evidence that rates on insured deposits do not include a premium for default risk. He then compares the rates on interest-bearing savings and time deposits. Consistent with the view that these deposits are not viewed by depositors

If large banks have a funding advantage because of TBTF perceptions, it should show up as a smaller differential between rates on uninsured deposits compared with insured deposits.

as fully insured, he shows that rates on these deposits are sensitive to risk.

Bassett compares the difference in the rates on uninsured and insured deposits for large and smaller banks in the precrisis and postcrisis periods. He finds a statistically insignificant funding advantage of 10 basis points in the precrisis period and no advantage in the postcrisis period. While Bassett's analysis provides no evidence of a TBTF subsidy — particularly in the postcrisis period — he notes that any such subsidy may be difficult to find in the environment of low interest rates and stable conditions that has prevailed since the Great Recession.

Stefan Jacewitz and Jonathan Pogach provide no evidence of a TBTF premium for the post-Dodd–Frank period, but their research helps to put bounds on the size of any pre-Dodd–Frank TBTF subsidy.¹³ Like Bassett, they compare the differential between rates paid on insured and uninsured funding sources by large and small banks. They focus on a narrower type of funding, money market deposit accounts (MMDAs), and consider the different interest rates paid on insured versus uninsured MMDAs. Prior to 2009, MMDAs in excess of \$100,000 were uninsured. Their main test compares the differential for banks with assets exceeding \$200 billion and all other banks. This is a relatively clean comparison, because regulatory restrictions impose uniformity on both large and small MMDAs. It is also economically important because MMDAs account for 35.3 percent of banks' liabilities.¹⁴

Jacewitz and Pogach's main finding is that prior to the crisis, banks with assets greater than \$200 billion had a 40 basis point funding advantage, but the spread declined to nearly zero when all MMDAs began to be insured during the financial crisis. This decline to zero once the larger accounts were insured is evidence that the measured differential reflects a TBTF subsidy. But the fraction of the differential that can reasonably be ascribed to TBTF is probably too large, as Jacewitz and Pogach themselves suggest.

They also try out a range of specifications to better understand the underlying source of the precrisis funding advantage for large banks. In particular, they find a significant premium of 21 basis points for banks with assets above \$10 billion compared with all other banks. Then again, few would argue that a \$10 billion bank would ever be considered important enough to the stability of the financial system to be bailed out. This reality suggests that up to 21 basis points of the measured funding advantage can't be explained by TBTF and leaves us with an estimate of the TBTF subsidy prior to the crisis ranging from a modest 20 basis points to a more significant 40 basis points.

CONCLUSION

There is evidence supporting and disputing the continued existence of TBTF subsidies. There are also many methods that can be used to find evidence of a TBTF subsidy that go beyond the studies reviewed here. The weight of the evidence is that while there may have been significant TBTF subsidies prior to and during the financial crisis, following the crisis any subsidies are small. In addition, there is evidence that funding costs now more accurately measure actual bank risk.¹⁵ This apparent absence of meaningful postcrisis subsidies could be partly due to the rules and regulations resulting from Dodd-Frank. Investors may now believe that they would have to take a hit to their wallets if a large bank were to fail. However, the low interest rate environment and relatively stable conditions in banking markets make it difficult to disentangle any subsidy by examining funding costs.

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NOTES

¹ The term *bailout* refers to a government intervention in which the bank is kept from failing and uninsured claimants are made whole.

² While size is one feature that might make a bank TBTF, other factors such as organizational complexity, dependence on funds that might disappear in a crisis, and interconnectedness with other financial institutions can affect banks' systemic risk. The notion of TBTF incorporates all of these factors.

³ Regulators incorporate a bank's stress test results into their quantitative assessment in an annual Comprehensive Capital Analysis and Review (CCAR), which evaluates the bank's "capital adequacy, capital planning process, and planned capital distributions, such as any dividend payments and common stock repurchases. As part of CCAR, the Federal Reserve evaluates whether BHCs [bank holding companies] have sufficient capital to continue operations throughout times of economic and financial market stress and whether they have robust, forward-looking capital-planning processes that account for their unique risks. The Federal Reserve may object to a BHC's capital plan on quantitative or qualitative grounds. If the Federal Reserve objects to a BHC's capital plan, the BHC may not make any capital distribution unless the Federal Reserve indicates in writing that it does not object to the distribution." See http://www.federalreserve.gov/newsevents/ press/bcreg/bcreg20160623a1.pdf.

⁴ Banks must also conduct their own stress tests under the same scenarios as well as tests under bank-developed scenarios. For more information on CCAR, Dodd–Frank Act stress tests, resolution plans, and other capital requirements, see the Federal Reserve Board's banking and regulation web pages at http://www.federalreserve.gov/bankinforeg/default.htm.

⁵ There are critics who do not believe that Dodd–Frank will prevent bank bailouts. This article does not focus on whether Dodd–Frank will actually prevent bailouts. Instead, it concentrates on the market's perception that a bank will be bailed out.

⁶ The Fed bases its GSIB designations on criteria developed by the Bank for International Settlements' Basel Committee on Banking Supervision, which include the bank's "size, interconnectedness, lack of readily available substitutes or financial institution infrastructure, global (cross-jurisdictional) activity and complexity." See http://www.bis.org/publ/bcbs207.htm. ⁷ See Randall Kroszner's survey of the evidence.

⁸ See the article by Joseph Hughes and Loretta Mester for evidence of significant scale economies.

⁹ In addition, they examine credit default swap (CDS) spreads. A CDS is a type of insurance contract in which the seller of the CDS promises to pay the buyer of the contract in the event of default on the firm's insured bonds. So, a smaller spread means there is a lower perceived risk of default on the firm's bonds. I focus on their results for bond spreads to facilitate the comparison with other studies.

¹⁰ Their evidence for CDS spreads is largely similar. However, they find evidence that CDS spreads were lower for larger commercial and investment banks during the crisis, potential evidence of a TBTF funding advantage at the time.

¹¹ To bolster their case that their results do not depend on the use of a particular measure of default risk, Acharya and his coauthors use a number of measures of default risk and get similar results. As in the study by Ahmed et al., this study includes measures of default risk in regressions to control for firms' risk of default for reasons other than size.

¹² Small time deposits are defined as deposits of less than \$100,000. Before October 3, 2008, deposits smaller than \$100,000 were fully insured by the Federal Deposit Insurance Corporation (FDIC). After October 3, 2008, deposits of \$250,000 or less became fully insured.

¹³ Evidence of a TBTF subsidy would not be expected after the rise in the insurance limit for MMDAs in 2008.

¹⁴ In addition, Jacewitz and Pogach examine pricing at the branch level to help control for differences in funding costs due to scale economies.

¹⁵ See Philip Strahan's article.

RESEARCH UPDATE

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Valuing "Free" Media in GDP: An Experimental Approach

"Free" consumer entertainment and information from the Internet, largely supported by advertising revenues, has had a major impact on consumer behavior. Some economists believe that measured gross domestic product (GDP) growth is badly underestimated because GDP excludes online entertainment (Brynjolfsson and Oh 2012; Ito 2013; Aeppel 2015). This paper introduces an experimental GDP methodology that includes advertising-supported media in both final output and business inputs. For example, Google Maps would be counted as final output when it is used by a consumer to plan vacation driving routes. On the other hand, the same website would be counted as a business input when it is used by a pizza restaurant to plan delivery routes.

Contrary to critics of the U.S. Bureau of Economic Analysis (BEA), the process of including "free" media in the input-output accounts has little impact on either GDP or total factor productivity (TFP). Between 1998 and 2012, measured nominal GDP growth falls 0.005% per year, real GDP growth rises 0.009% per year and TFP growth rises 0.016% per year. Between 1929 and 1998, measured nominal GDP growth rises 0.002% per year, real GDP growth falls 0.002% per year, and TFP growth rises 0.004% per year. These changes are not nearly enough to reverse the recent slowdown in growth.

The authors' method for accounting for free media is production oriented in the sense that it is a measure of the resource input into the entertainment (or other content) of the medium rather than a measure of the consumer surplus arising from the content. The BEA uses a similar production-oriented approach when measuring GDP. In contrast, other researchers use broader approaches to measure value. Brynjolfsson and Oh (2012) attempt to capture some consumer surplus by measuring the time expended on the Internet. Varian (2009) argues that much of the value of the Internet is in time saving, an additional metric for capturing consumer surplus. The McKinsey Institute (Bughin et al. 2011) attempts to measure the productivity gain from search directly. In particular, this production-oriented accounting has no method to account for instances in which the good or service precedes the revenue that it eventually generates. Over the past two decades, many Silicon Valley firms have followed the disruptive business model described as URL: ubiquity now, revenue later. Some firms have been creating proprietary software or research, which is already captured in the national accounts as investment. Other firms have been creating intangible investments in open source software, customer networks and other organizational capital. Despite their long-run value, none of these intangible assets are currently captured in the national accounts as investment. If we treat these asset categories as capital, then the productivity boom from 1995 to 2000 becomes even stronger and the weak productivity growth of the past decade may be ameliorated somewhat.

Working Paper 16–24. Leonard Nakamura, Federal Reserve Bank of Philadelphia Research Department; Jon Samuels, Bureau of Economic Analysis; Rachel Soloveichik, Bureau of Economic Analysis.

Localized Knowledge Spillovers: Evidence from the Agglomeration of American R&D Labs and Patent Data

The authors employ a unique data set to examine the spatial clustering of private R&D labs. Instead of using fixed spatial boundaries, they develop a new procedure for identifying the location and size of specific R&D clusters. Thus, they are better able to identify the spatial locations of clusters at various scales, such as a half mile, 1 mile, 5 miles, and more. Assigning patents and citations to these clusters, they capture the geographic extent of knowledge spillovers within them. Their tests show that the localization of knowledge spillovers, as measured via patent citations, is strongest at small spatial scales and diminishes rapidly with distance.

Working Paper 16–25. Kristy Buzard, Syracuse University; Gerald A. Carlino, Federal Reserve Bank of Philadelphia Research Department; Robert M. Hunt, Federal Reserve Bank of Philadelphia Payment Cards Center; Jake K. Carr, Ohio State University; Tony E. Smith, University of Pennsylvania. Supersedes Working Paper 15–03.

Borrower Credit Access and Credit Performance After Loan Modifications

While the preventive effect of loan modifications on mortgage default has been well-documented, evidence on the broad consequences of modifications has been fairly limited. Based on two unique loan-level data sets with borrower credit profiles, this study reports novel empirical evidence on how homeowners manage their credit before and after receiving modifications. The paper has several main findings. First, loan modifications improve borrowers' overall credit standing and access to credit. Modifications that provide principal reduction, rate reduction, or greater payment relief, as well as those received by borrowers not in financial catastrophe, lead to a larger improvement in borrowers' credit rating than others. Second, loan modifications lead to a slight increase in borrowers' debts, primarily on home equity line of credit (HELOC) accounts and auto loans. Third, borrowers' performance on nonmortgage accounts, however, has not been negatively impacted by modifications. This study demonstrates that interventions designed to improve household balance sheets could have a direct and sizable impact on borrower financial outcomes.

Working Paper 16–26. Lei Ding, Federal Reserve Bank of Philadelphia Community Development Studies & Education.

Identity Theft as a Teachable Moment

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 linked consumer credit data and alerts indicating identity theft, the authors show that the immediate effects of fraud on consumers 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 (indicating lower default risk). The authors argue that these changes are consistent with increased salience of credit file information to the consumer at the time of severe identity theft.

Working Paper 16–27. Nathan Blascak, Federal Reserve Bank of Philadelphia Payment Cards Center; Julia Cheney, Federal Reserve Bank of Philadelphia Payment Cards Center; Robert M. Hunt, Federal Reserve Bank of Philadelphia Payment Cards Center; Vyacheslav Mikhed, Federal Reserve Bank of Philadelphia Payment Cards Center; Dubravka Ritter, Federal Reserve Bank of Philadelphia Payment Cards Center; Michael Vogan, Moody's Analytics.

Supersedes Working Paper 14-28.

Information Spillovers, Gains from Trade, and Interventions in Frozen Markets

The authors study government interventions in markets suffering from adverse selection. Importantly, asymmetric information prevents both the realization of gains from trade and the production of information that is valuable to other market participants. They find a fundamental tension in maximizing welfare: While some intervention is required to restore trading, too much intervention depletes trade of its informational content. The authors characterize the optimal policy that balances these two considerations and explore how it depends on features of the environment. Their model can be used to study a program introduced in 2009 to restore information production in the market for legacy assets.

Working Paper 16–28. Braz Camargo, Sao Paulo School of Economics–FGV; Kyungmin Kim, University of Iowa; Benjamin Lester, Federal Reserve Bank of Philadelphia Research Department.

Supersedes Working Paper 13-20.

Declining Trends in the Real Interest Rate and Inflation: The Role of Aging

The authors explore a causal link between aging of the labor force and declining trends in the real interest rate and inflation in Japan. They develop a New Keynesian search/ matching model that features heterogeneities in age and firm-specific skills. Using the model, they examine the longrun implications of the sharp drop in labor force entry in the 1970s. They show that the changes in the demographic structure induce significant low-frequency movements in per-capita consumption growth and the real interest rate. These changes also lead to similar movements in the inflation rate when the monetary policy follows the standard Taylor rule, failing to recognize the time-varying nature of the natural rate of interest. The model suggests that aging of the labor force accounts for roughly 40% of the declines in the real interest rate observed between the 1980s and 2000s in Japan.

Working Paper 16–29. Shigeru Fujita, Federal Reserve Bank of Philadelphia Research Department; Ippei Fujiwara, Keio University, Australian National University.

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