

THE REGIONAL ECONOMIST

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Fourth Quarter 2017

Productivity
Is the Slowdown Due
to Retiring of Boomers?

President Bullard
A Review of 2017's
Key Policy Presentations

Shifting Times

The Evolution of the American Workplace



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Shifting Times: The Evolution of the American Workplace

By Alexander Monge-Naranjo and Juan Ignacio Vizcaino

Workers and work have changed dramatically since 1950. Workers are older, more educated and more diverse. Employment opportunities have shifted to higher-skilled occupations. Even jobs that have traditionally required low levels of schooling are employing people with more formal education.



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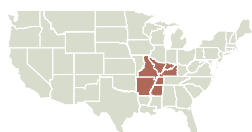
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The Eighth Federal Reserve District includes all of Arkansas, eastern Missouri, southern Illinois and Indiana, western Kentucky and Tennessee, and northern Mississippi. The Eighth District offices are in Little Rock, Louisville, Memphis and St. Louis.



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How Fast Will Banks Adopt New Technology This Time?

By Drew Dahl, Andrew Meyer and Neil Wiggins

To get an idea of how fast the banking industry might embrace new financial technologies—"fintech"—it might be worth looking at how quickly banks entered the internet age with a website almost a generation ago.

COVER IMAGE © THINKSTOCK/ISTOCK/ZAPP2PHOTO

A Year in Review

St. Louis Fed President James Bullard, a noted economist and scholar, has been a participant in Federal Open Market Committee (FOMC) deliberations since April 2008. Bullard actively engages with many audiences—including academics, policymakers, business and community organizations, and the media—to discuss monetary policy and the U.S. economy and to help further the regional Reserve bank's role of being the voice of Main Street.

Some of his key policy presentations during 2017 are summarized below, in chronological order. To see all of Bullard's public presentations, please visit www.stlouisfed.org/from-the-president.

Five Macroeconomic Questions for 2017

Jan. 12, 2017: In New York, Bullard discussed key questions related to the overall economy and to the Fed in particular. Bullard said the St. Louis Fed's recommended policy rate (the federal funds target rate) depends mostly on the safe real rate of return, and such rates are exceptionally low and are not expected to rise soon. "This, in turn, means that the policy rate should be expected to remain exceptionally low over the forecast horizon," he said. "The new administration's policies may have some impact on the low-safe-real-rate regime if they are directed toward improving medium-term U.S. productivity growth."

The Role of the Fed's Balance Sheet for the U.S. Monetary Policy Outlook in 2017

Feb. 28, 2017: Now may be a good time for the FOMC to begin allowing the balance sheet to normalize by ending reinvestment, Bullard said at George Washington University in Washington, D.C. "Adjustments to balance sheet policy might be viewed as a way to normalize Fed policy without relying exclusively on a higher policy rate path," he said. He also noted that current FOMC policy is distorting the yield curve. "Ending balance



President Bullard (left) often travels throughout the St. Louis Fed's District to share his views on the economy and to listen to the perspectives of others. In September, he visited Dot Foods, the nation's largest food redistributor, in Mount Sterling, Ill.

sheet reinvestment may allow for a more natural adjustment of rates across the yield curve as normalization proceeds and for 'policy space' in case balance sheet policy is required in a future downturn," he said. (The Fed began gradually reducing the size of its balance sheet in October 2017.)

Current Growth, Inflation and Price Level Developments in the U.S.

May 26, 2017: In Tokyo, Bullard said that U.S. macroeconomic data have been relatively weak, on balance, since the FOMC met in March and raised the policy rate. For instance, he noted that U.S. inflation and inflation expectations have surprised to the downside in recent months. He also said that even if U.S. unemployment declines substantially further, the effects on U.S. inflation are likely to be small. Regarding the U.S. price level, he said that it "has begun to deviate noticeably from the 2 percent path established in the mid-1990s." The price level is 4.6 percent below the previously established path.

The Path Forward for U.S. Monetary Policy

June 23, 2017: In Nashville, Tenn., Bullard said the Fed can wait and see how the economy develops before making any further adjustments to the policy rate. He noted that the U.S. policy rate has been rising while key policy rates abroad have remained fixed. He said the U.S. economy remains in a "regime" of low growth, low inflation and low interest rates, and that the current level of the policy

rate is likely to be appropriate for this regime over the forecast horizon. "Many future developments could impact this policy path, but the Fed does not need to pre-empt any of them," Bullard said.

When Will U.S. Inflation Return to Target?

Nov. 14, 2017: Inflation has been mostly below the Fed's 2 percent target since 2012 and is unlikely to return to target anytime soon, Bullard said in Louisville, Ky. "Inflation data during 2017 have surprised to the downside and call into question the idea that U.S. inflation is reliably returning toward target," he said. If the FOMC is going to hit the inflation target, "it will likely have to occur in 2018 or 2019," he added.

Assessing the Risk of Yield Curve Inversion

Dec. 1, 2017: In Little Rock, Ark., Bullard said that there is "a material risk of yield curve inversion" over the forecast horizon if the FOMC continues on its present course for raising the policy rate, as suggested in September's Summary of Economic Projections. Such an inversion—where short-term interest rates exceed long-term interest rates—has helped predict recessions in the past. He noted that yield curve inversion is best avoided in the near term by caution in raising the policy rate. "Given below-target U.S. inflation, it is unnecessary to push normalization to such an extent that the yield curve inverts," he said. [Q](#)



Shifting Times

The Evolution of the American Workplace

By Alexander Monge-Naranjo and Juan Ignacio Vizcaino

What are the main characteristics of American workers? What types of jobs do they do? Who does what? It turns out that the answers to these questions have been changing, in some cases dramatically.

For starters, the basic demographic makeup—age, gender and race—is very different now than it was nearly 70 years ago. Second, the educational levels of workers have been increasing dramatically.¹ Third, the occupations or types of jobs employing American workers are very different now relative to what American workers were doing just a few decades ago.

In this article, we explore these shifts in the American labor force and workplace. We show that the identity, education and occupations of the average American worker have all been changing. We also show that there are big changes in who does what, especially in the higher-skilled and higher-paying occupations.

Overall, the picture emerging from the data is very clear: American workers are older, more educated and more diverse. Because skilled workers are more abundant, the employment opportunities have been shifting to higher-skilled occupations, and this movement has taken place for workers of all genders and races. Workers with lower- or even middle-level skills are likely to face relatively tougher times because their remaining labor market opportunities are in the lower-skilled occupations.

Demographics and Education

To characterize American workers over the years, we collected individual level data from IPUMS-USA on the age, gender, race, educational level and current occupation

of workers.² For ease of use, we categorized the nine racial groups in the database into four broader groups: white, black, Asian and other.³ Similarly, for educational levels, we grouped the 11 categories in the data into five broader groups representing the maximum possible level of education attained by these individuals: primary or less (nursery through grade 8), secondary incomplete (grades 9-11), secondary complete (grade 12), college incomplete (one to three years of college), and college complete or more (four or more years of college).

The table contains the basic demographic information. A number of salient features are evident. First, female workers almost doubled their share in the labor force; nowadays, they are close to being half of the working population. Similarly, nonwhites as a whole more than doubled their share, accounting for nearly one in four workers.

An even more dramatic increment is in terms of schooling levels: In 1950, close to 40 percent of workers had only primary schooling (completed or less); today, the U.S. has only a negligible fraction of workers with such little formal education. On the opposite extreme, from having less than 18 percent of workers with at least some college, the U.S. now has about 60 percent of the labor force with either some college education or a completed college education.

A closer inspection of the data reveals that much of the changes took place in the 1970s and 1980s, when the baby boomers entered the labor market. Figure 1 shows the close relationship between the average age of American workers and the fertility rate of previous decades.⁴

The relatively high fertility rates of the 1950s and 1960s led to an interesting pattern in the age of active workers

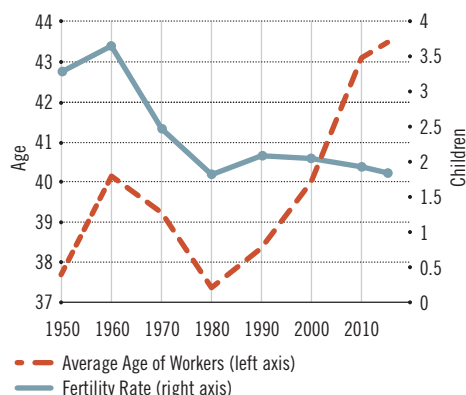
Characteristics of American Workers: 1950-2015

Year	Average Age	Gender		Race				Education				
		Male	Female	White	Black	Asian	Other	Primary or Less	Secondary Incomplete	Secondary Complete	College Incomplete	College Complete or More
1950	37.7	72.6%	27.4%	90.0%	9.6%	0.3%	0.2%	38.8%	19.3%	24.3%	9.3%	8.4%
1960	40.1	68.0%	32.0%	89.8%	9.3%	0.6%	0.3%	29.4%	22.3%	28.4%	10.4%	9.6%
1970	39.3	62.9%	37.1%	89.2%	9.5%	0.8%	0.4%	17.3%	21.0%	35.4%	13.4%	12.8%
1980	37.4	57.8%	42.2%	87.7%	9.7%	1.8%	0.8%	8.3%	15.4%	38.4%	19.3%	18.6%
1990	38.3	54.7%	45.3%	83.1%	10.0%	2.9%	4.0%	3.8%	9.2%	33.2%	45.5%	8.2%
2000	40.0	53.6%	46.4%	78.8%	10.1%	3.8%	7.3%	2.9%	7.7%	38.1%	41.6%	9.7%
2010	43.1	52.3%	47.7%	76.8%	10.8%	5.3%	7.1%	2.8%	5.4%	33.8%	46.5%	11.5%
2015	43.5	52.7%	47.3%	74.9%	11.5%	5.9%	7.7%	2.5%	4.8%	32.8%	47.5%	12.3%

SOURCE: IPUMS.

FIGURE 1

Workers' Average Age and Fertility in the U.S.

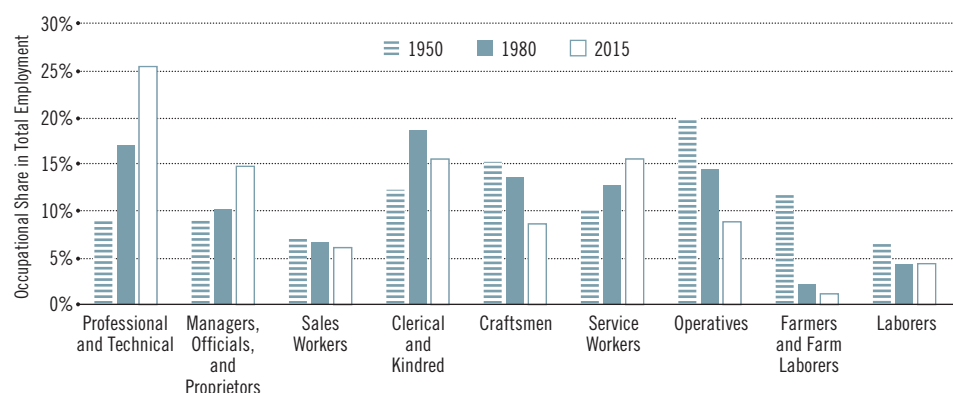


SOURCES: For the average age, IPUMS; for the fertility rate, World Bank via FRED.

NOTE: Total fertility rate represents the number of children who would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with current age-specific fertility rates.

FIGURE 2

Shifts in the Shares of U.S. Workers across Occupations



SOURCE: IPUMS.

NOTE: "Clerical and Kindred" includes those occupations whose clerical duties, such as those related to general office work or duties pertaining to the operation of various office machines, take up a majority of the worker's time or for which the major requirement is the ability to perform the clerical duties. "Operatives" includes those occupations in which duties related to operating and handling machines take up a majority of the worker's time.

over the years. First, average ages tended to increase between 1950 and 1960 as young female workers in the 1950s left the labor force to rear children. Later, however, when the baby boomers' children entered the labor force in the 1960s, the average age started to decline. Yet, with the lower fertility rates observed since the late 1970s and early 1980s, the average American worker started aging, a trend that has remained up until at least 2015, the last year for which we have data.

To be sure, the baby boomers had more formal education than their parents, but the boomers' education has since been eclipsed by that of their children. It is easy to see why the 1970s and 1980s were years of rapid expansion in the average educational level of American workers. After that, a steady increase in education

has been sustained up until 2015, and it is expected to continue.

These changes in the educational level of American workers are significant enough that one would expect to see important changes in the structure of the economy, i.e., in the types of occupations in the economy and the types of workers filling those jobs. The data show this vividly.

Changes in Work and in Who's Doing What

We now explore the changes in what the American workers do in the marketplace. To this end, we grouped workers into the following nine broad groups,⁵ ordered by their skill intensity⁶: professional and technical workers; managers, officials and proprietors; sales workers; clerical and kindred; craftsmen; service workers; operatives

(e.g., machine operators); farmers and farm laborers; and laborers.⁷

Figure 2 shows the shares of workers across the nine broad occupation categories in the data. For ease of presentation, we reported on the data only for the beginning, the middle and the end of the sample period. For each occupation, the first bar in each case corresponds to American workers in 1950, the middle bar corresponds to workers in 1980 and the last bar corresponds to 2015, the most recent year for the data.

Figure 2 shows important changes in what American workers do. First, there is a big shift toward professional and technical occupations and toward management. The first group almost tripled its share over all workers between 1950 and 2015, from 8.7 percent to 25.4 percent of all workers. The second group, i.e., the management positions, almost doubled its share, from 8.8 percent to 14.7 percent. Another occupation that expanded is service workers, a finding that is not surprising, given the well-known movement of the U.S. economy toward services and away from agriculture and manufacturing. This movement also explains the significant decline in craftsmen, operatives and farm workers.

Beyond these profound changes in the occupations or job types, we observed substantial shifts in the types of workers that are allocated across the different types of jobs. Each of the nine panels of Figure 3 shows the share of workers with different schooling levels in each of the nine broad occupation categories. Obviously, the educational level of the workforce was very different in 2015 relative to that of 1950 and even 1980.

Specifically, consider the notable difference in the schooling attainment of workers in professional and technical occupations between 1950 and 2015. In 1950, only half of these workers had completed a college degree. By 1980, those with college degrees already made up 60 percent of these workforces and by 2015 they accounted for 70 percent. In 1950, it was not uncommon to find workers with only a high school diploma in professional positions; in fact, one in 10 of these professional workers had not finished high school, and up to 6 percent of them did not have any secondary

FIGURE 3A

Schooling of Professional and Technical Workers in the U.S.

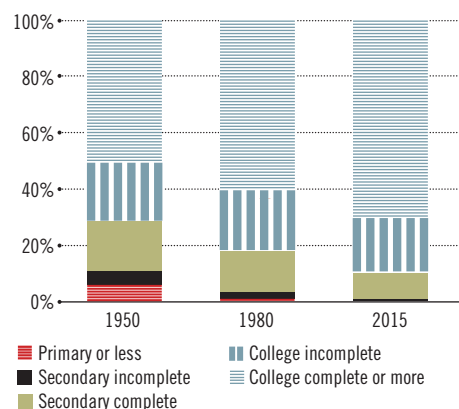


FIGURE 3B

Schooling of Managers

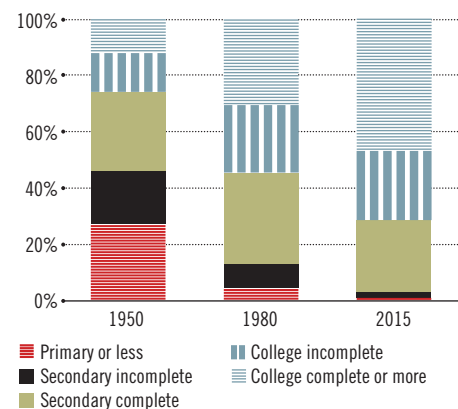


FIGURE 3C

Schooling of Sales Workers

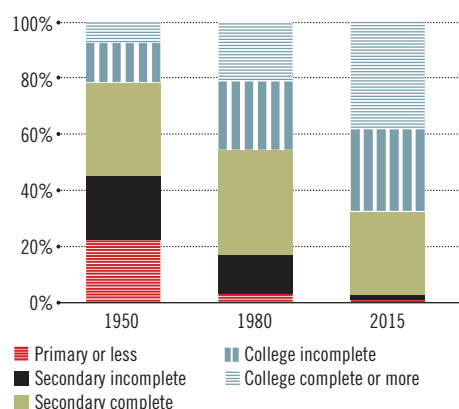


FIGURE 3D

Schooling of Clerical Workers

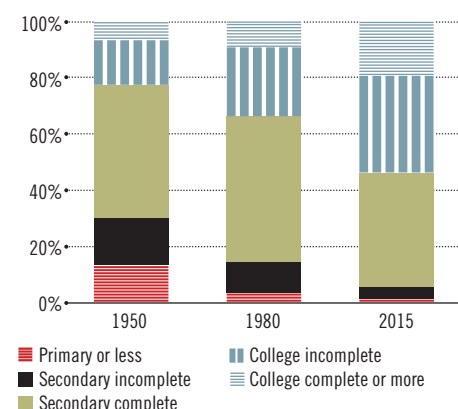


FIGURE 3E

Schooling of Craftsmen

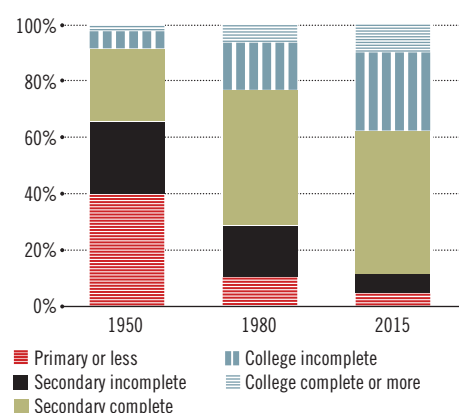
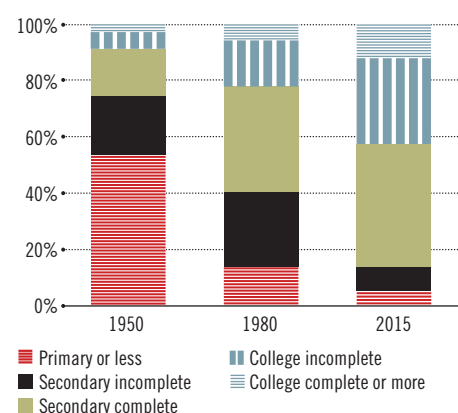


FIGURE 3F

Schooling of Service Workers



SOURCE FOR ALL FIGURES ABOVE: IPUMS.

FIGURES IN THIS SERIES ARE CONTINUED ON NEXT PAGE.

FIGURE 3G
Schooling of Operatives
(e.g., Machine Operators)

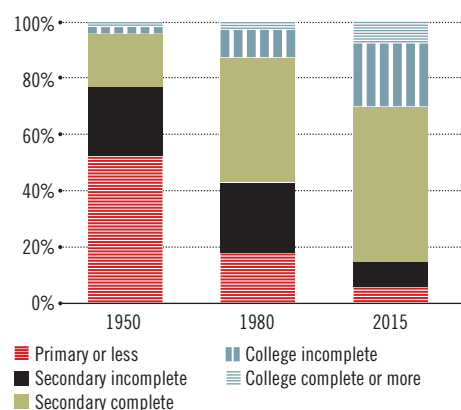


FIGURE 3H
Schooling of Farmers

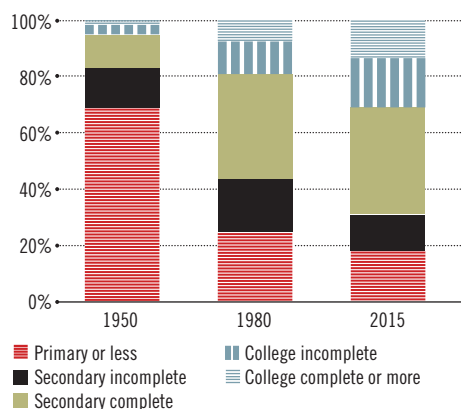
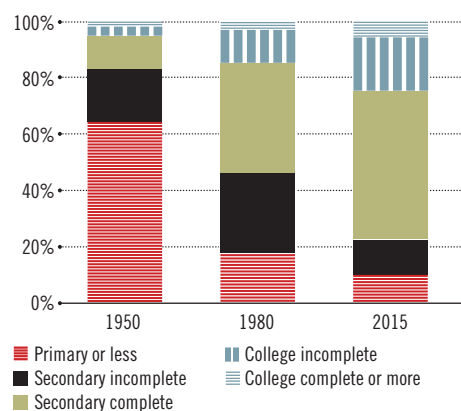


FIGURE 3I
Schooling of Laborers



SOURCE FOR ALL FIGURES ABOVE: IPUMS.

education at all. Formally or informally, this subset of professional workers must have accumulated technical knowledge on the job. As Figure 3A shows, this group of empiricist professionals had all but disappeared by 1980 and was completely gone in 2015.

Even more striking changes can be seen in workers occupying managerial jobs. In 1950, managers were predominantly workers with no formal college education: Individuals who had no more than a high school diploma accounted for more than three in four of American managers. (In 1950, 27.4 percent of managers had only primary education and only 11 percent of them had completed college.)

Figure 3B shows the drastic change that has taken place: In 2015, virtually all managers had completed at least secondary education, almost three-fourths of them had some form of college education and 46.4 percent of them had completed at least a college degree.

The movement toward higher levels of education can be seen also in all other occupations, albeit to a different extent. In all of them, there is an increasing share of college-educated workers and a decline in workers with primary education only. The main difference across occupations is in the incidence of secondary education (complete and incomplete) and in workers with some college education. For example, while in 1950 virtually no operative worker had any college education, in 2015 more than 30 percent of these operators had some college.

It is noteworthy that the agricultural sectors have attracted—or required—workers with higher levels of education. Nowadays, almost 31 percent of these workers have some college education. Notice that similar numbers apply to the group of laborers.

Despite some ambiguity in the share of workers who have completed secondary school over the years, all occupations in the country have undergone a process of skill upgrade, namely the movement in which the same form of task, job or occupation is now performed by workers with higher skill levels.⁸ This is most evident when looking at the share of college-educated workers performing more and more of all these broadly defined categories of jobs and also when looking at the sharp decline in the share of workers with only primary school

completed. This sharp decline appears even among farmers and laborers, a solid majority of whom have traditionally had only a primary school education.

Top-Earning Occupations

We now look more closely at the managerial and professional occupations, the two occupations that have been expanding at the fastest pace and that are the ones paying the highest salaries. Figure 4 breaks down the composition across gender and race groups for these two broad categories.

As the two panels of Figure 4 clearly show, both occupations have traditionally been performed predominantly by white workers and, up until recently, by predominantly white male workers. But that has changed profoundly. In 1950, white males accounted for more than 81 percent of all managers and for 51 percent of all professional and technical workers. Interestingly, the predominance of white males in both groups was even higher in 1960 and 1970, likely reflecting large numbers of younger, highly educated females leaving the marketplace to raise children. But by 2015, white males accounted for about half of the managers and for about 34 percent of professional workers.

The entry of highly educated white women is one of the main forces behind this change. From essentially being a rarity in the 1950s and 1960s—and even the 1970s—women in management positions accounted in 2015 for one of every three managers in the U.S. White women accounted for even more of the professional occupations, outnumbering white men in 2015.

A second major force of change is the entry of nonwhite workers. Indeed, from virtually being negligible in these two broad groups of higher-paying occupations, nonwhite workers now account for 20 percent of professionals and 15 percent of managers.

The rise of women and nonwhite workers in the marketplace can be tied to higher college enrollment rates over time and to reductions in educational and labor market distortions and barriers. In the case of women, some have argued that technological changes favor female skills and that the combination of women's higher social skills with increased cognitive skills has also played an important role.⁹

FIGURE 4A

Race and Gender of Managers in U.S.

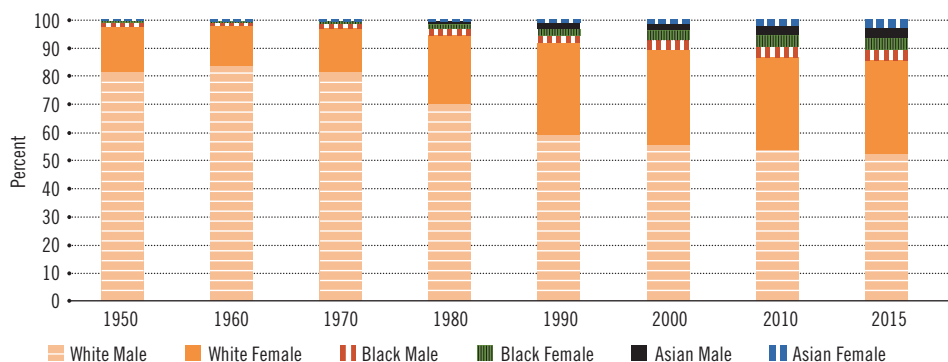
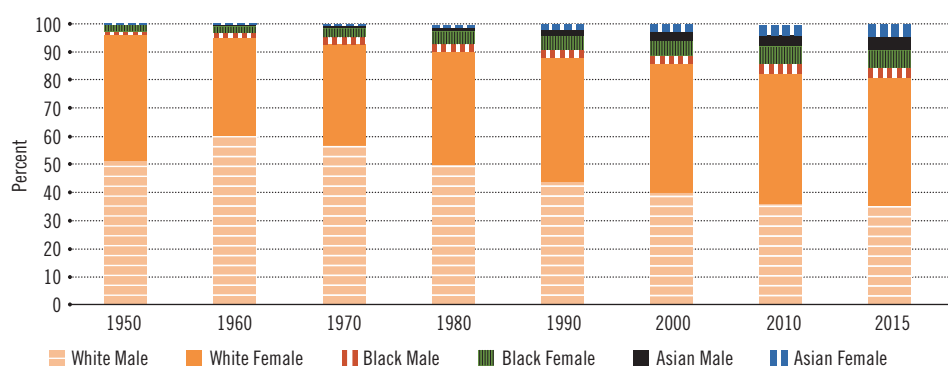


FIGURE 4B

Race and Gender of Professional and Technical Workers in U.S.



SOURCE FOR BOTH FIGURES: IPUMS.

Conclusions

We explored the substantial shifts in the American labor force and workplace over almost 70 years, showing that the identity, education, race and occupations of the average American worker have all been changing. We documented big changes in the types of jobs being done by American workers and on the assignment of jobs across workers with different educational levels and other characteristics.

The data discussed here provide a number of clear lessons. First, American workers are older, better-schooled and much more diverse in terms of race and gender. Second, employment opportunities have shifted to higher-skilled occupations. Third, there has been a generalized process of skill upgrading, as all occupations are employing workers with more formal education.

Needless to say, these changes have led to additional challenges for some groups of workers: Those with lower levels of

education may be unable to find jobs in occupations that their parents held with much less formal schooling. For those with higher levels of education, they now have heightened competition from more individuals with higher education, including groups that were rarely represented in these ranks in the past, e.g., females and nonwhites.

Regardless of how much more challenging labor markets become for everyone, the aggregate productivity is higher when the country takes advantage of the talent of all the demographic groups and not just a subset of them.¹⁰

Alexander Monge-Naranjo is an economist at the Federal Reserve Bank of St. Louis. For more on his work, see <https://research.stlouisfed.org/econ/monge-naranjo>. Juan Ignacio Vizcaino is a technical research associate at the Bank.

ENDNOTES

- See Monge-Naranjo.
- IPUMS-USA, University of Minnesota, www.ipums.org. We discarded individuals whose employment status is unknown or who are unemployed or are not in the labor force, as classified by the variable EMPSTAT codes 0, 2 and 3. Also, see Ruggles et al.
- In the database, racial categories consist of national origin groups. Beginning in 2000, the race question changed substantially to allow respondents to report as many races as they felt necessary to describe themselves. In earlier years, only one race response was coded. We grouped nine racial categories reported in IPUMS-USA into four broader groups: white (IPUMS-USA: White), black (IPUMS-USA: Black/African American/Negro), Asian (IPUMS-USA: Chinese, Japanese, Other Asian or Pacific Islander) and other (IPUMS-USA: American Indian or Alaska Native, two major races, three or more major races). IPUMS-USA contains separate information on ethnicity, in particular, whether a worker has Hispanic ethnicity. In a future article, we will focus exclusively on the participation of Hispanic workers in the U.S. labor force and in the different occupations.
- Fertility data come from the World Bank and were obtained via FRED at <https://fred.stlouisfed.org>.
- In order for occupations to be comparable across time, we used the 1950 Census Bureau occupational classification. Each of the nine categories groups occupations that are similar in nature according to their three-digit occupational code, the smallest level of desegregation the Census Bureau provides.
- The occupations with the highest percentages of workers with the top level of education (college or more) are deemed those that are most skill-intensive. The top four occupations were the same in 2015 as in 1950.
- Observations of individuals with unclassified, missing or unknown occupations are discarded.
- See Costinot and Vogel.
- See Rendall, Cortes et al. and Hsieh et al.
- This point is forcefully made by Hsieh et al.

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Boomers Have Played a Role in Changes in Productivity

By Guillaume Vandenbroucke



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In the 1970s, the U.S. economy experienced a prolonged period of low productivity growth. Nowadays, growth in productivity is once again slower than expected.

The causes of these slowdowns have been much debated. The 1970s' slowdown has often been associated with, among other causes, high energy prices following the 1973 oil price shock, increased antipollution regulations and a decline in the quality of education.¹ The current productivity slowdown is often associated with the 2007-08 financial crisis.

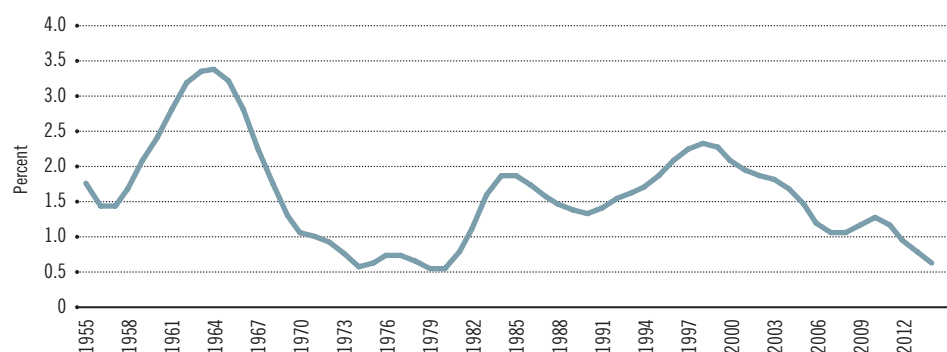
In this article, I hypothesize that the two slowdowns are related to a single, common factor: the baby boom, that period from 1946 to 1957 when the birth rate increased by 20 percent. This hypothesis is not to say that the baby boom was entirely responsible for these two episodes of low productivity growth. Rather, it is to point out the mechanism through which the baby boom contributed to both. Exactly how much did the baby boom contribute to these slowdowns? The answer to that question is beyond the scope of this article.

Productivity 101

A typical measure of productivity is labor productivity, which is gross domestic product (GDP) per worker.² Figure 1 shows that, in the 1970s, the growth rate of labor productivity was noticeably low.³ This slowdown started in the 1960s, when the growth rate of labor productivity started to decline. The growth rate of labor productivity accelerated between 1980 and 2000. Since 2000, another decline is noticeable. It is interesting to note that the current state of low labor productivity growth is comparable to that of the 1970s and that it results from a decline that started before the 2007 recession.

FIGURE 1

The Growth Rate of GDP per Worker in the U.S., 1955-2014



SOURCES: Bureau of Economic Analysis and Bureau of Labor Statistics, via FRED.

To understand how the baby boom may have contributed to both the 1970s slowdown and the current slowdown, it is worth taking a detour to think about what makes a worker productive.

Current thinking is that workers supply “human capital services” to their employer. Sometimes one can refer to “skills” or simply “productivity.” The exact terminology is not critical. What is critical is the theory that young workers have relatively low human capital and that, as they become older, they accumulate human capital.

The accumulation of human capital can be achieved in multiple ways. One is simply via experience: Older workers have more human capital, i.e., they know more just because they have done more and have experienced “learning by doing.” Another possibility is that workers go through periods of formal on-the-job training throughout their careers; so, they learn more as they grow older. Human capital is what makes a worker productive: The more human capital, the more output a worker produces in a day’s work.

Picture, then, a typical worker’s human capital profile throughout life. A stylized representation of this profile is in Figure 2. In theory, such a human capital profile implies that a worker’s earnings profile should look very similar. This is because, in theory, workers are paid according to their productivity. Interestingly, this is exactly the case in the United States: The data show that the typical earnings profile throughout a worker’s life increases until it reaches a peak, usually a few years before retirement. What, then, does human capital theory tell us about U.S. productivity?

Who Is More Productive?

Start with a simple example. Suppose that there are only young and old workers. Each young worker produces one unit of a good, while each old worker produces two units since the old worker has more human capital (Figure 2). Suppose now that there are 50 young and 50 old workers. The total number of goods produced is 150 and, therefore, labor productivity is $150/100=1.5$.

But what if there were a larger proportion of young workers? Suppose that there are 75 young and 25 old. The total production would be 125 and, therefore, labor productivity would be 1.25. Thus, the increased proportion of young workers reduces labor productivity as we measure it via output per worker.⁴

The mechanism just described is exactly how the baby boom may have affected the growth rate of U.S. labor productivity. Look at Figure 3. The blue line represents the growth rate of labor productivity, as in Figure 1. The red line represents the share of people between the ages of 23 and 33 (relative to the population between the ages of 23 and 63).⁵ An increase in the red line means that the 23-33 population represents a larger share of the U.S. population. The peak circa 1980 is the direct consequence of the baby boom: The U.S. birth rate peaked circa 1960, implying a large share of people in their 20s circa 1980. Note in Figure 3 that the two lines move mostly in opposite directions except during the 2000s. The correlation between the two lines is, indeed, -37 percent.

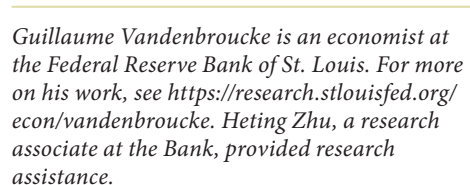
Note also that the share of 23-33 year-olds is increasing since the late 2000s. This can also be viewed as a result of the baby boom: The baby boomers are slowly leaving the 23-63 population, tilting the scale toward the younger population once again. This trend is noticeably less pronounced, however, during the 2000s than it was during the 1970s. Thus, the mechanism discussed here is likely to be a stronger contributor to the 1970s slowdown than to the current one.

Is There a Problem to Be Fixed?

What do these observations mean for productivity measurement?

It is important to realize that, should the theory proposed here be correct, there exists a sense in which the productivity slowdowns (especially in the 1970s) are statistical artifacts, that is, it may be that the productivity of individual workers did not change at all during the 1970s, but that the change in the composition of the labor force caused the slowdown in labor productivity. In a way, therefore, there is nothing to be fixed via government programs. Productivity slows down because of the changing composition of the labor force, and that results from births that took place at least 20 years before.

If we knew exactly how much human capital each worker has, better measures of productivity could be constructed. This, however, is a difficult endeavor since human capital is not directly observable.

The literature devoted to the measurement of human capital is large. Significant progress has been made, but much remains to be learned. 

Guillaume Vandembroucke is an economist at the Federal Reserve Bank of St. Louis. For more on his work, see <https://research.stlouisfed.org/econ/vandembroucke>. Heting Zhu, a research associate at the Bank, provided research assistance.

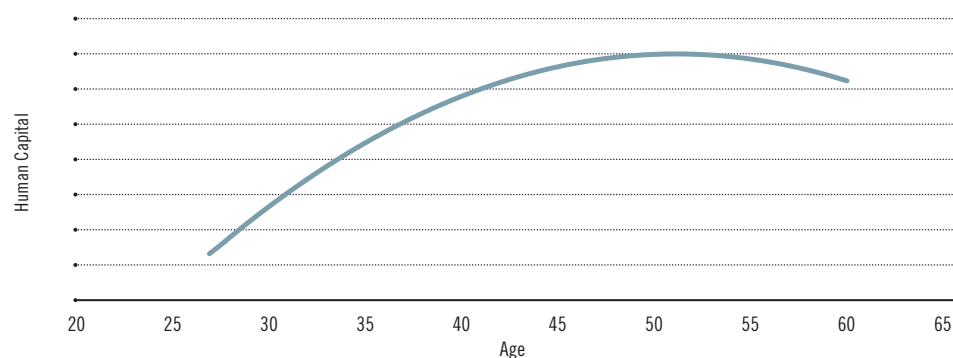
ENDNOTES

- 1 See Cullison.
- 2 Another measure of productivity is total factor productivity, also called multifactor productivity, which gauges the joint contribution of labor and capital to output, instead of the contribution of labor only, as does labor productivity.
- 3 The growth rate of productivity in Figure 1 was smoothed to remove frequent variations and to focus on secular changes.
- 4 The total number of workers is kept constant in this example, but that does not matter. Suppose there were 10 times more workers: 750 young and 250 old. Labor productivity would still be 1.25.
- 5 The share of people between ages 23 and 33 is a proxy for the share of young people. This does not imply that the old are all the people older than 33.

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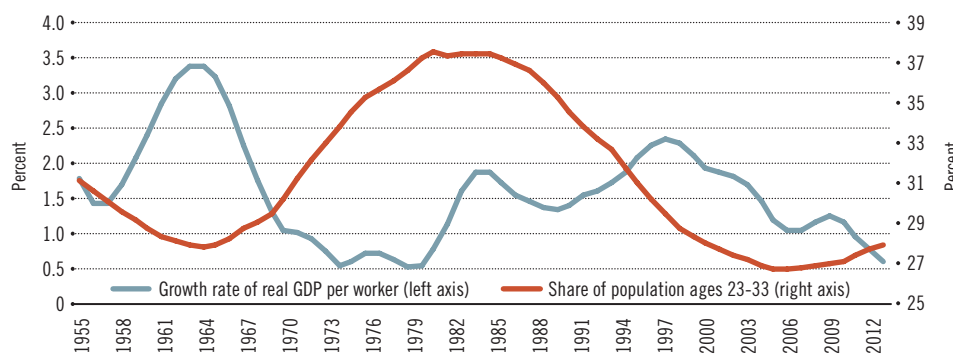
FIGURE 2
A Stylized Profile for a Worker's Human Capital



SOURCE: Author.

NOTE: In theory, a worker's earnings reflect his or her human capital and should be increasing until the earnings reach a peak shortly before retirement. In the U.S. data, the typical earnings profile of a worker displays this exact pattern.

FIGURE 3
The Growth Rate of GDP per Worker and the Share of 23-33-Year-Olds in the U.S., 1955-2014



SOURCES: Bureau of Economic Analysis and Bureau of Labor Statistics, via FRED; and the Human Mortality Database of the University of California, Berkeley, and the Max Planck Institute for Demographic Research (Germany), available at www.mortality.org or www.humanmortality.de.

Trade and Terror: The Impact of Terrorism on Developing Countries

By Subhayu Bandyopadhyay and Javed Younas



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Economists Walter Enders and Todd Sandler defined terrorism as the premeditated use of or threat to use violence by individuals or subnational groups to obtain a political or social objective through the intimidation of a large audience beyond that of the immediate victims. Central to this definition is the widespread sense of vulnerability that individuals or businesses in a venue nation—a country where the violence occurs—must feel.

This sense of vulnerability is particularly damaging to trade or foreign direct investment (FDI) because foreign nations always have a choice of conducting business with less-terror-prone nations. The decline in trade and foreign investments compounds the difficulties of developing nations, which suffer a myriad of economic and noneconomic costs associated with the loss of life and property from terror attacks. This article focuses on the economic costs that are imposed by terrorism on developing nations through diminished economic growth, trade and FDI.

Terrorism incidents are classified into two broad categories, “domestic” and “transnational.” Domestic incidents are ones in which the perpetrators, victims and damaged properties belong to the venue nation. In contrast, transnational terrorism involves different nationalities.

The table reports data for total terrorism, domestic terrorism and transnational terrorism incidents and associated fatalities and injuries for the 12 most-terrorism-prone countries in the world and for the world as a whole.¹ These 12 nations account for almost 79 percent of global terrorist incidents. It is also notable that most of these nations are developing countries.

It is understandable that developing nations are more vulnerable to terrorism

because they are unlikely to have the resources to adequately fight terrorism. This problem is often compounded by corruption, poor governance, and lack of proper judicial systems or rule of law in these nations. Such institutional shortcomings breed discontent in the population, which in turn can spur terrorism.

Notice that almost 87 percent of global terrorist incidents are domestic (12,899 out of a total of 14,820). Therefore, the vast majority of damages due to terrorism are borne exclusively by the citizens of the venue country. The associated rise in security costs and loss in productivity of the workforce—through damages to labor and capital—are likely to reduce national income.

Transnational incidents, although less numerous, have significant economic implications, especially through loss in trade and FDI. Transnational incidents involve foreign citizens and therefore garner international press attention. Such publicity makes foreign nations less willing to do business with a terrorism-prone nation, leading to less trade and FDI.

Growth Effects

A 2004 study by economists Brock Blomberg, Gregory Hess and Athanasios Orphanides used a sample of 177 nations (developed and developing) over the period of 1968 to 2000 to estimate the effect of terrorism on growth rates of gross domestic product (GDP). They found that transnational terrorism has rather modest effects on the economy, reducing per capita GDP growth by 0.048 percent in a given year.

A 2009 paper by Todd Sandler and his co-author Khusrav Gaibulloev highlighted the differences between developed and developing

nations by dividing a sample of 42 Asian nations into seven developed and 35 developing nations. They did not find any significant adverse effect on growth for developed nations. However, an additional transnational terrorist incident (per million people) reduced an affected developing nation’s growth rate by around 1.4 percentage points.

Foreign Direct Investment

Greater terrorism in a developing nation raises the risk for foreign investors of not being able to get the returns to their investments in the future. Such investors will look for safer alternate nations to invest in.

Economists Alberto Abadie and Javier Gardeazabal investigated this issue in a paper published in 2008 and found that there is substantial diversion of FDI from a venue nation of terrorism to alternate terror-free nations. One standard deviation increase in the risk of terrorism in a particular nation can reduce the country’s net FDI position by approximately 5 percent of its GDP.

This is a huge potential loss in capital formation for any nation, but it is especially hard on a developing nation that seeks to use foreign investments to fuel its growth. A 2014 paper by economists Subhayu Bandyopadhyay, Todd Sandler and Javed Younas focused on a sample of 78 developing countries from 1984 to 2008. They found that a one standard deviation increase in domestic terrorist incidents per 100,000 people reduces net FDI by between \$323.6 million and \$512.9 million for the average sample country, while the comparable reduction in the case of transnational terrorist incidents is between \$296.5 million and \$735.7 million. They also found that foreign aid can substantially mitigate terrorism-related FDI damages due to greater aid flows.

Terrorism Incidents and Casualties Summed over the Period 2001-2012

Country	Total			Domestic			Transnational		
	Terrorism incidents	Terrorism fatalities	Terrorism injuries	Terrorism incidents	Terrorism fatalities	Terrorism injuries	Terrorism incidents	Terrorism fatalities	Terrorism injuries
Pakistan	3,043	7,282	15,066	2,737	6,693	14,075	191	407	843
India	2,438	4,371	9,855	2,229	3,614	7,909	78	621	1,716
Thailand	1,027	820	2,995	985	788	2,786	21	20	186
Nigeria	842	2,164	1,680	712	1,829	1,498	92	305	181
Somalia	810	1,707	2,450	708	1,537	2,307	91	146	126
Russia	722	1,884	3,901	670	1,655	3,654	21	191	214
Philippines	702	862	2,280	621	779	1,960	51	66	239
Colombia	620	1,000	2,171	540	896	1,939	37	47	181
Israel	546	738	3,585	482	551	2,772	42	170	798
Nepal	323	439	713	282	411	607	27	8	69
Turkey	321	292	1,149	264	192	809	32	50	143
Yemen	313	648	685	261	573	627	42	59	52
World (167 countries)	14,820	33,910	62,651	12,899	26,135	52,179	1,296	6,894	9,273

SOURCE: Global Terrorism Database.

NOTES: Afghanistan, Iraq, Syria, and West Bank and Gaza are not included due to warlike/civil conflict situations there. Total terrorism incidents and casualties include incidents and casualties from domestic and transnational terrorism and from those terrorism incidents that cannot be unambiguously categorized into either of the two categories.

International Trade


Terrorism raises the costs of doing business across national borders. For example, shipping costs will rise if shippers have to buy insurance to cover possible damages in the ports of terrorism-prone nations. In turn, such costs are passed on to the consumers in the form of higher prices, which will tend to reduce both exports and imports of terror-affected nations.

Consider a pair of developed nations. Based on the table, which clearly shows that the most terror-prone nations are developing nations, we would not expect terrorism to be a significant deterrent to trade between this developed country pair. On the other extreme, consider a pair of developing nations—and to make the case clear, consider a pair from the top 12 nations in the table. For this pair, a good exported by one nation and imported by the other suffers potential risks in transportation in both nations. This will contribute to higher trade costs and prices and be a significant deterrent to trade. A 2004 paper by economists Volker Nitsch and Dieter Schumacher found that a doubling in the number of terrorist incidents over the period 1960 to 1993 is associated with a decrease in bilateral trade among 200 countries by about 4 percent.

There is evolving literature on this issue, with some papers finding more modest effects of terror on trade. Among other

reasons, this may be due to changes in a nation's production patterns in response to terror-related disruptions. For example, if terror disproportionately disrupts an import-competing domestic industry in a developing nation, that nation may be forced to turn to imports for the good in question, thus raising rather than reducing trade.

Conclusion

We have discussed some of the economic costs of terrorism. There are myriads of other costs like destruction of infrastructure, flight of skilled workers (brain drain) and diversion of funds to counterterrorism (compared to funding of health, education, etc.). A comprehensive discussion of these costs is beyond the scope of this article. However, a greater understanding of terrorism-related damages can help governments and multilateral organizations (e.g., United Nations, World Bank) to better direct scarce resources to mitigate terrorism-related costs. 

Subhayu Bandyopadhyay is an economist at the Federal Reserve Bank of St. Louis, and Javed Younas is an associate professor of economics at American University of Sharjah, United Arab Emirates. Research assistance was provided by Rodrigo Guerrero, a senior research associate at the Bank. For more on Bandyopadhyay's work, see <https://research.stlouisfed.org/econ/bandyopadhyay>.

END NOTE

¹ The data are drawn from the Global Terrorism Database (GTD) online, which records domestic, transnational and other terrorist incidents that cannot unambiguously be placed into either of the two categories (National Consortium for the Study of Terrorism and Responses to Terrorism, 2014). For this table, we have summed data over the period 2001-2012.

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Looking for the Positives In Negative Interest Rates

By Brian Reinbold and Yi Wen



The 2007 global financial collapse resulted in central banks around the world taking unprecedented action to combat weak aggregate demand in both consumption and investment. In the United States, the Federal Reserve implemented a zero-interest-rate policy, slashing the federal funds rate to the range of 0-0.25 percent beginning in late 2008. It was seven years later before the Fed raised rates—and then it was just by 25 basis points. Today, the target for the fed funds rate stands at a range of 1.25-1.50 percent.¹

Although the U.S. has never used negative interest rates (NIR), many other industrial nations have implemented them to spur their economies and continue to use them. For example, Denmark, Japan, Hungary, Sweden, Switzerland and the entire euro area have implemented negative nominal interest rates. The nominal interest rate in the entire euro area has been negative since 2014. Among this group of countries, Switzerland has the lowest level, at 75 basis points below zero. (See the figure.)

The use of negative interest rates raises three important questions for monetary theory. First, given the widely held doctrine of the zero lower bound on nominal interest rates, how is a negative interest rate policy possible? Second, if an NIR is possible, will it effectively stimulate aggregate demand? Finally, is it desirable to keep the nominal interest rate very low for so long? This article addresses these questions.

Different Countries, Different Rates

In general, the overnight lending rate on loans and deposits from a central bank to commercial banks is called a policy rate.

In the U.S., this rate is the federal funds rate. This overnight lending rate is a key

economic tool for central bankers as it can be used to adjust the cost of borrowing, which influences real economic activity. For example, since the Fed's lending (or deposit) rate directly translates into short-term government bond yields (e.g., through open market operations), low interest rates incentivize others to shift investment from low-yielding government bonds to more-productive investments.²

The interest rate for the euro area, set by the European Central Bank (ECB), is the overnight deposit rate that banks receive.

In Sweden, the official policy rate is the repo rate, which is the rate of interest at which banks can borrow or deposit funds at the Riksbank for a period of seven days. Normally, the overnight deposit rate is 0.75 percentage points lower than the repo rate, and the overnight lending rate is 0.75 percentage points higher than the repo rate at the Riksbank. The monthly average is reported here.

Japan's policy rate is the overnight deposit rate on excess reserve balances.

Switzerland's central bank does not set a target interest rate but instead sets a target range based on the three-month Libor (London Interbank Offered Rate) for three-month interbank loans in Swiss francs. The reported policy rate in the figure is the midpoint of this range.

The policy rate set by Denmark's central bank is the rate charged on certificates of deposit. The certificates of deposit are sold on the last banking day of the week and typically mature one week later.

The rate reported for Hungary is the overnight lending rate on deposits, analogous to the Federal Reserve's policy rate, the fed funds rate.

Conventional Wisdom

Conventional monetary theory always assumed that the policy rate cannot go below zero because an individual would not pay, in theory, to lend out his or her own money. Instead, people would hoard cash to prevent nominal rates from falling below zero. Since the policy rate is closely linked to the rate of return on short-term government bonds, the bond yield is also assumed bounded below by zero—the nominal rate of return on cash.

When the zero lower bound is reached, this situation is referred to by economists as a liquidity trap, the point at which further monetary injections do not stimulate the economy because people opt to hoard all cash available instead of investing or spending it. So, further monetary injections by the government would only end up hoarded by people or the banking system instead of being lent out and circulated in the economy. In monetary theory, this situation of low circulation is also called zero velocity of money because money is not circulated in the economy.

However, if there are costs for people or institutions to hoard cash, then it is possible for banks to charge depositors by offering a negative interest rate. This means that depositors need to pay to have banks hold cash for them, or commercial banks must pay to have the central bank keep their deposits. In this case, the nominal deposit rate can go negative without getting into the liquidity trap. Of course, how negative the nominal interest rate can go depends on the costs of holding cash in hand.

In other words, negative nominal interest rates are possible because there are costs to holding cash, especially for large

corporations.³ The central bank can also require (by law) large corporations to keep their cash, savings and loans in the banking system when a negative interest rate policy is implemented. The same argument applies to commercial banks that deposit their cash in the central bank. If the effective returns to cash go negative, then short-term yields of government bonds can also go negative, suggesting that there is still demand for government-issued debt even if it pays a negative interest rate.

This means that the lower bound of the nominal interest rate is not zero, but lower than zero, if there are costs of holding (hoarding) cash. So long as the negative interest rate falls short of reaching its lower bound determined by the cost of holding cash, conventional monetary policies remain as effective as in the case of positive interest rates.

What the Model Shows

Researchers Feng Dong and Yi Wen recently created a theoretical model with costs of holding cash to capture the negative interest rate phenomenon as seen in the figure. They showed that when aggregate demand for investment and consumption is extremely weak, it is optimal for central banks to implement negative interest rates.⁴ This policy would potentially reduce the cost of borrowing and stimulate investment spending.

In addition, these authors showed that the competitive interest rate on bank loans may move more than one-for-one with changes in the expected inflation rate, in contrast to the conventional wisdom. The conventional wisdom holds that given total bank deposits, a 1 percent increase in the expected inflation rate would induce a one-for-one increase in the nominal interest rate on bank loans to keep the lender indifferent between lending and not lending. However, this conventional wisdom fails to take into account the adverse general-equilibrium effect of inflation on total deposits. If total deposits decline as a result of the inflation increase, the competitive nominal interest rate would increase more than the increase in the expected inflation rate to keep the lender just as well off.

Indeed, we know that people opt to hold less cash when the inflation rate is expected

to be high. This implies that there is less money to be deposited into the banking system. So the nominal interest rate on bank loans has to increase more than the anticipated increase in inflation for profit-maximizing banks to break even. In this case, the correct definition of the real interest rate is no longer the difference between the nominal interest rate and the expected inflation rate, but something else. This means that under negative-interest-rate policy, the conventionally defined real interest rate (by the Fisherian relationship, $\text{Nominal Interest Rate} \approx \text{Real Interest Rate} + \text{Inflation}$) tends to overestimate the level of the real interest rate (namely, the real interest rate may be more negative than the conventional Fisherian principle suggests).

Not So Far-Fetched, After All

Negative interest rates may seem ludicrous since why would an individual buy a government bond with a negative yield, but this is what a central bank would like you to think. The central bank's goal is to incentivize agents to shift investments away from government bonds to something more productive economically, thus stimulating the economy. [Q](#)

Yi Wen is an economist at the Federal Reserve Bank of St. Louis, and Brian Reinhold is a research associate there. For more on Wen's work, see <https://research.stlouisfed.org/econ/wen>.

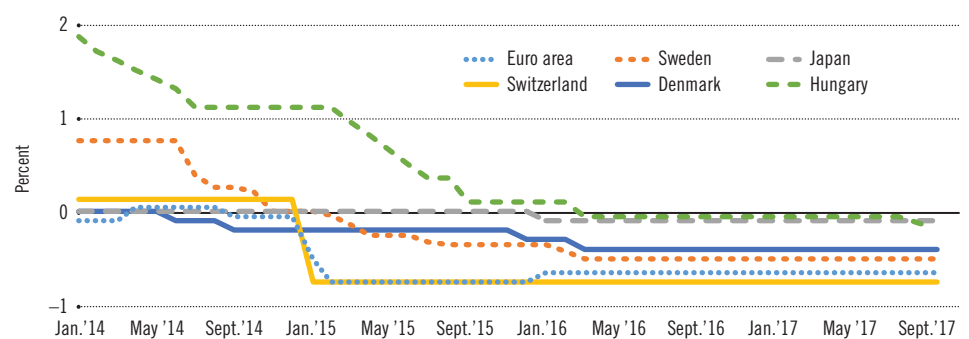
ENDNOTES

- ¹ As of Federal Open Market Committee meeting in December 2017.
- ² The overnight rate is the interest rate at which a depository institution lends funds to another depository institution (short term), or the interest rate the central bank charges a financial institution to borrow money overnight. The rate increases when liquidity decreases (when loans are more difficult to come by) and decreases when liquidity increases (when loans are more readily available). The Federal Reserve influences the overnight rate in the United States through its open-market operations. For example, selling government bonds can increase the bond yield and the overnight rate because these sales reduce the money supply to the economy. Hence, the overnight rate and bond yield move together.
- ³ For example, it is costly to build and secure a large private vault by private individuals or corporations, and such facilities yield no gains in normal times.
- ⁴ See Dong and Wen.

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Central Banks' Policy Interest Rates



SOURCES: European Central Bank, Riksbank, Denmark Nationalbank, Swiss National Bank, Bank of Japan, Central Bank of Hungary, Haver Analytics, Bloomberg, World Bank, Trading Economics.

Economy Bounces Back from Hurricanes

By Kevin L. Kliesen

Two major hurricanes hit the U.S. mainland in August (Harvey) and September (Irma).¹ Given the population and economic significance of the impacted regions, most forecasters immediately downgraded prospects for the U.S. economy's growth of real gross domestic product (GDP) in the third quarter.

Although the hurricanes reduced U.S. employment in September, employment subsequently recovered in October. Despite initial forecasts of a sharp slowdown in third-quarter real GDP growth, the pace of economic activity turned out to be stronger than expected.

Forecasters continue to see above-trend real GDP growth in the fourth quarter, bolstered by the burst in economic activity that normally occurs during the recovery and rebuilding phase after natural disasters.

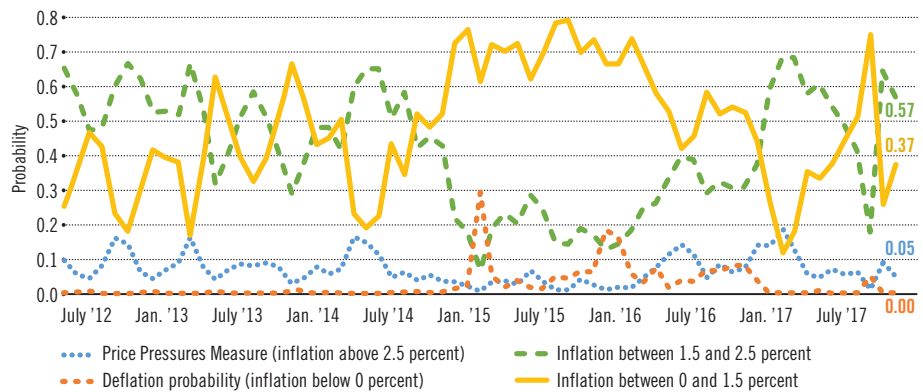
Economic Effects of Natural Disasters

Typically, natural disasters disrupt activity in three key ways. First, disasters destroy lives, property and other factors of production. These are termed direct losses. These losses reduce the region's and, if large enough, the nation's wealth and tend to adversely affect productivity, income and profits in the short term.

Second, indirect losses occur as a result of the disaster's direct losses. These indirect losses include disruptions to the supply chain, upending the efficient distribution of goods and services, as well as lost sales and increased costs for businesses. Some of these losses (e.g., restaurant meals or airline services) can never be made up.

Finally, natural disasters eventually trigger a rebound in economic activity, as structures, furniture, appliances and vehicles are repaired or replaced. For example, U.S. auto sales rose sharply in September and remained at a high level in October.

Probabilities of Different Levels of Inflation



SOURCE: Federal Reserve Bank of St. Louis.

This chart plots the four St. Louis Fed Price Pressures Measures (PPM). Each series measures the probability that the personal consumption expenditures price index (PCEPI) inflation rate over the next 12 months will fall within a certain bucket. The four buckets are as follows: below 0 percent, between 0 and 1.5 percent, between 1.5 and 2.5 percent, and above 2.5 percent. For example, the probability for the above 2.5 percent bucket ("Price Pressures Measure") is 0.05, which indicates there is a 5 percent probability inflation will exceed 2.5 percent over the next 12 months.

All data for this article are as of Dec. 1.

Developing Momentum

Despite the hurricane-spawned disruptions, U.S. real GDP accelerated at a 3.3 percent annual rate in the third quarter. The second estimate was modestly stronger than the advance estimate. The advance estimate of 3 percent was very close to the St. Louis Fed's Economic News Index (ENI) estimate, which had predicted third-quarter growth of 2.9 percent.

With the hurricanes in the rearview mirror, the near-term outlook for the economy is brightening. Business surveys, such as the purchasing managers reports and the national homebuilders survey, indicated high levels of activity in September and October. Importantly, business-capital expenditures continue on an upward trajectory.

Likewise, consumer confidence continues to trend higher, reflecting record-high stock prices and healthy labor market conditions. Indeed, the unemployment rate fell to 4.1 percent in October, its lowest level since December 2000.

Wage gains have also picked up, albeit at a sluggish pace. Importantly, labor productivity growth is finally beginning to accelerate, which would be a catalyst for stronger wage and real GDP growth.

Another factor helping to bolster the U.S. economy is the improving global economic

outlook, which has triggered an upswing in U.S. exports.

At the same time, the construction industry has slowed, mostly because of slowing in the multifamily and commercial segments. Housing sales have slowed, but homebuilders generally report that this reflects supply shortages (e.g., labor and lots) rather than a softening in demand.

The St. Louis Fed's ENI predicted on Dec. 1 that real GDP will increase at a 3.1 percent rate in the fourth quarter.

Inflation Developments

The effects of Hurricane Harvey were notable because it affected the heart of the nation's petrochemical industry on the Gulf Coast. As refineries, pipelines and chemical production facilities shut down, prices of gasoline, diesel fuel and petroleum-based products like resins and plastics rose appreciably; price increases were passed along to consumers and producers to varying degrees. However, as production returned to normal, these supply shortages abated and prices retreated accordingly.

Likewise, Hurricane Irma roared through Florida, disrupting its important tourism and agricultural industries. Food price increases were already on the upswing since fall 2016, and Irma may put additional upward pressure on them. The recent fires in northern

California may be another source of additional pressures on food price inflation.

Despite the uptick in food and energy prices, the personal consumption expenditures price index was up in October by only 1.6 percent from a year earlier. Still, the rise in crude oil prices in October and November suggests that inflation could drift higher in the fourth quarter.

Nonetheless, inflation expectations remain stable, perhaps reflecting the expectation of further tightening actions by the Federal Open Market Committee in 2018, which would be expected to help stanch rising price pressures. As of late November, the St. Louis Fed's inflation forecasting model continues to see a low probability of headline inflation exceeding 2.5 percent over the next 12 months. ¹

Kevin L. Kliesen is an economist at the Federal Reserve Bank of St. Louis. Brian Levine, a research associate at the Bank, provided research assistance. See <http://research.stlouisfed.org/econ/kliesen> for more on Kliesen's work.

ENDNOTE

¹ A third major hurricane, Maria, ravaged Puerto Rico. Because U.S. GDP and employment data do not include economic activity from Puerto Rico, this article does not discuss the potential economic effects stemming from Maria on the U.S. economy.

READ OUR NEW BLOG

Open Vault

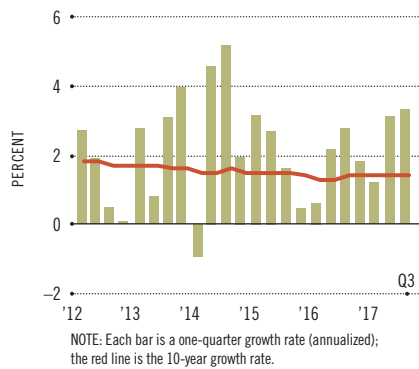
The *St. Louis Fed Open Vault* blog explains everyday economic concepts and provides a look at the people and programs that make the St. Louis Fed central to America's economy.

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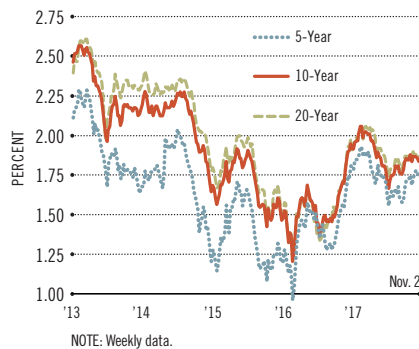
ECONOMY AT A GLANCE

All data as of Dec. 1.

REAL GDP GROWTH



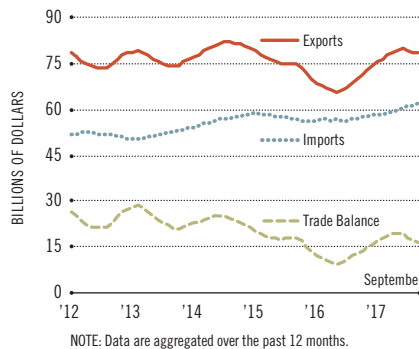
INFLATION-INDEXED TREASURY YIELD SPREADS



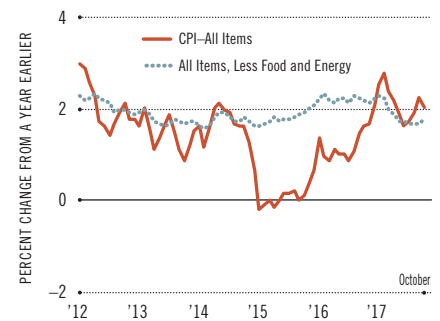
CIVILIAN UNEMPLOYMENT RATE



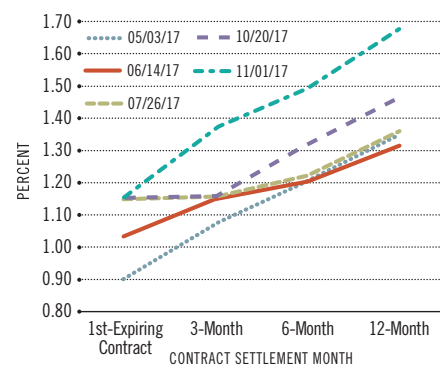
U.S. AGRICULTURAL TRADE



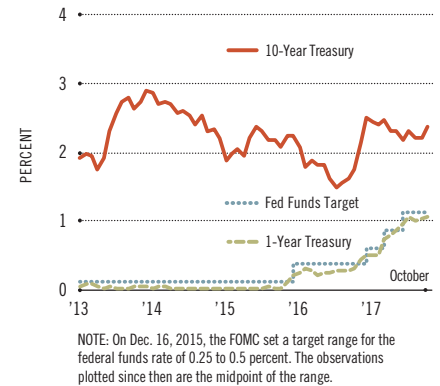
CONSUMER PRICE INDEX (CPI)



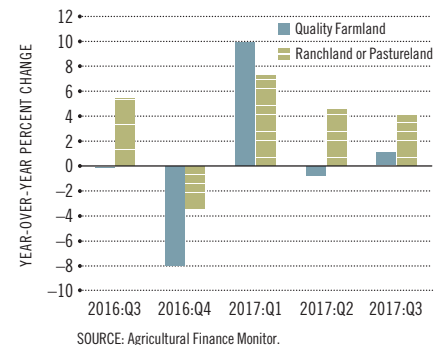
RATES ON FEDERAL FUNDS FUTURES ON SELECTED DATES



INTEREST RATES



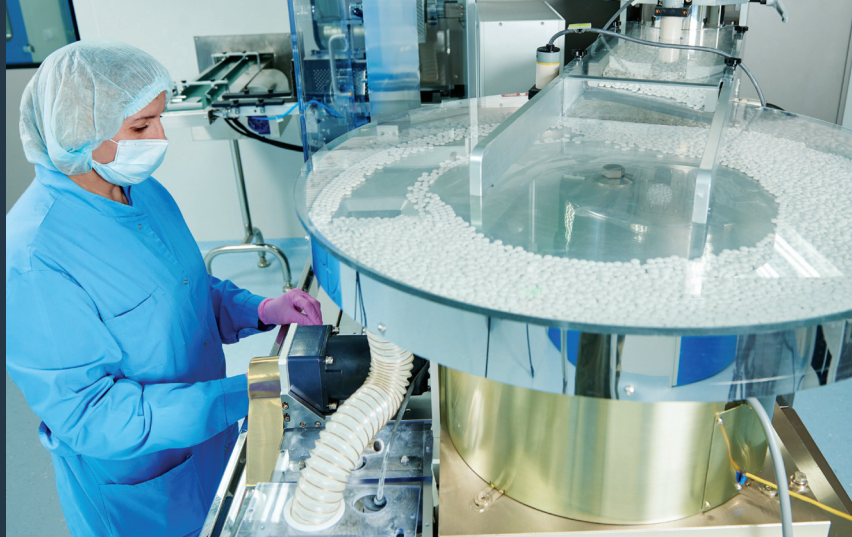
AVERAGE LAND VALUES ACROSS THE EIGHTH DISTRICT



On the web version of this issue, 11 more charts are available, with much of those charts' data specific to the Eighth District. Among the areas they cover are agriculture, commercial banking, housing permits, income and jobs. To see those charts, go to www.stlouisfed.org/economyataglance.

Advanced Manufacturing Is Vital across Nation, Including Eighth District

By Charles S. Gascon and Andrew Spewak



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Manufacturing has been one of the nation's largest and most productive sectors dating back to the Industrial Revolution, and that remains true today despite a long-term decline in employment.¹

As technological progress continues to alter the landscape of the economy, a subset of manufacturing industries known as “advanced manufacturing” serves as a critical source of growth as these products drive productivity gains throughout the economy.

In some sense, all manufacturing is “advanced” because it requires specific knowledge and use of modern technology. However, we refer specifically to the advanced manufacturing sector as industries in which research and development spending exceeds \$450 per worker and at least 21 percent of jobs require a high degree of technical knowledge.² These two metrics quantify the high level of development, design and technical work that is needed to initially develop advanced products.

Thirty-five manufacturing industries outlined in the North American Industry Classification System (NAICS) qualify as advanced. Among the largest U.S. advanced manufacturers are companies that produce electronics, motor vehicles and fuel. The table displays the largest advanced manufacturing firms, based on revenue, in the nation and the Eighth Federal Reserve District.³

A company is classified as a manufacturing firm if its main business purpose is to produce goods, regardless of how much it engages in the actual production of those goods. Consider Apple: Its purpose is to produce electronics, so it is a manufacturing firm even though it contracts production to other suppliers and has many employees developing software. Similarly, there are two types of manufacturing

employees: production workers, who physically make the goods, and nonproduction workers, who work in other occupations that include administrative, professional, technical and management positions.

We restrict our analysis to advanced manufacturing for two reasons. First, these industries are more productive than the rest of manufacturing. Although they historically have employed only about 45 percent of manufacturing employees, their output makes up to 53 percent of manufacturing output.

Second, there exists a wage premium for advanced manufacturing employees. The average employee in these industries earns about 40 to 50 percent more than the average private sector worker, depending on the data source. As of 2016, the wage premium for nonproduction workers compared with private sector workers is 72 percent, and the premium for production workers is 7 percent.⁴ In contrast, workers in non-advanced manufacturing sectors earn essentially the same wage as other private sector workers.

In this article, we will examine advanced manufacturing's long-term shifts, its current state and its impact on the Eighth District economy.

National Advanced Manufacturing

From January 1997 to the end of the Great Recession in June 2009, advanced manufacturing lost over 2 million employees. The biggest losses were in computer electronics manufacturing, which lost 720,000 jobs, and

Largest Advanced Manufacturing Firms by Revenue

	National	Eighth District
1	Apple (3342)	Emerson Electric (335) (St. Louis, Mo.)
2	Johnson & Johnson (3254)	MilliporeSigma (3254) (St. Louis, Mo.)
3	Gilead Sciences (3254)	Energizer Holdings (3359) (St. Louis, Mo.)
4	Intel (3344)	Hillenbrand (3339) (Batesville, Ind.)
5	Cisco Systems (3342)	American Railcar Industries (3365) (St. Charles, Mo.)
6	General Motors (3361)	Esco Technologies (3345) (St. Louis, Mo.)
7	General Electric (335)	FutureFuel (3251) (Clayton, Mo.)
8	Amgen (3254)	Kimball Electronics (3344) (Jasper, Ind.)
9	Pfizer (3254)	Escalade (3399) (Evansville, Ind.)
10	Exxon Mobil (3241)	Sypris Solutions (3363) (Louisville, Ky.)

SOURCE: Compustat.

NOTE: Firm location is based on the location of the headquarters, which is self-reported by the corporation. Company NAICS code in parentheses. All data are from December 2016 unless otherwise noted. MilliporeSigma data are from Sigma-Aldrich in December 2014; since then, Sigma-Aldrich has been bought out and merged into MilliporeSigma.

primary metals manufacturing, which lost 450,000. As a share of private employment, advanced manufacturing employment fell from 7.5 percent to 4.9 percent during this period. During the recovery from June 2009

to March 2017, advanced manufacturing employment increased 6 percent, but the share fell to 4.5 percent. (See Figure 1.)

Despite gains in recent years, employment in advanced manufacturing has fallen over 30 percent since 1997. Yet, that is not necessarily an indication of weakness in the sector. From 1997 to 2015, real output increased by over 50 percent due to gains in labor productivity. In 2015, advanced manufacturing was 40 percent more productive than the private sector as a whole.

Similarly, advanced manufacturing remains the largest U.S. exporter. In 2016, advanced manufacturing accounted for 60 percent of the dollar value of exports, down slightly from 68 percent in 1997, but up from 2014.

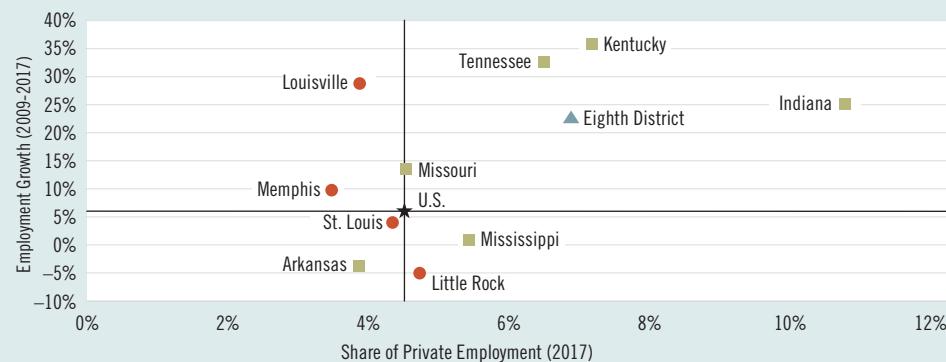
Moreover, wages in advanced manufacturing are high, with the average worker making over \$1,600 per week. Wages are highest in computers and electronics manufacturing, at \$2,300, and chemical manufacturing, at \$1,900. Real (inflation-adjusted) wages have grown 11 percent since the recession, with the largest gains in computers and electronics manufacturing. Today, the average advanced manufacturer makes \$1.53 for every \$1 that the average private sector worker makes. (See Figure 2.)

Most advanced manufacturing jobs are in large metropolitan statistical areas (MSAs). Employment is highest in Los Angeles, which has 232,000 employees, followed by Chicago, with 143,000, and New York, with 132,000. These three MSAs account for 9 percent of advanced manufacturing employment nationwide. While the total number of employees is smaller, as a share of private employment, advanced manufacturing is most heavily concentrated in Mid-western MSAs. The share is highest in Battle Creek, Mich. (the main product being autos), followed by Wichita, Kan. (airplanes), and Columbus, Ind. (machinery).

Regional Employment

Advanced manufacturing is especially vital to the Eighth District economy: The sector employs 7 percent of private sector workers and generates 11 percent of private output.⁵ As Figure 1 shows, both the employment share and growth since the recession exceed the national averages. Among District states, the employment

FIGURE 1
Advanced Manufacturing Employment



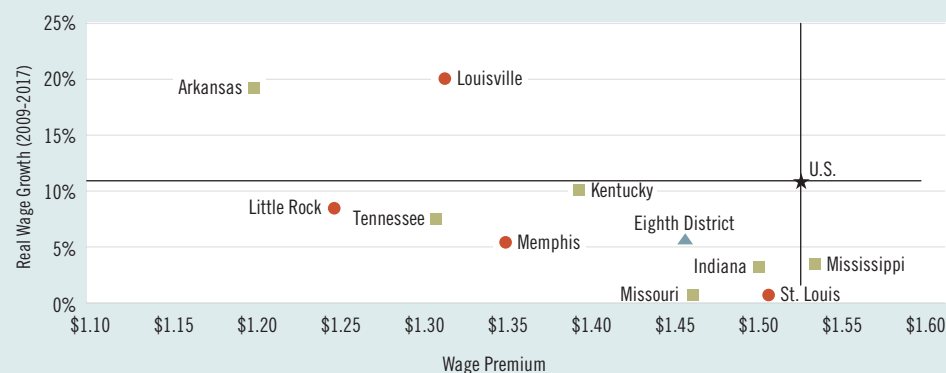
SOURCES: Bureau of Labor Statistics and authors' calculations.

This figure shows the advanced manufacturing employment share in March 2017 versus the growth of advanced manufacturing employment from the end of the recession in June 2009 until March 2017. Areas to the right of the vertical line have a higher employment share than the nation. Areas above the horizontal line have experienced faster employment growth than the nation. Areas in the top-right quadrant are the best-performing, as both the share and growth exceed the national averages.

NOTE 1: Due to nondisclosure at the county level for some industries over time, estimates for the Eighth District advanced manufacturing sector are calculated as the sum of data for the entirety of all District states except Illinois. We excluded Illinois from our calculations since most of Illinois' economic activity stems from the Chicago area, outside the District. The other District states are Arkansas, Indiana, Kentucky, Mississippi, Missouri and Tennessee.

NOTE 2: In calculating employment for each metropolitan statistical area (MSA), we estimated nondisclosed four-digit North American Industry Classification System (NAICS) industries by projecting the MSA employment data using the employment growth rate of the MSA's largest county. If the data were also nondisclosed in the largest county, we used the state growth rate. If the state data were also missing, we used the growth rate of the corresponding three-digit NAICS industry.

FIGURE 2
Advanced Manufacturing Wages



SOURCES: Bureau of Labor Statistics and authors' calculations.

Analogous to Figure 1, this figure shows the wage premium for advanced manufacturing workers in March 2017 versus real wage growth from the end of the recession in June 2009 until March 2017. Areas to the right of the vertical line have a higher wage premium than the nation. Areas above the horizontal line have experienced faster real wage growth than the nation. Areas in the top-right quadrant are the best-performing, as both the wage premium and growth exceed the national averages. The apparent negative relationship in the figure is due to the limited number of observations presented. A sample of all 50 states indicates a modest positive correlation between wage growth and wage premiums.

NOTE 1: The wage premium is calculated as the amount of money the average advanced manufacturing employee earns for every \$1 earned by the average private sector employee.

NOTE 2: Due to nondisclosure at the county level for some industries over time, estimates for the Eighth District advanced manufacturing sector are calculated as the sum of data for the entirety of all District states except Illinois. We excluded Illinois from our calculations since most of Illinois' economic activity stems from the Chicago area, outside the District. The other District states are Arkansas, Indiana, Kentucky, Mississippi, Missouri and Tennessee.

NOTE 3: Due to nondisclosure at the county level for some industries over time, wage estimates are based off the 3-digit NAICS industries 325, 327, 331, 333, 334, 335, 336 and 339.



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Auto production accounts for 39 percent of the advanced manufacturing jobs in Eighth District states. The auto industry's share of these jobs is highest in Indiana, Kentucky and Tennessee.

share is largest in Indiana, Kentucky and Tennessee. Among the District's four largest MSAs (St. Louis, Mo.; Memphis, Tenn.; Louisville, Ky.; and Little Rock, Ark.), the employment share is highest in Little Rock.

Since the end of the recession, advanced manufacturing employment in the District states has grown 23 percent, outpacing the national rate considerably. That translates to 139,000 new jobs in the District states. Employment growth has been fastest in the eastern portion of the District: Kentucky, Tennessee and Indiana are growing substantially more rapidly than the rest of the District states. Among the MSAs, Louisville has experienced the fastest employment growth since 2009, at 29 percent, followed by Memphis, at 10 percent.

Auto Manufacturing in the District

Auto manufacturing has a significant presence regionally, employing 39 percent of advanced manufacturing workers, and has driven the bulk of advanced manufacturing's growth. On net, 90 percent of new advanced manufacturing jobs since 2009 are automotive.

Among District states, auto manufacturing employment as a share of advanced manufacturing employment is largest in Indiana, Kentucky and Tennessee. Among the MSAs, the auto employment share is largest in Louisville, at 37 percent, and Memphis, at 15 percent. Recall from Figure 1 that these areas also experienced the fastest growth in advanced manufacturing employment.

The Regional Impact

District productivity in the sector mirrors the nation. Advanced manufacturing in 2015 was 36 percent more productive than the overall private sector, with the most


productive subsector being transportation equipment manufacturing. Advanced manufactures are a larger component of trade for the District than nationally. They make up 70 percent of the dollar value of District state exports to the world, above the 1997 share of 64 percent.

Average weekly advanced manufacturing wages in the District are generally below the U.S. average. However, nominal wages are lower throughout the private sector in the Eighth District, mostly because of the District's lower cost of living.⁶ Figure 2 shows that the District's wage premium, which accounts for differences in cost of living, also tends to fall below the U.S. average. This result is largely due to the fact that nonproduction workers, who garner higher wages than production workers, constitute a smaller proportion of the sector's workforce in the District compared to the nation. Of the District MSAs and states, only Mississippi's wage premium of 54 percent exceeds the national average. Among the four MSAs, the premium is highest in St. Louis, at 51 percent.

Likewise, real wage growth in the District, while positive, is slow. Of the states, only Arkansas real wages are growing more quickly than the national average. Among the MSAs, real wages are growing fastest in Louisville and Little Rock, at 20 percent and 9 percent, respectively.

Sector Still Significant

Advanced manufacturing employment as a share of private employment has steadily declined over the years, but the sector remains a significant cog in the U.S. economy. Advanced manufacturing accounts for 7 percent of private output and 60 percent of the dollar value of U.S. exports.

In the Eighth District, advanced manufacturing has a relatively large presence, mostly due to a high concentration of automotive manufacturing employment. However, the wage premium for advanced manufacturing employees, while significant, is smaller regionally than nationally. Likewise, though real wages are growing positively in the Eighth District, the pace of growth lags behind the national average. 

Charles Gascon is a regional economist, and Andrew Spewak is a senior research associate, both at the Federal Reserve Bank of St. Louis. For more on Gascon's work, see <https://research.stlouisfed.org/econ/gascon>.

ENDNOTES

- ¹ See Kliesen and Tatom.
- ² See Muro et al.
- ³ Headquartered in St. Louis, the Eighth Federal Reserve District includes all of Arkansas and parts of Illinois, Indiana, Kentucky, Mississippi, Missouri and Tennessee. In our analysis we exclude Illinois; see endnote 5 for more information.
- ⁴ The Quarterly Census of Employment and Wages (QCEW) and Occupational Employment Statistics (OES), both from the Bureau of Labor Statistics, report industry-level wages. The advanced manufacturing wage premium is estimated to be 53 percent (QCEW) and 42 percent (OES). The OES provides estimates for both nonproduction and production occupations. Throughout the rest of the article, we will use QCEW data, as they are better suited for time series and regional analysis. When available, we have tested the robustness of our results using the OES data.
- ⁵ Due to nondisclosure at the county level for some industries over time, estimates for the District's advanced manufacturing sector are calculated as the sum of data for the entirety of all District states except Illinois. We excluded Illinois from our calculations since most of that state's economic activity stems from the Chicago area, which is outside the District.
- ⁶ See Coughlin, Gascon and Kliesen for more information on the relationship between cost of living and income.

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First-Time Homebuyers Appear to Be Younger, Less Creditworthy in Eighth District

By Brian Reinbold and Paulina Restrepo-Echavarria



First-time homebuyers are essential to the dynamics of the housing market by allowing current homeowners to trade up. The number of first-time homebuyers decreased between 2000 and 2011, and then started slowly increasing again. (See Figure 1.) There are many possible reasons why this happened, such as rising rent and home prices, rising student debt and tightening credit standards.

Have there been fewer first-time homebuyers in the Eighth Federal Reserve District? In this article, we study the number and some characteristics of first-time homebuyers in the Eighth District¹ and see how they compare to those at the national level.

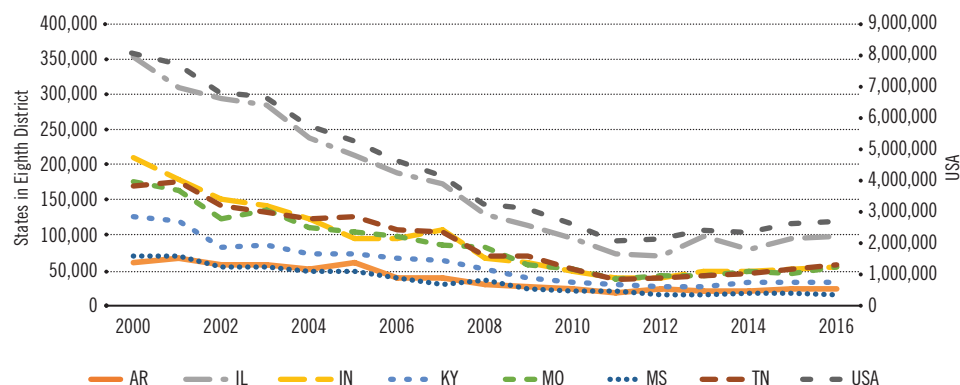
We used the Federal Reserve Bank of New York Consumer Credit Panel/Equifax to estimate the number of first-time homebuyers. The FRBNY Consumer Credit Panel (CCP) consists of detailed credit-report data, updated quarterly, for a unique longitudinal panel of individuals and households beginning in 1999. It provides information on various forms of debt, including student loans, auto loans and mortgages.

The CCP is a nationally representative 5 percent random sample of individuals in the United States with a Social Security number and credit report.²

We took a 10 percent random sample of the CCP dataset, so we have a 0.5 percent nationally representative sample. In other words, we have 1,347,520 unique records for this sample in 2016, out of approximately 269,504,000 individuals in the U.S. with a Social Security number and a credit report.

A drawback of the CCP dataset is that it only includes homebuyers who finance

FIGURE 1
Total Number of First-Time Homebuyers



SOURCES: Federal Reserve Bank of New York Consumer Credit Panel/Equifax and authors' calculation.
NOTE: Some parts of these states lie outside of the Eighth District.

their purchase with a mortgage; it excludes all cash purchases. However, it is likely that most first-time homebuyers finance their home.

Following work by Jessica Dill and Elora Raymond, we used the CCP to estimate the number of first-time homebuyers.³ We took the year of the oldest mortgage on file for individuals within the dataset to determine the first time they obtained a mortgage. This analysis does not consider individuals who transitioned back to renting and then purchased a home later on.⁴

Figure 1 is a plot of the total number of first-time homebuyers from 2000 to 2016 by each state in the Eighth District⁵ and the whole U.S. The number of first-time homebuyers decreased significantly since 2000. The decline bottomed out around 2011 and 2012 for the U.S. and most states in the District.

From 2000 to 2011, the rate of decline for these District states is similar to the 76 percent decline nationwide. Indiana and

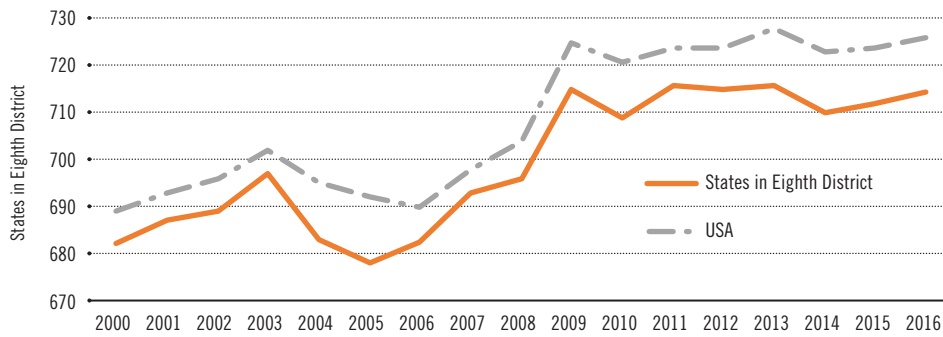
Illinois experienced the sharpest decline during this period, each falling about 80 percent, while Arkansas had the smallest decline, dropping about 70 percent.

The number of first-time homebuyers bottomed out in 2011 for the nation and most states in the Eighth District. Since 2011, the number of first-time buyers nationally has increased 34 percent. The growth rates since 2011 for Missouri and Tennessee exceeded the nation's at 46 and 54 percent, respectively. The rates in Arkansas, Illinois and Indiana are in line with the nation's. However, the rate remains flat in Kentucky, while the rate in Mississippi has actually declined 22 percent since 2011.

Figure 2 plots the median credit score of first-time homebuyers at the date of purchase. As we can see, credit worthiness appears to be of lesser importance in the states of our District throughout the whole period of 2000 to 2016; the combined credit score is lower than the national level.

FIGURE 2

Median Risk Score of First-Time Homebuyers at Date of Purchase

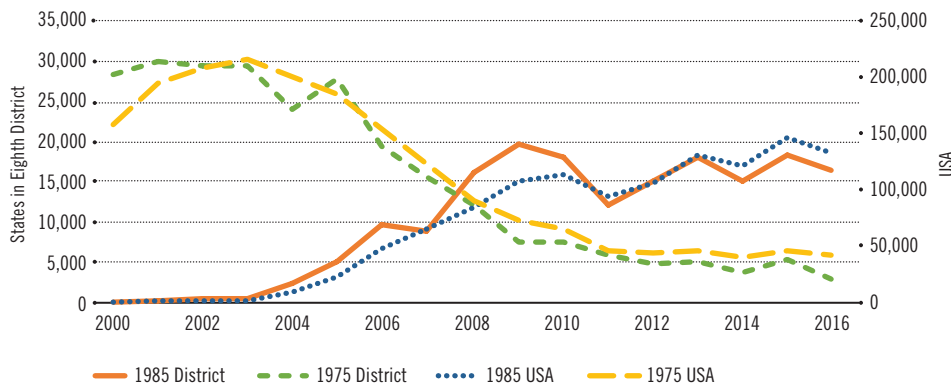


SOURCES: Federal Reserve Bank of New York Consumer Credit Panel/Equifax and authors' calculation.

NOTE: Some parts of these states lie outside of the Eighth District.

FIGURE 3

Total Number of First-Time Homebuyer by Birth Year



SOURCES: Federal Reserve Bank of New York Consumer Credit Panel/Equifax and authors' calculation.

NOTE: Some parts of these states lie outside of the Eighth District.

Qualitatively, however, the District and national trends behave the same. Credit requirements eased from 2003 to 2006, corresponding to the time of the housing bubble. When the housing bubble burst, credit significantly tightened as lenders increased credit worthiness requirements. As we mentioned, credit scores in the District follow a similar trajectory but began to increase a year earlier than the national trend. After the sharp increase, the District and national trends flattened out in 2009.

Although increasing over the last several years, the number of first-time homebuyers is still much lower than the pre-2007 level, suggesting that tightened lending standards have been a headwind for first-time homebuyers.

Did this decline affect age groups differently? Figure 3 shows the total number of

first-time homebuyers who were born in 1975 and 1985 for the U.S. and the District, from 2000 to 2016. The number of first-time homebuyers for those born in 1975 peaked in the early 2000s, when they were in their late 20s, while the number of first-time homebuyers for those born in 1985 has remained more constant since 2010.

For those born in 1975, the total number of first-time homebuyers fell precipitously after age 30, while the number for those born in 1985 remained fairly constant after 2010. These results suggest that demand by first-time buyers is more spread out for later generations.

From these data, we can conclude that the number of first-time homebuyers in the District states has a trend which is very similar to the national level and that credit requirements are somewhat looser in the District. ⁹

ENDNOTES

¹ Headquartered in St. Louis, the Eighth District includes all of Arkansas and parts of Illinois, Indiana, Kentucky, Mississippi, Missouri and Tennessee.

² See van der Klaauw and Lee.

³ See Dill.

⁴ According to the U.S. Department of Housing and Urban Development, a first-time home buyer is "an individual who has no ownership in a principal residence during the 3-year period ending on the date of purchase of the property." Therefore, an individual who buys their first home, then becomes a renter and finally purchases a home three or more years later would be considered a first-time home buyer again. See HUD.

⁵ The sample includes individuals from the entire state, not just those from the parts of the state that belong to the District.

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Paulina Restrepo-Echavarria is an economist, and Brian Reinbold is a research associate, both at the Federal Reserve Bank of St. Louis. For more on Restrepo-Echavarria's work, see <https://research.stlouisfed.org/econ/restrepo-echavarria>.

ASK AN ECONOMIST



Don Schlagenhauf has been an economist at the Federal Reserve Bank of St. Louis since 2015. His research interest is in macroeconomics and policy, with emphasis on housing. He enjoys baseball. Don was born in St. Louis and has been a lifelong Cardinals fan. In fact, he is a season ticket holder for the Cards spring training. For more on his research, see <https://research.stlouisfed.org/econ/schlagenhauf>.

Q: How did consumer borrowing change after the Great Recession?

A: Following the run-up in household debt during the early 2000s, consumers have been steadily reducing their overall debt level (i.e., deleveraging) since the Great Recession ended in June 2009. The ratio of household debt to personal income peaked in the mid-2000s at nearly 1.2, and it has declined to about 0.9 in the second quarter of 2017.

However, looking at aggregate data tells us only part of the story. To better understand the run-up in debt and subsequent deleveraging, Carlos Garriga, Bryan Noeth and I studied patterns in mortgage debt, credit card debt, auto loans and student loans held by different age groups between 1999 and 2013.¹

Obviously, the biggest change in borrowing over that period has been mortgage debt. In the early 2000s, average mortgage debt increased among all age groups, but especially for younger households. In 1999, homeowners with the largest mortgage debt (about \$60,000 in 2013 dollars) were around 45 years old. In 2008, peak mortgage debt (about \$117,000) occurred for those around age 42. Despite large deleveraging after the recession (particularly among those younger than 60), average mortgage debt remained higher in 2013 than in 1999.

For the other types of debt, the general patterns we found were:

- Credit card debt also increased, primarily for those older than 30, and then began to decline after 2008. Unlike other types of debt, average credit card debt in 2013 was below its 1999 level for most age groups.
- Auto debt also rose between 1999 and 2008, but dropped across all age groups after the recession. Auto debt then rebounded in 2013.
- Student debt, on the other hand, consistently grew from 2005 to 2013 for all age groups. For those over 50, the rise is likely due to parents or grandparents taking on loans or co-signing for relatives.

Having debt is not necessarily bad, as it allows individuals to make up for the mismatch between income and consumption expenditures earlier in life; consumers just need to be prudent with the amount of debt they take on. By studying debt patterns, however, we hope to gain a better understanding of the tipping point between manageable debt and debt levels that expose consumers to excessive risk.

¹ Garriga, Carlos; Noeth, Bryan; and Schlagenhauf, Don E. Household Debt and the Great Recession. Federal Reserve Bank of St. Louis Review, Second Quarter 2017, Vol. 99, No. 2, pp. 183-205.

LETTERS TO THE EDITOR

These letters pertain to articles in our Third Quarter issue (stlouisfed.org/publications/regional-economist/third-quarter-2017). The first letter is about the article Quantitative Easing: How Well Does This Tool Work?

Dear Editor:

I agree with you on the point that QE should not be repeatedly used in the future as a monetary policy because (1) purchasing private bonds is too influential to the firms' financial health, which may result in economic biases; and (2) public sentiment can no longer be more optimistic than it was from 2008. On the other hand, I believe that people's faith in QE positively worked at least in the past.

In the analyses with Japan and Canada, you did not mention exchange rates. However, both Japanese yen and Canadian dollars significantly changed during the past decade. I also studied international economics and learned that Canadian transports with the U.S. remarkably increased after US-Can FTA (1989), and its economy became more reliant on the U.S. economy. Likewise, Japanese trade volumes and its stock prices are reacting in accordance to JPY-USD exchange rates.

Therefore, the fact that Canadian real GDP boosted without QE is explained by 1) its reliance on US economy, and 2) large fluctuations in exchange rates.

By the way, nominal GDP in U.S. dollars shows completely different trends. The growths from 2008 to 2015 are: Canada 0.24 percent, Japan -13.06 percent and U.S. 23.11 percent.

Emi Igawa, Nagoya, Japan

The second letter comments on the article titled Household Participation in Stock Market Varies Widely by State.

Dear Editor:

I think the methodology in this analysis is very flawed, and a wide variety of conclusions could, therefore, be drawn.

Our household falls within the key household income group discussed. We do all of our savings within tax-deferred retirement vehicles and have substantial savings, with about 75 percent in equities. We never report dividends because we own no equities outside the tax-deferred accounts; so, we are a reason that they report low participation in the stock market.

So an alternative explanation of the data shown in this paper is that the people in the states with high stock market participation rates are investing in tax-inefficient vehicles and could benefit from financial advice to put more or all of their savings into tax-deferred plans. Between Roth and Regular IRAs, 401(k)s, and 403(b)s, there is no reason for anybody making less than \$200k per year to have ANY taxable stock dividends.

We may have a retirement crisis, but it is not because people are not buying stocks outside of tax-deferred accounts.

Raymond D'Hollander, Fayetteville, N.Y., an engineer

We welcome letters to the editor, as well as questions for "Ask an Economist." You can submit them online at www.stlouisfed.org/re/letter or mail them to Subhayu Bandyopadhyay, editor, The Regional Economist, Federal Reserve Bank of St. Louis, P.O. Box 442, St. Louis, MO 63166-0442.



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The Regional Economist: 100 Issues and Counting

In January 1993, the first issue of the *Regional Economist* debuted. The three articles focused on health insurance, the business cycle and exports from our District. The editor then was James Bullard, now president and CEO of the St. Louis Fed.

The issue you are reading is the 100th of this quarterly publication. Much has changed over the past 25 years—the magazine is bigger, readership has mushroomed (thanks largely to our web presence), the topics span from the local to the international, and all articles are now written by our economists (but still in layman's language).

To prepare RE for its next 100 issues, we're introducing some changes in the coming year:

- Articles will be published online (www.stlouisfed.org/re) as they are finished—one every two weeks or so. This will ensure that they don't become outdated while waiting for the next quarter's release. We think online

readers will also appreciate the one-article-at-a-time approach. (Print subscribers will continue to receive this magazine—with all of the articles—in their mailbox four times a year.)

- The online version of RE will be redesigned to reflect our new approach of continuous publishing. Check it once in a while to see what's new. (Readers who already subscribe to receive an email when a new issue is published will receive in the future an email when each new article is posted. Sign up for this email newsletter at www.stlouisfed.org/subscribe/re.)
- The print version of RE will also be redesigned—the first new look since 2008.

We hope you like the changes.

Subhayu Bandyopadhyay,
Editor



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