Monthly Labor Review

October 2015

# Freelancers in the U.S. workforce

*Editor's note: This essay is part of a series being published to help commemorate the Monthly Labor Review's centennial (July 1915–July 2015). The essays—written by eminent authorities and distinguished experts in a broad range of fields—cover a variety of topics pertinent to the Review and the work of the Bureau of Labor Statistics. Each essay is unique and comprises the words and opinion of the author. We've found these essays to be enlightening and inspirational. We hope you do as well.*


**Sara Horowitz**

Sara Horowitz is the founder and Executive Director of Freelancers Union.

We're entering a new era. For much of the past century, the 9-to-5 job has defined what most Americans think of as "work."

But that is changing—fast. More than 53 million Americans are now earning income from work that's not a traditional 9-to-5. That's 1 in 3 workers.

We are still at the leading edge of a once-in-a-century upheaval in our workforce. The freelance surge is the Industrial Revolution of our time.

The surge in freelancing is more than two decades old at this point. When I founded Freelancers Union in 1995, the term "freelancer" was still new and not well understood. Whether by choice or by circumstance, millions of workers in the intervening years have started working gig to gig, project to project.

In the past couple of years, though, we've seen an acceleration. Online work platforms, such as Uber, Airbnb, Etsy, and Elance, that connect workers directly to consumers and clients are completely reimagining the work relationship. Under the National Labor Relations Act, however, these workers and the millions of other freelancers are largely prohibited from forming unions.

There are a couple of strategies that labor and political leaders could use to deal with this change.

First, we could simply try to stop these platforms, declare them illegal, or argue that those finding work through the platforms are "employees" of the platforms and therefore eligible for the same protections and benefits as traditional employees. In fact, some states and countries are trying both of those approaches. So far, this strategy has seen limited success.

Or we could acknowledge and even embrace the dramatic shift in the workforce and focus on ensuring that these new workers have the support and opportunity they need in order to thrive. This approach historically has been the mandate of labor leaders.

The freelance surge is the Industrial Revolution of our time.

Unions of the early 20th century didn't waste their efforts by trying to stop the unstoppable shift from agrarian to industrial work. They looked at the new industrial-era challenges—deplorable working conditions, low pay, little security—and figured out how best to gather workers' power and address those challenges.

While many of the era's victories played out at the bargaining table, others were achieved by recycling workers' capital and building union-owned banks, housing, insurance companies, vacation camps, and more. It was solidarity in action.

Even among this new independent workforce, there's an opportunity to find that solidarity again. Freelancers across industries often have more in common with each other than they do with traditional employees in their own industry. Workers (especially younger workers) are increasingly comfortable in this new way of working, juggling multiple identities and even careers.

Still, Uber drivers and Handy.com home cleaners have many of the same challenges and fears as freelance accountants and graphic designers. Unpaid work. Uneven income. No unemployment protection. Lack of benefits or security. We'd be smart to look for ways that support all these workers in an economy where people are having new risks foisted on them.

What the new workers are realizing, though, is that the government still doesn't understand them. Our work policies are stuck in the 1950s.

For an answer to what we should do in the future, we should actually look to the past. In the 1910s and 1920s, workers realized that government can't (and shouldn't) provide the full support system. These social unionists wanted government to enable and empower them to do it themselves.

That's where the future is: ensuring "sustainable flexibility" for all workers—workers helping workers to transform the economy together, boosted by a government that understands, and provides reliable information about, their needs.

I'm often asked, "Is freelancing good or bad?" I always respond, "Freelancing *is*." It's our job in the labor movement to make this new way of working sustainable for all of us.

SUGGESTED CITATION

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Monthly Labor Review

October 2015

# Job switching: a prelude to wage growth?

Demetrio Scopelliti

Workers may want to switch jobs for a multitude of reasons. Whether to improve the quality of work life or to garner higher wages, they typically switch jobs by quitting their existing job rather than by becoming unemployed or leaving the labor force and then pursuing a new job. During economic expansions, the number of available jobs exceeds the number of workers seeking employment. The tighter labor market makes it more likely that employers offer higher wages to prospective employees, thereby creating an incentive for workers to switch jobs.

In "Job switching and wage growth," authors R. Jason Faberman and Alejandro Justiniano (*Chicago Fed Letter*, Federal Reserve Bank of Chicago, April 2015) argue that, because quits are procyclical—meaning they rise during economic expansions and fall during recessions—the worker quit rate, measured as a ratio of total quits to employment for a specific period, can be used to predict nominal wage growth and inflation pressures.

The authors argue that the procyclicality of quits implies that wages are also procyclical. Under the assumption that people typically switch jobs during an economic expansion to pursue higher paying jobs, Faberman and Justiniano assert that aggregate wages rise in concert with the quit rate. In contrast, wage growth would be lower during periods of economic contraction, when the quit rate declines. As evidence of a strong correlation between wage growth and the quit rate, the authors cite correlations between the quit rate and the wage component of the Employment Compensation Index (ECI) as well as the growth in average hourly earnings of production and nonsupervisory workers. The quit rate tends to move two quarters ahead of the ECI and four quarters ahead of average hourly earnings, indicating that changes in the quit rate anticipate changes in wage growth by 6 months to a year. The authors note that the relationship of the quit rate to wages is similar to that of the quit rate to unemployment. Low unemployment makes it more likely that job seekers will hold out for higher wages, while higher unemployment makes it more likely that workers will accept the prevailing wage.

How does the quit rate help predict the cyclical component of inflation known as the inflation gap—that is, the difference between actual and long-run expected inflation? Citing the association between changes in prices and wages, the authors indicate that "the strong predictive relationship between quits and wage growth should, in theory, translate to inflation." Considering current economic conditions, the authors suggest that inflation remains below expectations because of modest increases in the quit rate despite growth in the labor market and a declining unemployment rate. Assuming the quit rate returns to where it was prior to the Great Recession, the authors suggest that the quit rate may be a precursor to increased wage growth and future inflation.

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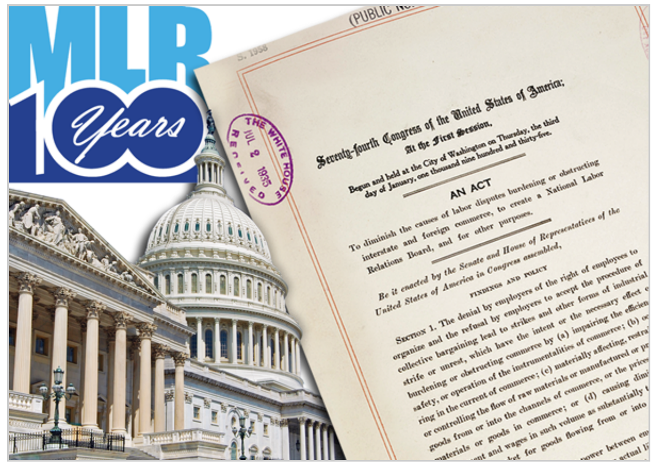
# Labor law highlights, 1915–2015

*To help mark the Monthly Labor Review's centennial, the Review invited several producers and users of BLS data to take a look back at the last 100 years. This article highlights important U.S. labor legislation since 1915. Areas of focus are child labor laws, gender equality, racial equality, working conditions, and union membership.*

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"Democracy cannot work unless it is honored in the factory as well as the polling booth; men cannot truly be free in body and spirit unless their freedom extends into places where they earn their daily bread." This declaration, uttered by Senator Robert Wagner as he introduced the National Labor Relations Act (NLRA) of 1935, offers a fair summation of the reasoning underlying many of the labor laws enacted during the past century. Equality and the rule of law are considered among the most important principles of democracy—principles that Wagner articulated. This article highlights some of the more important labor laws that have been passed in the hundred years that the *Monthly Labor Review* has been in publication. All the legislation discussed in this article has, in some way, advanced principles of democracy within the U.S. workforce.

Throughout the early 1900s, working conditions for the average American worker were fairly grim. Child labor was well entrenched. Discrimination of all types was common and acceptable. Lax safety regulations allowed hazardous working conditions to persist. And a lack of federal protection for unions made bargaining for better conditions very difficult for workers. In the years since, a number of changes have made life for the American worker more tolerable. The convergence of a variety of social and legal shifts created the environment necessary for such change.

The evolution of the nation has been met by an evolution of the law:

- As society has placed more value on education and child welfare, child labor laws have ensured that more children take advantage of education and the leisure currently associated with childhood.
- As society has become less concerned with traditional gender roles, laws promoting equality have increased opportunities for women in the workplace.

- As society has become less tolerant of prejudice, legislation prohibiting discrimination in the workplace has improved employment opportunities for minority workers.
- As society has become more concerned about the safety of workers, laws have been enacted that have contributed to a decline in the number of workers lost to grievous workplace injuries.
- And with the advent of federal protections for organized labor, access to union membership has given all workers more opportunity to bargain collectively for improved working conditions.

These changes have combined to produce a labor force that is better educated, more diverse, safer, and working under better conditions today than in 1915.

## Child labor

The early-American view of child labor was largely inherited from colonial England. At least as far back as the 17th century, many people believed that idle children were a source of crime and poverty.[1] To combat such idleness, apprenticeships were common for children of working-class families.[2] Child labor, rather than being viewed as exploitive, was often considered an act of charity.[3]

Children remained an active part of the American workforce well into the 20th century. The 1900 U.S. Census revealed that the 1.75 million children ages 10–15 who were employed composed about 6 percent of the nation's labor force.[4] With the rise of the Industrial Revolution, more children were being exposed to the workplace hazards of factory jobs. In 1904, the National Child Labor Committee (NCLC) was established to examine the impact of child labor.[5] The NCLC initially promoted state reforms, but because of vast differences in the implementation and enforcement of such reforms state to state, the committee began in 1912 to push for national legislation.[6] However, reform at the national level would prove challenging as well.

In 1916, Congress passed the Keating–Owen Child Labor Act, the first national child labor bill. This legislation banned the sale of products manufactured with the labor of any child under age 14 and heavily restricted labor for children under age 16.[7] Keating–Owen was challenged and, in 1918, was overturned by the Supreme Court.[8] A year later, child labor protections were passed as part of the Revenue Act of 1919 (also called the Child Labor Tax Law).[9] Like Keating–Owen, this legislation was held unconstitutional.[10] Legislators would wrangle with the child labor issue for the next couple of decades before establishing a more permanent solution.

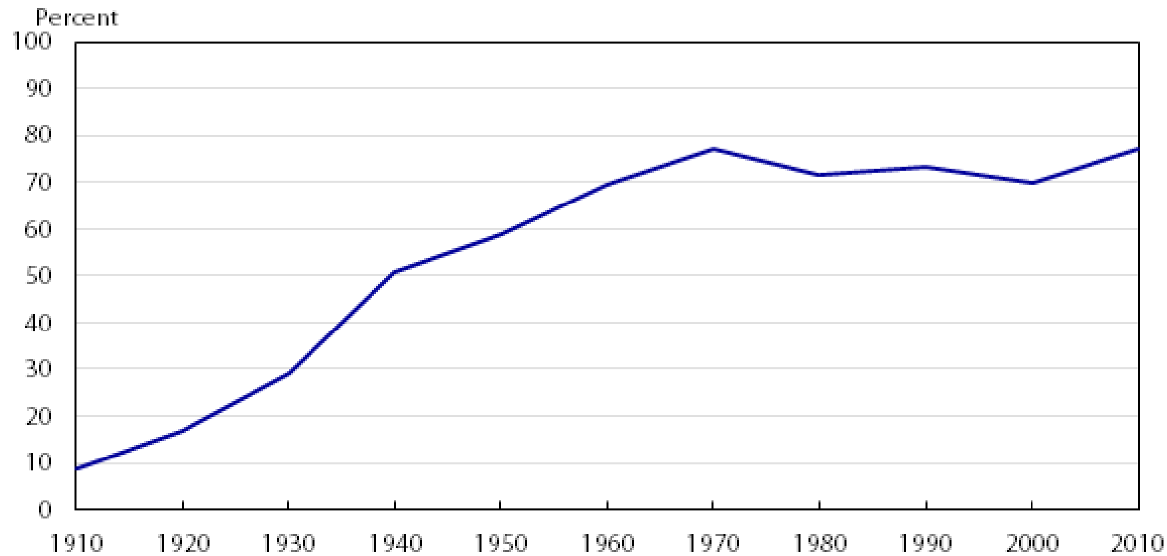
It was not until 1938, with the passage of the Fair Labor Standards Act (FLSA), that permanent federal protections for children in the workplace were instituted. The FLSA child labor provisions were nearly identical to those in the Keating–Owen bill—restricting industries for children under age 18, limiting working hours for children under 16, and banning children under 14 from most kinds of work.[11] (See table 1 for a complete list of minimum age requirements under the FLSA.) The law also requires employers to document the age of child workers and empowers the Secretary of Labor to investigate possible violations.[12] Like Keating–Owen and the Child Labor Tax Law, the FLSA was challenged and ultimately argued before the Supreme Court.[13] However, reversing earlier precedent, the Court upheld the FLSA, and it remains in force today.[14]

**Table 1. Age requirements under the federal Fair Labor Standards Act**

| Category | Nonagricultural employment | Agricultural employment |
|---|---|---|
| Minimum age for nonhazardous employment | • 14 years old (with some exceptions including newspaper delivery, babysitting, radio/television/movie/theater performing, and work for parents in family business) | • 10 and 11 years old, with parental consent, on farms not covered by minimum wage requirements<br>• 12 and 13 years old, with parental consent; 14 and 15 years old, no restrictions on nonhazardous work |
| Minimum age for hazardous employment | • No work during school hours<br>• On school days: 3 hours/day, 18 hours/week maximum<br>• When school is out of session: 8 hours/day, 40 hours/week<br>• Labor Day–May 31: all work must occur 7 a.m. to 7 p.m.<br>• June 1–Labor Day: all work must occur 7 a.m. to 9 p.m. | • No work during school hours |
| Federal minimum wage and overtime | • Federal minimum wage is $7.25 per hour<br>• Youth minimum wage is $4.25 per hour for employees under 20 years of age during their first 90 consecutive calendar days of employment with an employer<br>• Overtime must be paid after 40 hours/week | • Many agricultural employers are exempt from federal minimum wage requirements<br>• For agricultural employers who are not exempt from minimum wage laws, the same federal and youth minimum wages for nonagricultural employment apply<br>• Agricultural employees are exempt from overtime requirements under federal law |

Source: Fair Labor Standards Act.

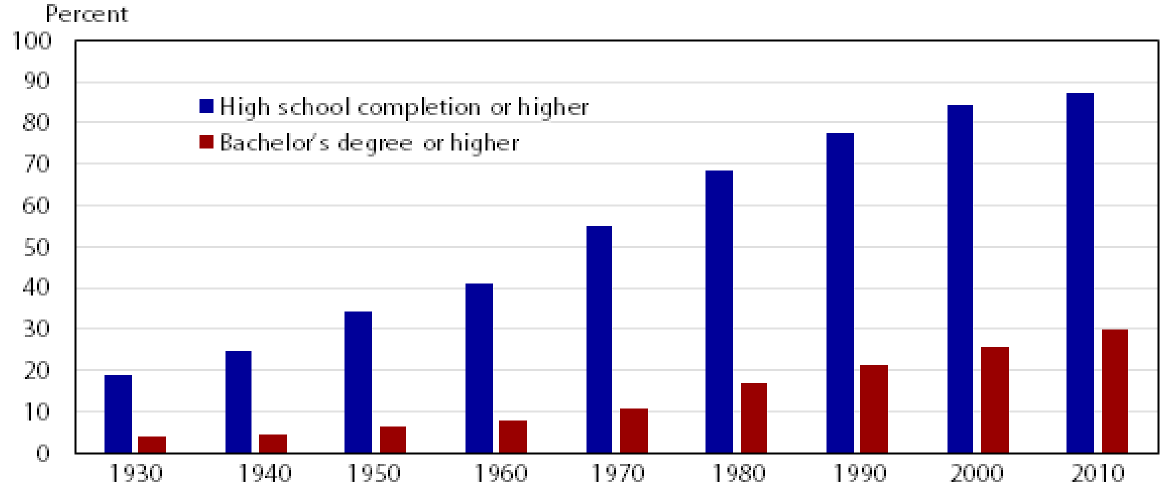
**Figure 1. High school graduates as a percentage of the 17-year-old population, 1910–2010**




Source: National Center for Education Statistics.

Passage of the FLSA, in conjunction with local compulsory school attendance laws, has had a significant impact on the U.S. education system. Because more children were required to attend school, more children completed high school, thus creating a better educated workforce. Since the FLSA became law, school enrollment and high school completion rates have all increased steadily. Figure 1 shows U.S. high school completion rates by decade.

**Figure 2. Percentage of people in the United States age 25 and over with high school completion or higher and a bachelor's degree or higher, by decade, 1930–2010**



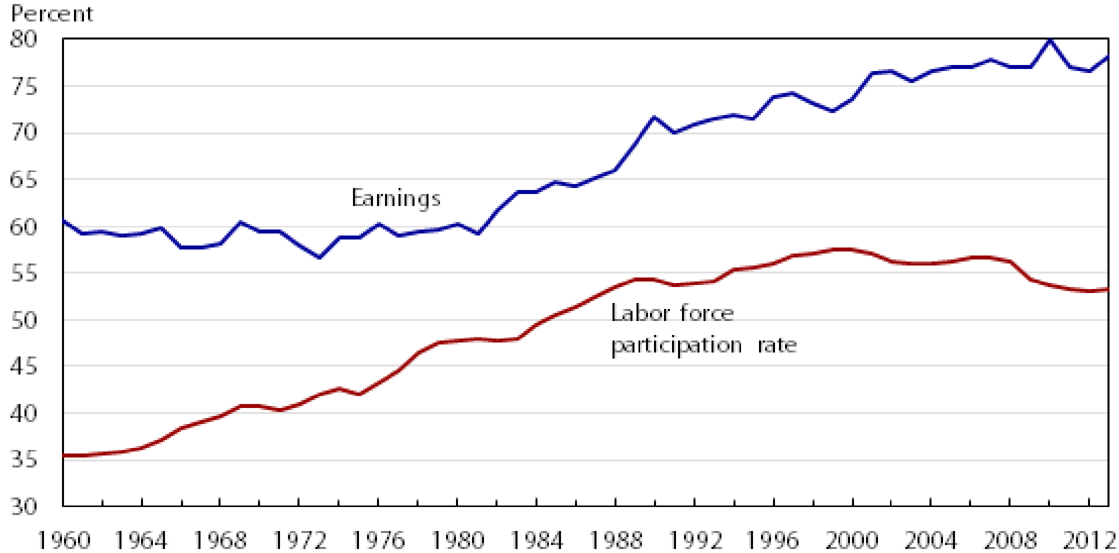

Source: National Center for Education Statistics.

As enrollment and graduation rates have risen, so too has overall educational attainment in the United States. In 1930, prior to the FLSA, fewer than 1 in 5 people over the age of 25 possessed a high school diploma; by 2011, nearly 88 percent of people in this age group held diplomas.[15] As more people completed high school, the pool of potential college applicants increased. This, in part, has contributed to the steady rise in bachelor's degree holders. Figure 2 shows the decade-by-decade increase in the percentage of adults who have graduated high school and college.

The benefits of child labor laws extend beyond the classroom. Removing children from the workforce has had several positive results: workplace accidents have decreased, especially as young children often were particularly susceptible to environmental hazards;[16] children were no longer filling job openings that might otherwise have gone to adults;[17] and children have more time for nonschool activities that have a positive impact on quality of life. Additionally, other changes would occur to ensure that when these children reached adulthood, they entered a more tolerant, more equitable work environment.

## Gender equality

**Figure 3. Women's earnings as a percentage of men's earnings, and civilian labor force participation rate of women ages 16 and over, annual averages, 1960–2013**




Note: Percentages are calculated from annual averages of median usual weekly earnings for full-time wage and salary workers.
Source: Current Population Survey, U.S. Bureau of Labor Statistics.

One of the most dramatic changes to the American workplace in the past 100 years is the role of women. In much of early-American society, relatively few women entered the labor force. In 1950, about one-third of women ages 16 and over were in the labor force; the proportion rose to 60 percent by 2000 and is now just over 58 percent. (See figure 3.) Women often experienced pervasive inequality in opportunity and status, even as more women sought work outside of the home. Another area in which women have been routinely subject to inequitable treatment is pay.

The concept of "equal pay for equal work" was promoted at the federal level as early as 1898 but would not be codified in federal law until passage of the Equal Pay Act (EPA) of 1963.[18] The EPA was the first U.S. legislation targeted to eliminate gender-based pay inequities, thereby ushering in a new norm of gender equality in the workplace.[19] Mandating that men and women engaged in the same work earn the same, the law covers all forms of pay, including salaries, incentives, and benefits.[20]

The ultimate goal of "equal pay for equal work" has not yet been achieved. However, the gender wage gap has decreased substantially. In 1960, 3 years before the EPA, women earned 60.7 percent of what men earned; in 2013, women earned 78.3 percent of what men earned. Figure 3 shows the increase of women's earnings as a percentage of men's, as well as the increase of women in the workforce.

## Racial equality

Like women, racial-minority workers in the United States have had to battle discrimination. The passage of legislation targeting gender discrimination opened the door for similar action on racial discrimination. A year after passing the EPA, Congress passed sweeping legislation designed to target racial discrimination in the workplace.

Racial equality has long been a growing concern in the United States. African-Americans, in particular, have struggled to gain equality in a variety of areas, including employment. During the Civil Rights Movement of the 1960s, protestors engaged in a prolonged campaign of demonstrations, including marches, sit-ins, and freedom rides.[21] These activities drew national attention to the fact that racial discrimination was prevalent in a variety of areas, including the American workplace. Unemployment rate tables available at the time showed that Blacks were twice as likely as Whites to be unemployed and that Blacks who were employed were far more likely to occupy low-skill, low-wage positions.[22]

For nearly a century after the Civil War, the controlling federal law designed to prohibit employers from discriminating along racial lines was the Civil Rights Act of 1866. This act, while not specific to employment, was designed to guarantee all citizens, including newly freed former slaves, “full and equal benefit of all laws and proceedings for the security of person and property.”[23] While the plain language of the act suggested equality, its lack of enforcement mechanisms rendered the law ineffective in practical terms. Similarly, the 14th Amendment, which says, “No state shall . . . deny to any person within its jurisdiction the equal protection of the laws,”[24] proved a toothless deterrent to employment discrimination. Employers could discriminate openly with little fear of consequence and would be able to do so for nearly a century.

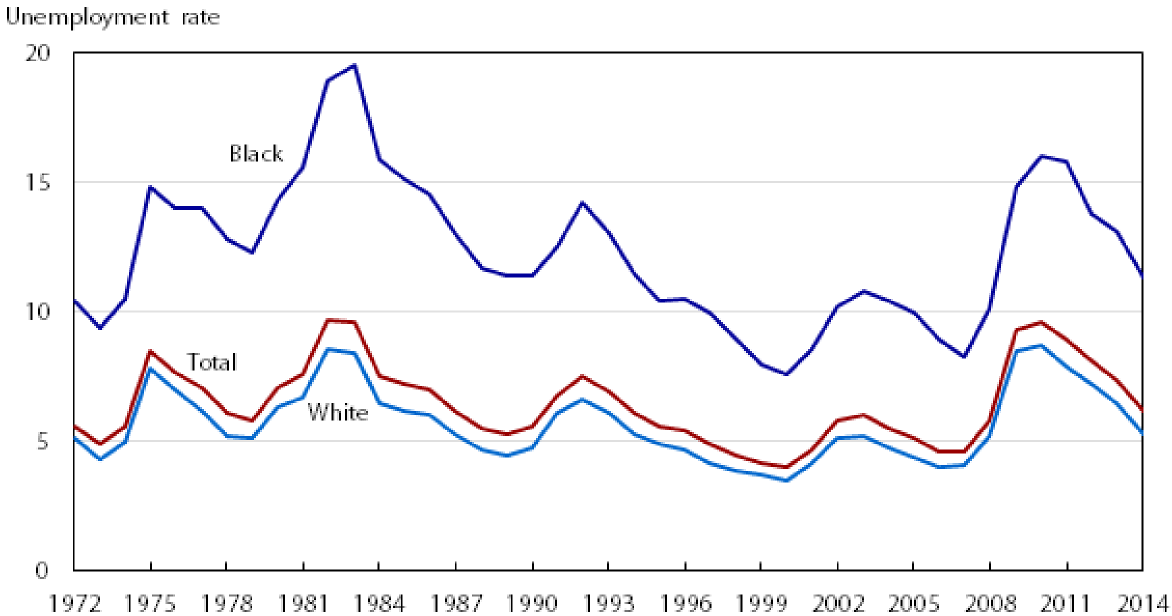
In 1964, Congress passed the Civil Rights Act, making it illegal for employers to discriminate on the basis of race. Title VII states, “It shall be an unlawful employment practice for an employer . . . to fail or refuse to hire . . . or otherwise to discriminate against any individual . . . because of such individual’s race.”[25] From its enactment, the constitutionality of the Civil Rights Act was heavily litigated, but the act was ultimately upheld and cited by the Supreme Court as the basis for the legality of affirmative action policies.[26]

The Civil Rights Act is enforced by the Equal Employment Opportunity Commission (EEOC), which began operations in 1965. The EEOC is tasked with investigating and adjudicating workplace discrimination claims. While the Supreme Court has never overturned the Civil Rights Act, a number of decisions early on made the act more difficult for the EEOC to enforce.

In 1989, the Court held that an employee could not sue for damages stemming from racial harassment that occurred after the employment contract was formed.[27] That same year, the Court placed the burden of proof in discrimination suits on claimants; in essence, a victim of workplace discrimination had to prove that a particular policy produced inequality in the workplace.[28] Soon after these rulings, Congress passed the Civil Rights Act of 1991.

This updated civil rights act is mostly procedural, laying out the means by which claimants can pursue relief and specifying the remedies available. Notably, the bill is intended “to respond to recent decisions of the Supreme Court . . . in order to provide adequate protection to victims of discrimination.”[29] Under the 1991 Act, claimants need only prove that a policy has a disparate impact (a more negative effect on one group than another) for relief to be available.[30]

**Figure 4. Unemployment rate, by selected races, 1972–2014 annual averages**




Source: U.S. Bureau of Labor Statistics.

While prohibiting overt discrimination has undoubtedly improved the working environment for most black workers, the various civil rights acts have not substantially reduced the unemployment rate for Blacks. Black workers were twice as likely as white workers to be unemployed in the 1960s. That trend continued through the 1970s and persists today. (See figure 4.)

As figure 4 shows, the unemployment rate for black workers follows the same cyclical pattern as the rate for white workers but consistently remains about twice as high. Despite the disparity in unemployment rates, conditions for black workers have continued to improve, in large part because of the passage of laws designed to improve conditions for all American workers.

## Working conditions

Legislative initiatives have created safer work environments, benefiting all workers. In the early 1900s, few standards targeted health and safety in the workplace. Lack of federal regulation, combined with an often unresponsive legal system, left workers with little recourse when injured on the job. Workers' compensation laws at the state level together with the Occupational Safety and Health Act at the federal level have contributed to make working conditions much safer for U.S. workers.

Theodore Roosevelt, arguing in favor of workers' compensation (then known as workmen's compensation) laws in 1913, offered the story of an injured worker that summed up the legal recourse available for workplace injuries at the time. A woman's arm was ripped off by the uncovered gears of a grinding machine. She had complained earlier to her employer that state law required the gears be covered. Her employer responded that she could either do her job or leave. Under the prevailing common-law rules of negligence, because she continued working she had assumed the risk of the dangerous condition and was not entitled to compensation for her injury.[31]

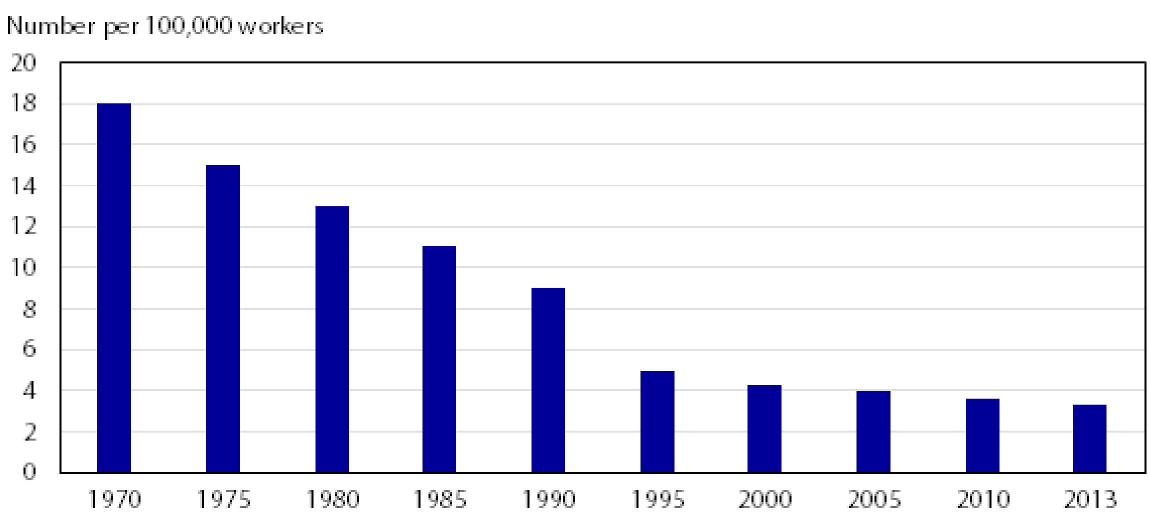
As the example illustrates, common-law negligence was not ideal for handling workplace injuries. Workers who noticed hazards could either "assume the risk" and continue working, or leave work; they were powerless to change the condition. Employers were at risk as well: they were vulnerable to negligence suits that could yield large, unanticipated awards for injured workers. Workers' compensation, where employers insure against the cost of workplace injuries and workers have defined benefits in the case of injury, significantly reduced the risk for both parties.[32]

Despite Roosevelt's efforts, the path to nationwide adoption of workers' compensation would prove a long one. In 1910, New York became the first state to adopt comprehensive workers' compensation; by 1929, all but four states had enacted the legislation. But the law would not reach all states until 1948, with its passage in Mississippi.[33]

Arguably more important overall than providing benefits for injured workers is preventing workplace injuries from occurring in the first place. Early efforts at improving safety focused on those workers in the most hazardous industries—railroad workers, coal miners, harbor workers, and the like. Not until 1970 was the most expansive federal legislation regulating workplace safety passed, the Occupational Safety and Health Act.

The act, which went into effect April 1971, defines an employer to be any "person engaged in a business affecting commerce who has employees."[34] The act empowers the Occupational Safety and Health Administration (OSHA) to enforce workplace standards. The Occupational Safety and Health Act's general duty clause requires employers to keep workplaces "free from recognized hazards likely to cause death or serious physical injury."[35] Since its enactment, conditions have become much safer for American workers.

**Figure 5. Workplace fatalities per 100,000 workers, 1970–2013**




Note: Data for the earlier years are National Safety Council (NSC) estimates; data for the later years are from the U.S. Bureau of Labor Statistics (BLS) and are based on a census. In 1994, the NSC adopted the BLS counts.
Source: 1970–90 National Safety Council; 1995–2013, Census of Fatal Occupational Injuries, U.S. Bureau of Labor Statistics.

One indication that the American workplace has become safer is the decline of the worker fatality rate. The worker fatality rate measures the number of workers killed on the job out of every 100,000 workers. In 1970, the worker fatality rate was 18. Twenty years later, nineteen years after the Occupational Safety and Health Act became law, that rate was cut in half. In 2013, the worker fatality rate was 3.3. (See figure 5.)

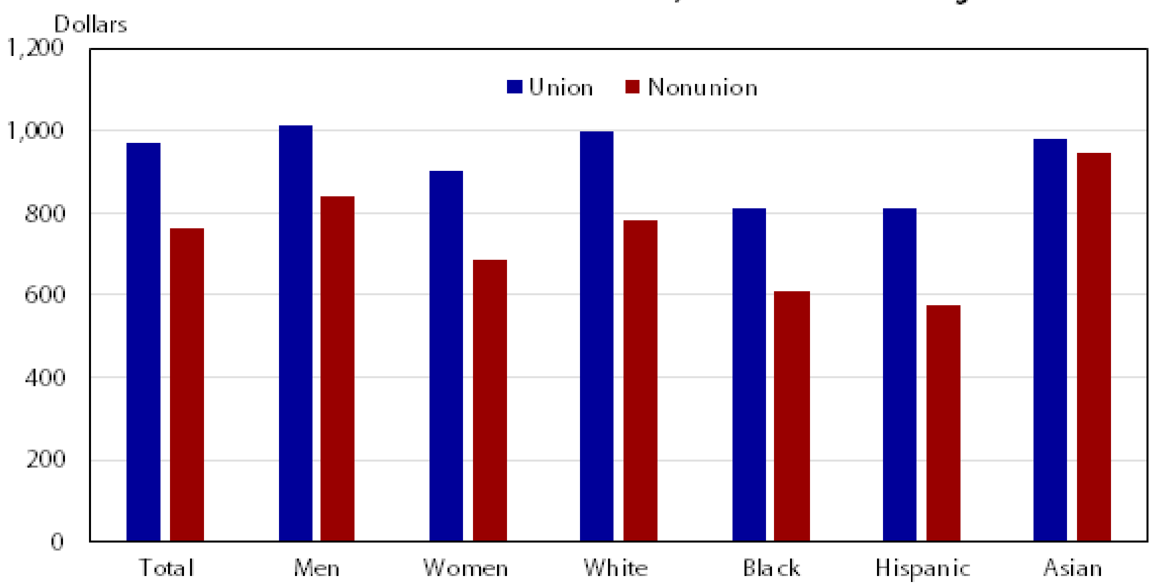
## Union membership

The labor union movement in this country has a long history that is rife with struggle. Workers who wanted to join unions did so in the absence of federal protections, so workers were susceptible to mistreatment by antiunion employers. The Ludlow Massacre, where at least 66 were killed, is arguably the most violent conflict between striking workers and their corporate employer in U.S. history.[36] It occurred in 1914, the year before the *Monthly Labor Review* was first published, and demonstrated a need for federal protections of striking workers. Nevertheless, the first successful efforts to enact federal protections for worker unions would not come for nearly two decades.

In March 1933, Congress passed the National Industrial Recovery Act (NIRA). This legislation articulated the specific rights of unions to exist and to negotiate with employers. Although it lacked true enforcement powers, the law did require that employers recognize the right of labor to organize.[37] The NIRA lasted only 2 years before being held unconstitutional by the Supreme Court in 1935.[38] This setback for the labor movement was short lived; little more than a month later, Congress passed a law granting even stronger protections for labor unions.

Under the leadership of Senator Robert F. Wagner, Congress passed the National Labor Relations Act in July 1935. The NLRA went beyond the NIRA by guaranteeing private-sector workers the right to unionize, allowing workers to engage in collective bargaining as a matter of national policy, providing for secret ballot elections as the means for choosing unions, and protecting workers from employer intimidation, coercion, and reprisal.[39] The NLRA, as amended in 1947 by the Taft-Hartley Act and in 1959 by the Landrum–Griffin Act, is still in force today.

**Figure 6. Median weekly earnings of full-time wage and salary workers, by union affiliation and selected characteristics, 2014 annual averages**




Source: U.S. Bureau of Labor Statistics.

Perhaps the benefit of union membership that has the greatest impact on workers is higher compensation—those represented by unions routinely earn more than nonunion members. As figure 6 shows, higher earnings among union members is a pattern that holds among a broad range of demographic groups.

Despite the fact that union membership gives workers more influence in the workplace and yields higher earnings, union membership is on the decline. Union membership rose steadily after the passage of the NLRA but has been declining steadily since the 1960s.[40] In 2014, 11.1 percent of all workers were union members.[41] Many factors likely contribute to the decline. Some people attribute it to changes in the composition of the labor force.[42] Others note a concerted effort by employers to combat unionization, including an uptick in employers' threats that a workplace will close or move if a union is formed.[43] Regardless of the decline in membership, the fact that most workers have the opportunity to unionize and can choose whether or not to do so by popular vote has expanded democracy in the workplace.

## Conclusion

The past century has seen pronounced change in the structure of the American workplace. Much of that change can be attributed to legislation affecting working conditions and access to jobs. Young children, once active participants in the labor force, are now, for the most part, prohibited from working. Because children are at school, not work, the U.S. workforce is much better educated than in the past. Despite the fact that it's not entirely reflected in pay, women have played a more prominent role in the workplace, and legislation has been put in place to address gender inequities. By law, racial discrimination is no longer tolerated. The U.S. workplace is much safer today than in the past. And unions continue to provide an opportunity for workers to bargain for higher pay and better conditions. Because individuals and society will continue to transform, such transformations undoubtedly will be reflected in future labor legislation. And 100 years from now, our descendants will likely deem the employment legislation of today as antiquated as we view the laws that governed when the *Monthly Labor Review* was first published.

SUGGESTED CITATION

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Monthly Labor Review

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# New measure of labor productivity for private community hospitals: 1993–2012

*The Industry Productivity Studies (IPS) program of the Bureau of Labor Statistics (BLS) has developed a new index of labor productivity, defined as output per hour, for private community hospitals. This labor productivity index relies upon volume-based measures of hospital services, which are separated into outpatient visits and inpatient courses of treatment.*

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Health care, one of the largest sectors of the U.S. economy, accounted for 12.9 percent of all nonfarm payroll employment in 2012.[1] That same year, hospitals accounted for 35.7 percent of gross output in the health care sector[2] and employed approximately 4.7 million workers.[3] The number of hospital workers is expected to increase by more than 15 percent in the next decade.[4] As employment in this industry continues to grow, it is important to measure labor productivity—the efficiency with which hospital workers provide services.

Despite the size and importance of hospitals in the U.S. economy, an official Bureau of Labor Statistics (BLS) measure of labor productivity has not been available in the past. While the Industry Productivity Studies (IPS) program publishes labor hours for hospitals, output measures had not previously been developed. This is due to the complex nature of the services that hospitals provide and the difficulty of measuring these services in a single index of output. Responding to this need, IPS has developed a new measure of labor productivity for community hospitals.[5] This article details the data sources and methods used to measure output (typically the most difficult aspect of productivity measurement) and introduces a final measure of labor productivity. According to this new measure, output for community hospitals grew at an average annual rate of 2.1 percent from 1993 to 2012, and labor productivity grew at a rate of 0.5 percent over the same period.

## What is hospital output and how can we measure it?

Defining and measuring hospital output poses many challenges. Like most service industries, the hospital industry provides many different types of services—from relatively simple diagnostic x-rays to incredibly complex open-heart surgeries. But what is the best way to define and measure these different services?

For most of the service industries measured by IPS, output is calculated with a deflated revenue model. In this model, constant-dollar revenues serve as a proxy for volume of output. However, this approach is not well suited to the hospital industry because transactions are not conducted within a single-price, perfectly competitive market. Patients pay different prices based upon their payment methods and are generally unaware of the relevant pricing structures. Additionally, the hospital service providers direct the transactions due to either patient incapacitation or a lack of medical knowledge. Because prices do not reflect marginal costs in the hospital industry, the output derived from deflated values is likely to be highly distorted.

To address the problems with deflated-value output in this industry, IPS developed and analyzed two volumetric output concepts—one based on the number of procedures and the other based on the number of complete treatments administered.[6] Both concepts measure output via a physical count of services provided. The output concept based on the number of procedures was rejected on the grounds that hospitals, rather than consumers, direct the number of procedures. IPS concluded that the volume-based “course of treatment model” was superior because it best answers the question, “What services are being demanded by a patient?” For hospitals, the patient is purchasing the treatment of a specific health problem. The course of treatment model also aligns with the Organization for Economic Co-operation and Development (OECD) recommendation which states, “The target definition of health care volume output . . . is the number of complete treatments with specified bundles of characteristics so as to capture quality change and new products.”[7]

## Output, outcomes, and quality

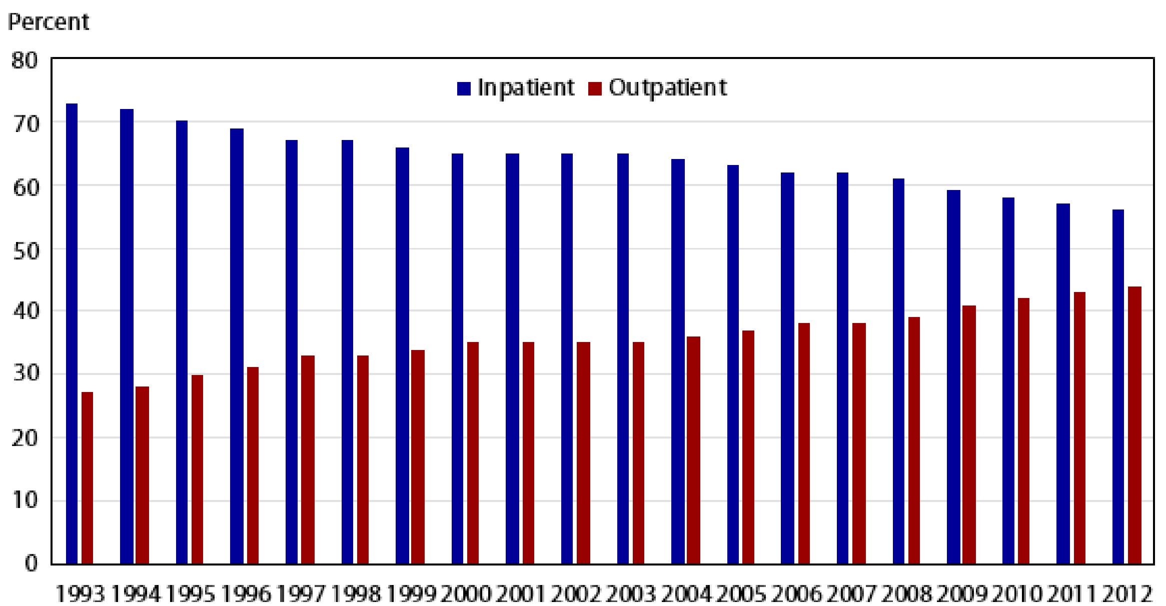
As noted by the OECD, an ideal measure of hospital services would account for the outcome of the treatment itself. Patients seek to have their ailment cured or, at least, alleviated. Therefore, unsuccessful treatments are fundamentally different from those which result in a cure or alleviation. Positive outcomes offer the best indicator of service quality, followed by expediency and comfort.

Currently, the only available patient-level outcome statistic is the inpatient mortality rate. For patients who live, there is no information on whether they were completely cured, had their health somewhat improved, or were discharged unimproved, with the same illness. While it is possible to incorporate mortality data into industry output measures,[8] doing so is of questionable value because it is often not possible to determine whether the hospital is directly responsible for a patient’s death. Numerous factors outside the hospital’s control, such as prior health of the patient, the patient’s adherence to treatment, and random chance can affect outcomes. These outside factors must be taken into account in order to isolate the hospital’s role. For these reasons, the IPS output index does not account for either the outcome or the quality of treatment. Hospital output is defined as the *treatment* of disease, rather than the *cure* of disease.

## Types of hospital services

The IPS program separates hospital services into two general categories—outpatient services and inpatient services. This distinction is necessary because the measurement of “complete treatments” differs for outpatient and inpatient treatments. Outpatient treatments are “complete” by definition. These are services, such as x-rays or noninvasive surgeries, that do not require an overnight stay. Inpatient treatments, on the other hand, require an overnight stay of 1 or more days and may include several different services, such as diagnostic tests, major surgical procedures, monitoring, and room and board. The individual services for inpatients do not constitute “complete treatments”; rather, treatment is “complete” when the patient is discharged from the hospital. Additionally, statistics for inpatient and outpatient services are produced by different federal programs. Outpatient services have become increasingly prominent, accounting for 44 percent of total hospital revenue in 2012, up from 27 percent in 1993.[9] (See figure 1.)

**Figure 1. Revenue share for inpatient and outpatient services at community hospitals**




Source: American Hospital Association, Trendwatch Chartbook 2012.

The inpatient and outpatient services that compose hospital activity can be aggregated into a single index of output, using revenue shares as weights. Each inpatient discharge and outpatient visit is assigned a disease and associated cost. Annual changes in the quantity of each disease is weighted by its share in the total value of output. Therefore, those diseases that contribute more to total revenue are given a greater weight in the overall output index.

## Index of inpatient services

The Nationwide Inpatient Sample (NIS) is the largest all-payer inpatient care database in the United States. It contains patient discharge data, including information on health care costs and utilization, and provides an excellent source for measuring output for inpatient stays. Since 1993,[10] private hospital inpatient discharges have been calculated by applying nationally representative weights to the discharges recorded in the NIS. Because the

NIS contains discharge-level records, rather than patient-level records, individual patients who are hospitalized more than once in a single year may appear in the NIS multiple times.

Each discharge is assigned a Diagnosis-Related Group (DRG) that corresponds to both the primary condition being treated and the associated bundle of procedures and services used during treatment. These treatment bundles correspond to differing amounts of hospital resource utilization. A single charge is reported for the complete stay, and this charge is converted to hospital costs using ratios developed by the Agency for Healthcare Research and Quality (AHRQ).

The DRG system, the primary system for classifying hospital discharges, was developed by the Center for Medicare and Medicaid Services (CMS). It offers a uniform payment system for Medicare and Medicaid patients across the United States.[11] With this approach, an inpatient output index is constructed by assigning each patient a single DRG with one corresponding charge, as opposed to a set of multiple procedures or diagnoses with multiple charges. The classification of diagnoses in the DRG system is updated annually to include more specific types of ailments, as well as differing levels of severity. New DRGs are also assigned for substantial advances in medical treatment.[12] The DRG system allows IPS to classify inpatient services by complete treatments with specific bundles of characteristics.

Another aspect of the DRG system is that it differentiates patients with secondary pathologies, often called "co-morbidities." These patients pose a problem because their multiple courses of treatment are not recorded separately in the NIS. However, separate diagnosis groups have been created to account for cases where there are serious complications or co-morbidities. The DRGs that include complications and co-morbidities tend to have higher average costs and charges, thereby contributing more weight to the overall inpatient index.

The total number of inpatient discharges in each DRG category are aggregated (using the Tornqvist formula) into a single quantity index of inpatient output with weights based on each DRG's share of total cost:

where

$I_t/I_{t-1}$ = the ratio of inpatient output in the current year (t) to the previous year (t-1),

$n$ = the number of DRGs

ln ($i_{DRG,t}/i_{DRG,t-1}$) = the natural logarithm of the ratio of the number of *inpatient stays* for each DRG in the current year to the number in the previous year, and

$w_{DRG,t}$ = the average value share weight for each DRG over the current year (t) and the previous year (t-1).

To get total inpatient values, the number of inpatient treatments for each DRG is multiplied by their average cost or charge. Based on these values, relative weights are derived by dividing the total value for each DRG category in a given year by the sum of values for all DRGs that year.

Since 2001, average cost data have been used for weighting. Because cost data are unavailable for earlier years, charge data are used for that period. Cost refers to the dollar amount incurred by a hospital to provide services. Charge refers to the final amount on a patient's bill. Costs are not subject to external market forces, thus making them a more accurate measure of the value of an inpatient stay than charges. For specific years where cost data are unavailable, charge data are an acceptable proxy because, presumably, the value of hospital resources used to provide inpatient services is the primary factor that determines the final charge. Hospital cost data, as calculated by the AHRQ, differs from charge data on the basis of the hospital providing service, rather than on the basis of the

DRG. Therefore, the relative cost share weights among DRGs are practically equivalent to the corresponding relative charge share weights, and there is no discontinuity in the time series data.

## Index of outpatient services

The number of outpatient visits from the American Hospital Association (AHA) *Chartbook* serves as the basis of the physical quantity measure of outpatient services.[13] The AHA defines an outpatient visit as follows:

> [A] visit by a patient not lodged in the hospital while receiving medical, dental, or other services. Each visit an outpatient makes to a discrete unit constitutes one visit regardless of the number of diagnostic and/or therapeutic treatments that the patient receives. Total outpatient visits should include all clinic visits, referred visits, observation services, outpatient surgeries, and emergency room visits.[14]

The National Hospital Ambulatory Medical Care Survey (NHAMCS) offers a more detailed representation of outpatient visits. This survey is a product of the Centers for Disease Control and Prevention (CDC) National Center for Health Statistics (NCHS), and provides nationally representative estimates of diagnoses and patterns of use of emergency and outpatient services in U.S. hospitals.[15] NHAMCS data are used for calculating ratios of outpatient visits for each major disease category relative to total outpatient visits. Major disease categories correspond to particular organ systems, as well as injuries, accidents, and poisonings (conditions that are commonly treated in emergency departments). Total outpatient visits for each major disease category are obtained by applying the NHAMCS ratios to the AHA totals.

The number of visits for each major disease category are matched with corresponding charge data from CMS. CMS compiles billing data for hospital outpatient visits that are covered by Medicare and Medicaid, including the total number of outpatient visits and the associated charges for each of the more than 900 ICD-9-CM categories.[16] The total visits and charges for individual ICD-9-CM categories are aggregated to the 15 major disease groupings. Total charges are divided by the number of visits for each respective major disease category to obtain an average charge per outpatient visit. Average charges are then multiplied by the number of outpatient visits calculated using data from AHA and CDC. The resulting values are used to derive weights for combining the quantities of various outpatient visits:[17]

where

$O_t/O_{t-1}$ = the ratio of outpatient output in the current year (t) to the previous year (t-1),

$n$ = the number of major disease categories (15)

ln $(o_{MDC,t}/o_{MDC,t-1})$ = the natural logarithm of the ratio of the number of **outpatient visits** for each major disease category (MDC) in the current year to the number in the previous year, and

$w_{MDC,t}$ = the average value share weight for each MDC over the current year (t) and the previous year (t-1).

A potential problem with this approach is the lack of a representative patient sample. Because Medicare and Medicaid charges represent treatment to a subset of the population (the elderly and the poor), it is possible that using these charges alone may introduce some bias to the outpatient measure. However, as with the charge data used to weight inpatient services, the value of hospital resources used to provide the outpatient services is thought to be the primary factor influencing these charges. Therefore, we assume that shares for each major disease category calculated from the CMS data are similar to corresponding shares for the general population. The various quantities of outpatient visits are combined into a single outpatient index, with their associated share of the total nationwide value used as weights.

## Index of hospital output

The independently constructed indexes of inpatient services and outpatient services are combined to create a total output index for private hospitals. Average share weights for inpatient and outpatient services are calculated using the percentages of inpatient and outpatient gross revenue published in the AHA's *Trendwatch* report.[18] Again, relative costs to provide services would be the preferable method for weighting, but such data are unavailable for outpatient services. The AHA revenue data place outpatient and inpatient services on the same basis. Such data are, therefore, of value in determining the relative importance of each with respect to overall hospital activities.

The growth rate of hospital output is derived as a weighted aggregation (using the Tornqvist formula) of the growth rates of inpatient and outpatient services:

where

*A* = output index for community hospitals,

*I* = Inpatient input,

*O* = Outpatient input, and

$w_i$, $w_o$ = value share weights.

## Labor input

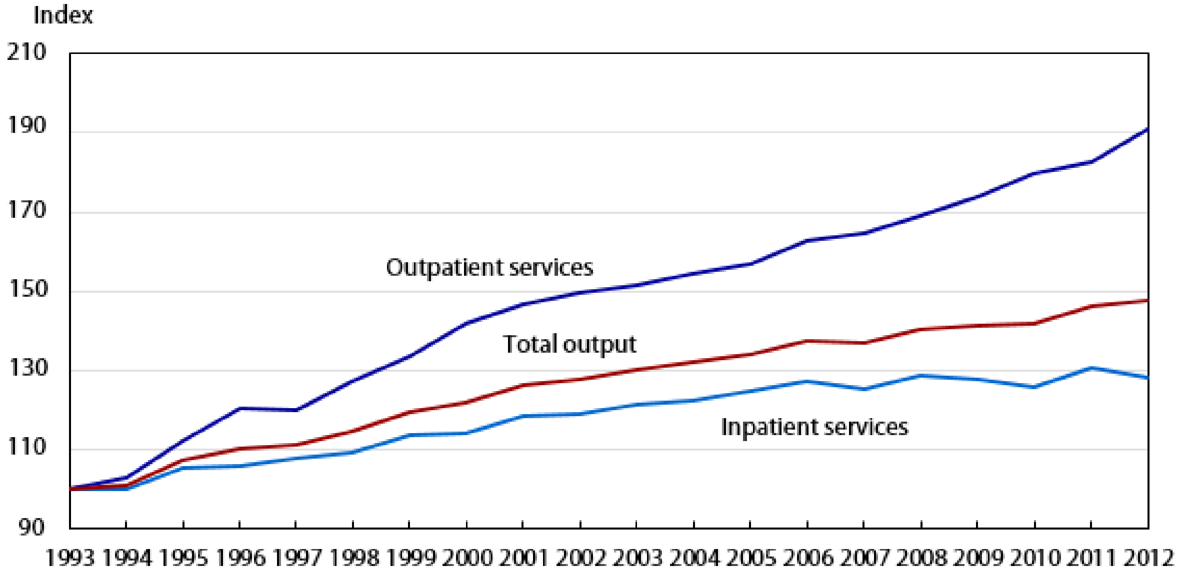
For our purposes, labor input refers to BLS estimates for the total number of hours worked in community hospitals during the year. Total hours is equal to the sum of hours worked by supervisory workers and nonsupervisory workers in North American Industry Classification System (NAICS) 6221 (General medical and surgical hospitals) and NAICS 6223 (Specialty, except psychiatric and substance abuse, hospitals).[19] Annual hours for workers in each category are calculated by multiplying total weekly hours (employment times average weekly hours) by 52 (the number of weeks in a year).

The Current Employment Statistics program publishes employment data for all employees and nonsupervisory workers, along with average weekly hours for nonsupervisory workers. To estimate hours for supervisory workers, ratios of average weekly hours for supervisory workers relative to those of nonsupervisory workers are estimated using data from the Current Population Survey. These ratios are applied to average weekly hours for nonsupervisory workers.[20] Hours paid are converted to hours worked using ratios derived from the National Compensation Survey.

Both total employment and total hours worked in community hospitals have seen continuous growth between 1993 and 2012. Over this period, community hospitals have added over a million new employees, and hours have increased by an average of 1.6 percent per year.

## Trends in labor productivity growth

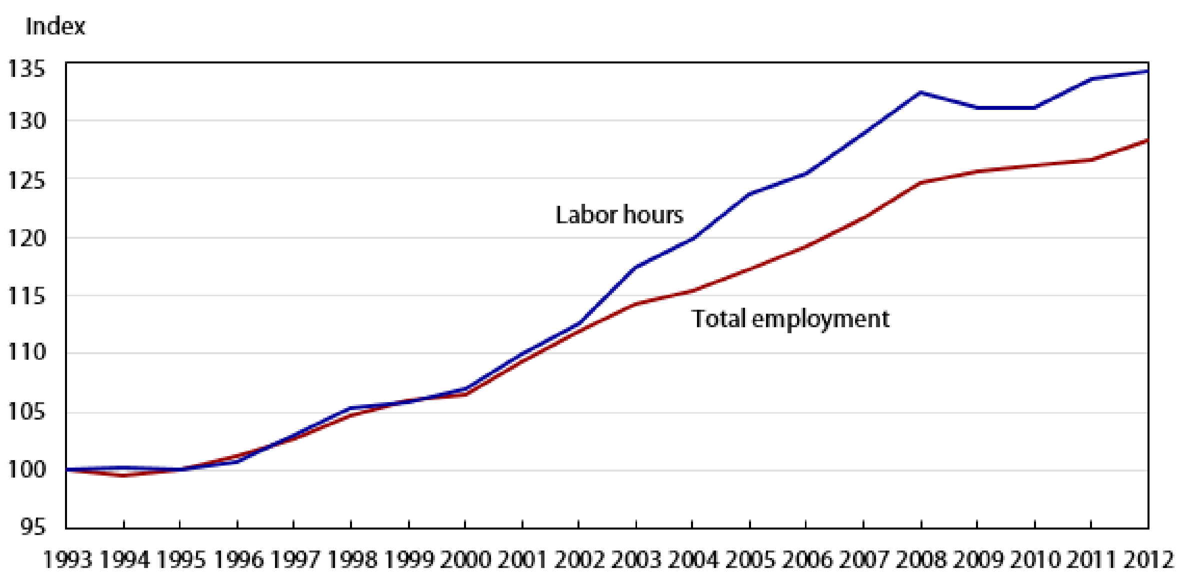
**Figure 2. Index of total output, inpatient services, and outpatient services for private community hospitals**




Source: U.S. Bureau of Labor Statistics, Industry Productivity Studies.

From 1993 to 2012, the output of community hospitals grew at an average annual rate of 2.1 percent; there was positive year-to-year growth every year, except in 2007. The index of outpatient services rose by an average of 3.5 percent annually, while inpatient services grew by 1.3 percent annually over this time period. Starting in 1993, outpatient services experienced 20 years of almost continuous yearly growth. However, this trend is not replicated for inpatient services. From 1993 through 2006, inpatient services grew by an average annual rate of 1.9 percent. But in the years since, inpatient services growth has slowed significantly. From 2006 to 2012, the growth rate was a mere 0.1 percent. (See figure 2.)

**Figure 3. Indexes of labor hours (all employees) and total employment for private community hospitals**

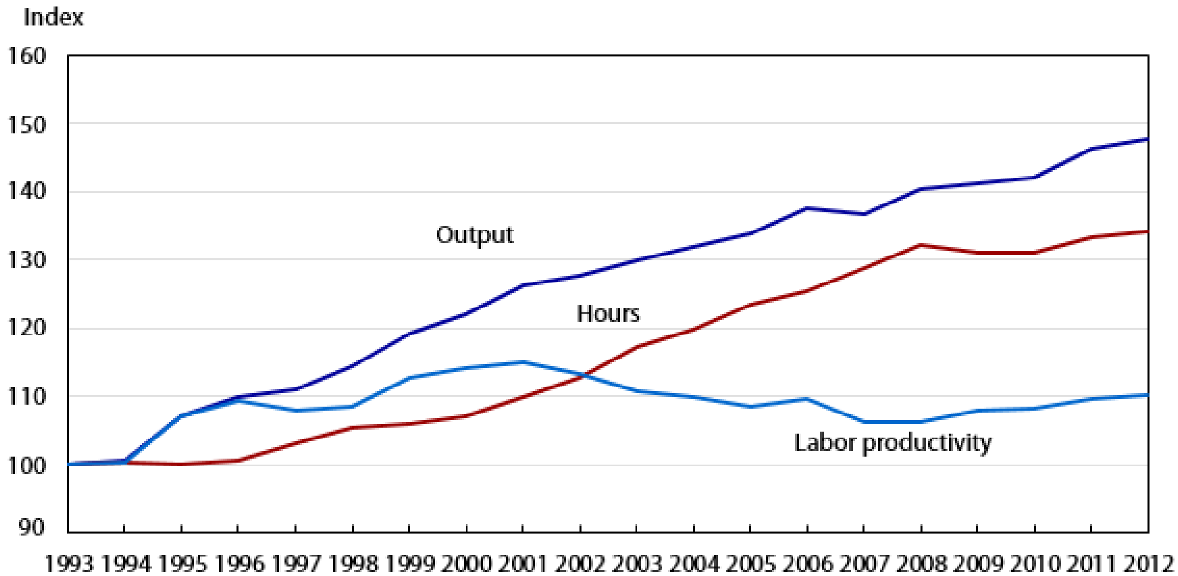



Source: U.S. Bureau of Labor Statistics, Industry Productivity Studies.

Labor hours increased at an average annual rate of 1.6 percent from 1993 to 2012, while total employment grew by 1.3 percent. These indexes moved in tandem from 1993 to 2002. From 2003 to 2008, the number of hours worked increased by an average of 2.4 percent per year while employment increased by only 1.7 percent. This indicates that employees began to work more hours per year over that time period. From 2008 to 2012, average annual growth has been modest for both hours worked (0.4 percent) and employment (0.7 percent). (See figure 3.)

Labor productivity is determined by dividing the index of output by the index of labor hours. From 1993 through 2012, hospital output has grown at a faster rate than hours, resulting in average annual growth of 0.5 percent for labor productivity. A closer look at the index reveals that labor productivity increased through 2001, and declined thereafter. From 2001 to 2012, labor productivity decreased by an average of 0.4 percent annually. (See figure 4.)

**Figure 4. Index of labor productivity, output, and hours for private community hospitals**




Source: U.S. Bureau of Labor Statistics, Industry Productivity Studies.

A number of factors have contributed to the decline in hospital labor productivity since 2001. As technology, pharmacology, and medical science have improved, many conditions that once required hospitalization can now be treated on an outpatient basis. As seen in figures 1 and 2, the volume of outpatient treatments has grown significantly over the period studied. This trend generally serves to increase labor productivity in hospitals, as fewer labor hours are required to treat patients on an outpatient basis. However, the rise in outpatient procedures has not been confined to the hospital industry. Such treatments are administered in physicians' offices (NAICS 6211), ambulatory care centers (NAICS 6214), and even at home (NAICS 6216).[21] Hospitals see no productivity gains when outpatients are treated in other facilities.

In general, outpatients require fewer resources for treatment than do inpatients, and therefore receive less weight in the overall output index. Shifts between outpatient and inpatient treatments therefore impact the labor productivity index through the influence of their relative weights. As a certain percentage of patients shift from inpatient to outpatient care, the remaining inpatients are given a greater relative weight in the output measure. This weighting effect is further magnified by the fact that the cases still being treated as inpatients are increasingly those with the most serious health conditions.

One way of quantifying the level of sickness of patients is the presence of multiple chronic conditions (MCC). According to the Healthcare Cost and Utilization Project (HCUP), the percentage of inpatients with MCC has been steadily increasing, from 63.5 percent in 2003 to a projected 78.1 percent in 2014.[22] These patients have more than one long-term illness and require additional resources. HCUP reports that "patients with MCC had higher in-hospital mortality rates, longer lengths of stay in the hospital, and higher average hospital costs compared with patients without MCC."[23]

An analysis of the DRGs confirms that hospital inpatients have experienced more serious conditions in recent years. Certain DRGs classify patients with comorbidities or complications. These DRGs indicate cases with serious problems that require more resources to treat. In 1993, the NIS sample showed that 22.5 percent of inpatients were labeled as having complications or comorbidities. By 2012, this percentage had risen to 25.9 percent.

Hospital labor productivity is unique in that it is affected strongly by patient characteristics, a factor outside the hospital's control. There are two countervailing trends on productivity. On the one hand, patients who are less sick can be treated on an outpatient basis, requiring fewer labor hours and raising labor productivity. On the other hand, the remaining inpatients tend to be the most serious cases, requiring more resources and lowering labor productivity. These resource-intensive patients also receive a higher weight in the overall output index. This impact is further heightened by the fact that, as discussed earlier, the outcome of treatment is currently not accounted for in this measure. Future changes in patient treatment, as well as potential incorporation of new data on treatment outcomes, may result in very different labor productivity trends.

## Conclusion

Over the last several years, U.S. federal statistical agencies have developed new methods and data to measure the health care sector. Such efforts include the Bureau of Economic Analysis health care satellite accounts and the BLS disease-based producer price indexes. Complementary to these statistics are the new measures of hospital output and labor productivity introduced in this article.

While the majority of IPS industry labor productivity measures are calculated using a deflated-value methodology, the most logical and practical means to measure productivity for community hospitals is to use a physical quantity measure, specifically by counting the number of courses of treatment. Each inpatient stay is counted when the patient is discharged from the hospital, while each outpatient visit is a single discrete unit. Both inpatient and outpatient quantities are classified by diagnostic type and are derived using comprehensive detailed data from the NIS, the AHA annual survey, the NHAMCS, and CMS.

This labor productivity measure is available on the BLS website and will be updated annually.

## Appendix: Nationwide Inpatient Sample

Industry Productivity Studies (IPS) measures of inpatient services are based on patient discharge data from the Nationwide Inpatient Sample (NIS). Sponsored by the Agency for Healthcare Research and Quality (AHRQ), the NIS is the largest all-payer inpatient care database publicly available in the United States, providing information on health care utilization and charge data, with annual data starting in 1988. As part of the Healthcare Cost and Utilization Project (HCUP), the NIS is drawn from those states participating in HCUP; for 2010, these states account for more than 96 percent of the U.S. population. The 2011 database contains information on more than 8 million hospital stays, from about 1,000 hospitals in 45 states, sampled to approximate a 20-percent stratified sample of U.S. community hospitals. The NIS is a stratified probability sample of hospitals in the frame, with sampling probabilities proportional to the number of U.S. community hospitals in each stratum. The universe of U.S. community hospitals is divided into strata using five hospital characteristics: ownership/control, bed size, teaching status, urban/rural location, and U.S. region. In 2012, the NIS sample was redesigned to improve national estimates. The NIS is now a sample of discharge records from all HCUP-participating hospitals.

The unit of observation is an inpatient stay record. NIS inpatient stay records are composed of clinical and resource use information, typically available from discharge abstracts. These records encompass more than 100 data elements for each hospital stay; the data elements include primary and secondary diagnoses, admission and discharge status, hospital characteristics, expected payment source, primary and secondary procedures, length of stay, patient demographics, and total costs and/or charges.[24] The NIS is the only national hospital database with charge information on all patients, regardless of payer, including people covered by Medicare, Medicaid, private insurance, and the uninsured.[25]

For the purposes of this study, we remove state and local government hospitals from the original NIS dataset, leaving only the privately-owned non-profit and for-profit hospitals. We do this to ensure consistency between the output measure and the BLS labor input series that is used in the final labor productivity calculations. The sample of discharge records is made into a nationwide measure by applying weights to each inpatient discharge and its associated charge. Patient-level data are weighted with respect to the type of hospital where the service takes place.[26] The nationwide discharge data are then summed with respect to each Diagnosis-Related Group (DRG).

## SUGGESTED CITATION

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## NOTES

1 For more information, see BLS Current Employment Statistics at https://www.bls.gov/ces/.

2 Bureau of Economic Analysis, National Income and Product Accounts, Gross Output by Industry, https://apps.bea.gov/industry/xls/io-annual/GDPbyInd_GO_NAICS_1997-2013.xlsx.

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4 Elka Torpey, “Health Care: Millions of Jobs now and in the future,” (Bureau of Labor Statistics Office of Occupational Statistics and Employment Projections, 2014), https://www.bls.gov/careeroutlook/2014/spring/art03.pdf .

5 Community hospitals, as defined by the American Hospital Association, are “all nonfederal, short-term general, and other special hospitals. Other special hospitals include obstetrics and gynecology; eye, ear, nose, and throat; rehabilitation; orthopedic; and other individually described specialty services. Community hospitals include academic medical centers or other teaching hospitals if they are nonfederal short-term hospitals. Excluded are hospitals not accessible by the general public, such as prison hospitals or college

infirmaries." These hospitals are a combination of general medical and surgical hospitals (NAICS 6221) and specialty (except psychiatric and substance abuse) hospitals (NAICS 6223).

[6] Brian Chansky, Corby Garner, and Ronjoy Raichoudhary, "Measuring output and productivity in private hospitals" (National Bureau of Economic Research, October 2013), https://www.nber.org/chapters/c13096.pdf.

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[8] Chansky et al., "Measuring output and productivity in private hospitals," p. 26.

[9] *Trendwatch chartbook 2012: supplementary data tables trends in hospital financing* (American Hospital Association, 2012), p. A–33.

[10] The NIS is built from data provided by state health agencies. Prior to 1993, only a small number of states were sampled. Thus, based primarily on the addition of states to the NIS dataset over time, the U.S. Department of Health and Human Services recommends that time-series analyses of these data begin with 1993.

[11] DRGs are derived from the *International classification of diseases, ninth revision, clinical modification* (ICD–9–CM) (U.S. Department of Health and Human Services, Centers for Medicare and Medicaid Services. Official version: International Classification of Diseases, Ninth Revision, Clinical Modification, Sixth Edition. DHHS Pub No. (PHS) 06–1260).

[12] We are able to create time series of inpatient services by using DRG versions 10, 18, and 24. The NIS provides yearly discharge data for these versions.

[13] AHA statistics do not segregate private hospitals from government hospitals. NIS data are used to calculate the percentage of hospitals that are privately owned in the United States. This percentage is applied to the AHA data to remove government-owned hospitals.

[14] *Trendwatch chartbook 2009: trends affecting hospitals and health systems* (American Hospital Association, 2009), p. A–57.

[15] For more information, see http://www.cdc.gov/nchs/ahcd/about_ahcd.htm.

[16] For more information, see http://www.cdc.gov/nchs/icd/icd9cm.htm.

[17] CMS data have only been available since 2004. Therefore, all average charge data are held constant from 1993 through 2003, using 2004 values.

[18] *Trendwatch chartbook 2012: supplementary data table, trends in hospital financing* (American Hospital Association, 2012).

[19] Self-employed and unpaid family workers are also included in total hospital employment and labor hours using data from the BLS Current Population Survey.

[20] For more information, see https://www.bls.gov/lpc/iprhours.htm.

[21] The Bureau of Economic Analysis reports that, from 1997 to 2013, real gross output has increased at an average annual rate of 4.4 percent in offices of physicians (NAICS 6211). The yearly average growth for outpatient care centers (NAICS 6214) and home health care centers (NAICS 6216) was 4.9 percent and 2.8 percent, respectively.

[22] Claudia Steiner, Marguerite L. Barrette, Audrey J. Weiss, and Roxanne M. Andrews, "Trends and projections in hospital stays for adults with multiple chronic conditions, 2003–2014," statistical brief 183, (Healthcare Cost and Utilization Project, November 2014), p. 2, http://www.hcup-us.ahrq.gov/reports/statbriefs/sb183-Hospitalizations-Multiple-Chronic-Conditions-Projections-2014.pdf.

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[25] *Introduction to the HCUP Nationwide Inpatient Sample (NIS) 2009*, (U.S. Department of Health and Human Services, May 2011), p. 5, http://www.hcup-us.ahrq.gov/db/nation/nis/NIS_2009_INTRODUCTION.pdf.

[26] These weights take into account geographic region, urban/rural location, teaching status, bed size, and ownership control; see ibid., p. 6, http://www.hcup-us.ahrq.gov/db/nation/nis/NIS_2009_INTRODUCTION.pdf.

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# To retire or not to retire

*Vidalina Alpuerto-Abadam*

Like a movie plot twist, the rise in the share of the American workforce composed of people ages 66 and older seems to contradict our notions about the labor force. In fact, the labor force participation rate of older workers has been steadily increasing since the late 1990s. Pundits are pointing a finger at several factors. A likely explanation is demographic change. People are living longer after retirement, so they need additional retirement savings and continued access to employment-based health insurance. At the same time, the birth rate is tumbling, which in turn decreases the share of younger workers in the labor force.

On the flip side, it's possible that older employees are opting to stay or remain in the workforce simply because it makes them happy and healthy. The literature is teaming with evidence that the extra years at work may actually be better for the mind and body. However, less is known on how various working and partial-retirement arrangements—such as part-time work and flexible employment—correlate with older workers' well-being.

In "Employment, late-life work, retirement, and well-being in Europe and the United States" (*IZA Journal of European Studies, 2014*), authors Milena Nikolova and Carol Graham take a look at that. They explore the relationship between employment arrangements and levels of subjective well-being and job satisfaction. They use pooled cross-section individual-level data spanning 2009 to 2012 from the Gallup World Poll (GWP) for the United States and nine European countries.

The GWP includes questions that capture the respondents' life and job satisfaction and levels of anger, stress, and happiness. The authors use these metrics as the dependent variables in their regression analyses. The individuals are classified into age cohorts and six employment categories: employed full-time for an employer, employed full-time for self, voluntarily employed part-time, involuntarily employed part-time, unemployed (i.e., did not work in the past 7 days but were actively looking for a job and were able to begin work), and out of the labor force (i.e., homemakers, retired, students, and disabled individuals).

The GWP is a probability-based and nationally representative (of populations ages 15 and over) survey that is done annually in 160 countries. The data are collected using the same survey methodology across countries, thereby making results comparable on a cross-sectional basis and over time.

The study challenges the traditional model of full-time work followed by retirement by age 66. The authors report three important findings. First, the regression analyses confirm that the unemployed are more likely to experience anger compared with full-time workers. Second, their results reveal that, in general, voluntary part-time workers—that is, people who work part time by choice—are happier, experience less stress and anger, and have higher job satisfaction than other employees. Finally, the propensity score matching estimation, which compares retired individuals with observably similar late-life workers, shows that older people who continued working under full-time and voluntary part-time arrangements reported higher levels of well-being and job satisfaction than their retired counterparts. The study results can prove helpful for policymakers when they consider issues that deal with optimal retirement age and contribution plans.

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# New PPI net inputs to industry indexes

*This article describes the Producer Price Index program's recently expanded coverage of net inputs to industry indexes. It also presents improvements to the methodology used to calculate those indexes and a limited data analysis for two industries.*

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Effective with the release of data for January 2015 on February 18, 2015, the Producer Price Index (PPI) program revised its methodology and broadened its scope for calculating net inputs to industry price indexes. The 28 newly published aggregate indexes measure price change for products consumed by selected industries as inputs to production (excluding capital investment, labor, and imports). These indexes are published in table 14 of the *PPI Detailed Report*.[1]

PPI first suggested calculating inputs to industry indexes as part of its comprehensive 1978 revision. This revision called for the development of a system of price indexes encompassing four major components: (1) industry net output indexes, (2) detailed commodity indexes, (3) stage-of-processing indexes, and (4) net inputs to industry indexes.[2] The system to be developed was meant to provide data users with a much more complete picture of producer inflation than was provided before the revision.

PPI has worked toward the goals of the 1978 revision. In 1986, the program completed the development of a set of industry net output price indexes covering the mining and manufacturing sectors of the economy.[3] Since the 1980s, it has expanded industry output index coverage to include over 71.5 percent of the services sector and 34 percent of the construction sector.[4] It completed the development of detailed commodity indexes in 2009, with the introduction of wherever-provided (i.e., commodity-based) services and construction indexes.[5] In 2014, PPI transitioned from the Stage of Processing (SOP) price index aggregation system to the Final Demand–Intermediate Demand (FD–ID) aggregation system. The FD–ID system expanded PPI aggregate index coverage beyond that of the SOP system (through the addition of services and construction indexes) and introduced a new set of rigorously developed stage-based price indexes.[6] Also in 1986, the program introduced a set of inputs to industry price indexes; however, coverage was limited to goods inputs to the construction sector and the indexes were constructed from industry-based net output indexes.

Until recently, PPI has not expanded its coverage of inputs to industry indexes or improved the methodologies used to calculate those indexes. This article describes recent enhancements in both coverage and methodology and presents a limited data analysis for two industries. Coverage enhancements include the addition of more construction industries and expansion into the goods and services sectors of the economy. Among these new industries are those which produce no marketable output, such as membership associations and organizations. Although PPI cannot develop output price indexes for industries that produce no marketable output, it can develop input indexes for them. The new input indexes could potentially be used in deflating nonmarketable output. Methodological improvements include the construction of inputs to industry indexes from commodity-based PPIs, as opposed to industry-based PPIs, and the addition of services and construction inputs. Constructing input indexes from commodity-based price indexes is a methodological improvement, because industries actually consume commodities as inputs to production, irrespective of the commodities' industries of origin. The addition of services and construction inputs is also a methodological improvement, because it provides a more complete picture of industry input costs.

The article is organized into four sections. The first section explains the methodology used to construct the inputs to industry indexes and why the new indexes are an improvement over previous PPI input indexes. The second section describes the coverage and publication structure of the inputs to industry indexes. The third section analyzes historical input-index data for two industries. The analysis includes a comparison of the inputs to industry price indexes to their corresponding output price indexes. The last section illustrates inherent limitations of the PPI inputs to industry indexes and suggests areas for future research.

## Methodology

PPI *net inputs to industry indexes* measure the average change in prices industries pay for inputs, excluding capital investment, labor, and imports. These indexes contrast with PPI's widely published industry *net output indexes*, which measure the average change in prices that industries receive for their output. For example, the PPI output index for paint and coating manufacturing (North American Industry Classification System (NAICS) 325510) measures the average change in prices paint and coating manufacturers receive for the outputs they sell, such as architectural coatings and finishes for original equipment manufacturers. The PPI input index for paint and coating manufacturing measures the average change in prices the industry pays for inputs, including products such as basic organic chemicals, paint colors, thermoplastic resins, industrial electric power, and legal services, as measured by PPI's commodity price indexes. It is important to note that net industry input indexes are not constructed from buyers' transaction prices. Because firms often sell their output to other firms as intermediate goods, these indexes are constructed from commodity output price indexes, which stand in for the prices that individual buyers pay.

*Products, weights, and calculation.* To determine the set of inputs to be included in an inputs to industry index, PPI analyzes the Bureau of Economic Analysis (BEA) "Use of commodities by industries" table (hereafter referred to as the "use table").[7] The use table provides, on an industry-by-industry basis, the set and dollar value of products consumed by each domestic industry as inputs to production. The main source of data employed by BEA to construct the use table is the Economic Census.[8] Data in the table are presented in terms of BEA Input–Output (I–O) codes. From the use table, PPI determines the set of commodities, classified by I–O code, that a given industry or industry group consumes as inputs. The inputs are then translated from I–O classification to PPI commodity-code classification. This step is necessary because the input indexes are constructed from six-digit PPI commodity-based indexes. The translation is accomplished through a concordance between PPI commodity indexes and NAICS codes. BEA I–O data are generally classified according to NAICS, and BEA provides a concordance between the NAICS and I–O codes, which further enhances the match.

After the set of commodities consumed by an industry (classified in terms of PPI commodity codes) has been determined, PPI develops weights for each commodity included in the input index. The gross weight for a given commodity within an inputs to industry index reflects the value of the input commodity in relation to total industry inputs at a specific time. PPI constructs weights for inputs to industry indexes from both the use table and data for wherever-made value of shipments. These latter data—typically derived from U.S. Census Bureau information and other sources—provide the total domestically produced value of shipments of a commodity for a given reference year, regardless of which industry produced the commodity.[9] Currently, the weight reference year is 2007 for the inputs to industry indexes; however, the reference year will be updated as new Economic Census and I–O data become available.[10] The gross value weight of each commodity included in an industry input index is equal to the share of the total value of the commodity consumed by the industry multiplied by the wherever-made value of shipments for that commodity during the reference year. Since the weights for the PPI inputs to industry indexes are based on values, as opposed to quantities, the weights are considered value weights.[11] Assuming there are *i* = 1 through *n* industries and *c* = 1 through *n* commodities, the share of the commodity *c* consumed by industry *i* for reference year *t* is given by

$$S^{u}_{c,i,t} = \mathrm{Use}_{c,i,t} / \left(\sum_{i=1}^{n} \mathrm{Use}_{c,i,t}\right),$$

where

$\mathrm{Use}_{c,i,t}$ refers to the use of commodity *c* by industry *i* at time *t*, and

$\sum_{i=1}^{n} \mathrm{Use}_{c,i,t}$ is the total use of commodity *c* by all 1 through *n* industries included in the use table at time *t*.

The gross value weight of commodity *c* in the input index for industry *i* at time *t* can then be written as

$$\mathrm{GVW}_{c,i,t} = S^{u}_{c,i,t} \times \mathrm{VOS}_{c,t},$$

where $\mathrm{VOS}_{c,t}$ is the wherever-made value of shipments for commodity *c* at time *t*.

As one example of this calculation, consider the index for inputs to paint and coating manufacturing. According to the BEA use table, the industry consumes plastics material and resin (I–O commodity code 325211). In terms of dollar value, the use of this commodity by the industry is equal to $2,476,000.[12] According to the 2007 Economic Census value-of-shipments data, the total use of plastics material and resin by all industries is $95,880,000. Therefore, the paint and coating industry consumes 2.58 percent ($2,476,000/$95,880,000) of total plastics material and resin. Based on the concordance between I–O and PPI commodity codes, plastics material and resin (I–O code 325211) maps to two PPI commodities, thermoplastic resins and plastics materials (I–O code 066212) and thermosetting resins and plastics materials (I–O code 066306). The wherever-made value of shipments for thermoplastic resins and plastics materials is equal to $70,675,148 and the wherever-made value for thermosetting resins and plastics materials is equal to $13,657,080. The respective final gross weights of these two commodities included in the PPI for inputs to paint and coating manufacturing are calculated as follows:

$$GVW_{TPR,PM,2007} = (\$2,476,000/\$95,880,000) \times \$70,675,148 = \$1,852,111$$

and

$$GVW_{TRS,PM,2007} = (\$2,476,000/\$95,880,000) \times \$13,657,080 = \$352,679.$$

After an input commodity's gross weight is determined, PPI converts it to a net weight by removing the portion of the commodity's value that was produced within the consuming industry. Net weighting removes multiple-counting bias from the overall input index. Such bias occurs when prices from several stages of production are included in an aggregate index.

To understand multiple-counting bias in the context of an input index, suppose that one firm classified as an automobile manufacturer purchases iron and steel to produce automobile engines and then, in turn, sells the engines to a second firm also classified as an automobile manufacturer. The second firm then uses the engines as an input to produce automobiles. An input index that included prices for both the iron and steel purchased by the first firm and the engines sold from the first to the second firm would suffer from multiple-counting bias. Assume, for example, that there was a large increase in the price of iron and steel—an increase that caused the price of engines to rise. The index for inputs to automobile manufacturing would go up as a result of the rise in price of both iron and steel purchased by the first firm and the automobile engines purchased by the second firm (produced by the first). In other words, the increase in iron and steel prices would be counted twice, once as the actual rise in iron and steel prices and again as the increase in automobile engine prices resulting from the rise in iron and steel prices.

A net weight is calculated by applying a net input ratio to the gross weight. The net input ratio represents the share of the commodity not produced by the consuming industry and is calculated with data from the BEA "Make of commodities by industry" table, which provides the set and dollar value of products made by each domestic industry.[13] The share of commodity *c* produced by industry *i* during reference year *t* is given by

$$S^m_{c,i,t} = \text{Make}_{c,i,t}/(\sum_{i=1}^{n} \text{Make}_{c,i,t}),$$

where

$\text{Make}_{c,i,t}$ refers to the make of commodity *c* by industry *i* at time *t*, and

$\sum_{i=1}^{n} \text{Make}_{c,i,t}$ is the total make of commodity *c* by industries 1 through *n* at time *t*.

The net input ratio of commodity *c* for industry *i* at reference year *t* is the share of commodity *c* not made by industry *i*. The ratio is calculated as follows:

$$\text{NIR}_{c,i,t} = 1 - S^m_{c,i,t}.$$

Continuing with the paint and coating example, we calculate that the paint and coating industry makes 0.28 percent ($271,000/$95,880,000) of the total make value of I–O commodity 325211, plastics material and resin. The net input ratio for this commodity—the ratio representing the proportion of plastics material and resin not made by the paint and coating industry—is therefore 0.9972 (1 − $271,000/$95,880,000).

The final net value weight for commodity *c* in the input index for industry *i* for reference year *t* is calculated as

$$\text{NVW}_{c,i,t} = (1 - S^{m}_{c,i,t}) \times S^{u}_{c,i,t} \times \text{VOS}_{c,t},$$

which can be rewritten as

$$\text{NVW}_{c,i,t} = \text{NIR}_{c,i,t} \times \text{GVW}_{c,i,t}.$$

Again, net weighting eliminates multiple-counting bias from PPI inputs to industry indexes. Completing the paint and coatings example, we calculate that the respective net weights of the two commodities included in the index for inputs to paint and coating manufacturing—thermoplastic resins and plastics materials and thermosetting resins and plastics materials—are as follows:

$\text{NVW}_{\text{TPR,PM,2007}}$ = (0.9972) × ($2,476,000/$95,880,000) × $70,675,148 = $1,820,001

and

$\text{NVW}_{\text{TRS,PM,2007}}$ = (0.9972) × ($2,476,000/$95,880,000) × $13,657,080 = $351,692.

Once the products and weights for a net inputs to industry index are determined, the index is calculated with a modified Laspeyres index formula based on standard PPI methodology.[14]

*Cutoff rule.* The general methodology for determining the set of products included in a PPI inputs to industry index is outlined in the preceding section; however, PPI also implements a cutoff rule that removes commodities that account for less than 0.5 percent of total inputs.[15] The 0.5-percent cutoff considerably reduces the work required to build and maintain the inputs to industry indexes, while having a negligible effect on index movements.[16]

To determine the effect of the 0.5-percent cutoff rule on index movements, PPI compared changes in two versions of input indexes—a cutoff version developed with the cutoff rule and a full version built without it. Table 1 presents correlations for 1-month percent changes between the two index versions for three industries: paint and coating manufacturing, automobile manufacturing, and offices of health care practitioners.[17]

**Table 1. Correlations in 1-month percent changes between the full and cutoff versions of PPI industry input indexes**

| Industry code | Industry title | Correlation |
|---|---|---|
| 325510 | Paint and coating manufacturing | .998 |
| 336111 | Automobile manufacturing | .986 |
| 621A00 | Offices of health care practitioners | .990 |

Source: U.S. Bureau of Labor Statistics.

The correlations for 1-month changes between the two versions of input indexes are very high, indicating that the 0.5-percent cutoff rule has little effect on index movements. Given this minimal effect, PPI chose to implement the cutoff rule when constructing the inputs to industry indexes.

*Changes in methodology for indexes for inputs to construction.* From 1986 through 2014, PPI published a set of indexes for net inputs to construction industries. The methodology used to develop those indexes was similar to the updated methodology described earlier; however, the updated methodology incorporates two substantial improvements and one simplification.[18]

The former PPIs for net inputs to construction industries were developed from industry-based, primary-product-level PPIs. These PPIs were used as proxies for PPI commodity-based indexes. PPI inputs to industry indexes are now constructed from commodity-based PPIs. Commodity indexes track price change for products—goods and services—regardless of their industry of origin. The use of commodity indexes is methodologically superior, because industries actually consume commodities as inputs to production, irrespective of the commodities' industries of origin. In addition, constructing inputs to industry indexes from commodity-based PPIs allows for the assignment of inputs at a more detailed level than that permitted by industry-based, primary-product-level indexes. Consequently, products that are clearly not consumed by the industry can be excluded. For example, developing an input index for a construction industry from detailed commodity-based indexes allows for the assignment of commercial electric power as an input. If the same index were instead constructed from industry-based, primary-product-level indexes, total electric power—which includes residential and commercial electric power—would be assigned. Regarding services inputs, the ability to assign inputs at a more detailed level permits PPI to drill down to business wired telecommunications and business loans, while excluding consumer sales.

The second methodological improvement to the indexes for net inputs to construction industries is the addition of services inputs and maintenance and repair construction inputs. Previously, these indexes included only goods inputs. The addition of new inputs provides a more complete picture of industry costs. In some cases, such as in the input index for membership associations and organizations, over 90 percent of the industry's inputs are services. For industries that rely heavily on services inputs, an input index including only goods would provide little analytical value.

Finally, as a methodological simplification, the 0.5-percent cutoff rule explained earlier was applied to all input indexes. Previously, no cutoff threshold was applied to the input indexes for construction industries.

## Coverage and publication structure

Since the release of January 2015 data, PPI has been publishing net inputs to industry indexes for 28 industries and industry groupings. Of these, 19 are indexes for inputs to construction industries, 6 are indexes for inputs to goods-producing industries, and 3 are indexes for inputs to services industries. Industries were chosen on the basis of data-user feedback and analyses of usage statistics for the industries' corresponding output indexes. Table 2 presents the industries and industry groups for which PPI publishes input indexes.

**Table 2. Coverage for PPI industry input indexes**

| Code | Title |
|---|---|
| | **Inputs to construction industry indexes** |
| IP230000 | Inputs to construction industries, excluding capital investment, labor, and imports |
| IP231000 | Inputs to new construction industries, excluding capital investment, labor, and imports |
| IP231100 | Inputs to residential construction industries, excluding capital investment, labor, and imports |

See footnotes at end of table.

**Table 2. Coverage for PPI industry input indexes**

| Code | Title |
|---|---|
| IP231110 | Inputs to single family residential construction, excluding capital investment, labor, and imports |
| IP231120 | Inputs to multifamily residential construction, excluding capital investment, labor, and imports |
| IP231130 | Inputs to other residential construction, excluding capital investment, labor, and imports |
| IP231200 | Inputs to nonresidential construction, excluding capital investment, labor, and imports |
| IP231210 | Inputs to commercial and healthcare structures, excluding capital investment, labor, and imports |
| IP231211 | Inputs to commercial structures, excluding capital investment, labor, and imports |
| IP231212 | Inputs to healthcare structures, excluding capital investment, labor, and imports |
| IP231220 | Inputs to industrial structures, excluding capital investment, labor, and imports |
| IP231230 | Inputs to other nonresidential construction, excluding capital investment, labor, and imports |
| IP231231 | Inputs to highways and streets, excluding capital investment, labor, and imports |
| IP231232 | Inputs to power and communication structures, excluding capital investment, labor, and imports |
| IP231233 | Inputs to educational and vocational structures, excluding capital investment, labor, and imports |
| IP231234 | Inputs to other misc. nonresidential construction, excluding capital investment, labor, and imports |
| IP232000 | Inputs to maintenance and repair construction, excluding capital investment, labor, and imports |
| IP232100 | Inputs to residential maintenance and repair, excluding capital investment, labor, and imports |
| IP232200 | Inputs to nonresidential maintenance and repair, excluding capital investment, labor, and imports |
| | **Inputs to manufacturing industry indexes** |
| IP325510 | Inputs to 325510, paint and coating manufacturing, excluding capital investment, labor, and imports |
| IP326100 | Inputs to 326100, plastics products manufacturing, excluding capital investment, labor, and imports |
| IP333130 | Inputs to 333130, mining and oil and gas field machinery manufacturing, excluding capital investment, labor, and imports |
| IP336111 | Inputs to 336111, automobile manufacturing, excluding capital investment, labor, and imports |
| IP336411 | Inputs to 336411, aircraft manufacturing, excluding capital investment, labor, and imports |
| IP336611 | Inputs to 336611, ship building and repairing, excluding capital investment, labor, and imports |
| | **Inputs to services industry indexes** |
| IP484000 | Inputs to 484000, truck transportation, excluding capital investment, labor, and imports |
| IP621A00 | Inputs to 621A00, offices of health practitioners, excluding capital investment, labor, and imports |
| IP813000 | Inputs to 813000, membership associations and organizations, excluding capital investment, labor, and imports |

Source: U.S. Bureau of Labor Statistics.

For *each industry or industry grouping* included in table 2, PPI publishes an aggregate index measuring price change for all inputs consumed by the industry (excluding capital investment, labor, and imports). PPI also publishes separate subaggregate indexes measuring price change for goods, services, and construction inputs consumed by the industry. Final breakdowns are published by type of good or service consumed. Table 3 presents an example of the breakdowns PPI publishes *under each industry input index* from table 2. In cases where the industry does not consume a sufficient quantity of a specific good or service category (a determination made on the basis of the 0.5-percent cutoff rule), no index is produced for that grouping.

**Table 3. PPI detailed publication structure for industry input indexes**

| Code | Title |
|---|---|
| IP621A00 | Inputs to 621A00, offices of health practitioners, excluding capital investment, labor, and imports |
| IP621A001 | Inputs to 621A00, goods |
| IP621A0011 | Inputs to 621A00, foods |

See footnotes at end of table.

**Table 3. PPI detailed publication structure for industry input indexes**

| Code | Title |
|---|---|
| IP621A0012 | Inputs to 621A00, energy |
| IP621A0013 | Inputs to 621A00, goods less foods and energy |
| IP621A002 | Inputs to 621A00, services |
| IP621A0021 | Inputs to 621A00, trade services(1) |
| IP621A0022 | Inputs to 621A00, transportation and warehousing services |
| IP621A0023 | Inputs to 621A00, services less trade, transportation, and warehousing |
| IP621A003 | Inputs to 621A00, maintenance and repair construction |

Notes:

(1) The PPI measures trade services as the change in margins received by wholesalers or retailers.

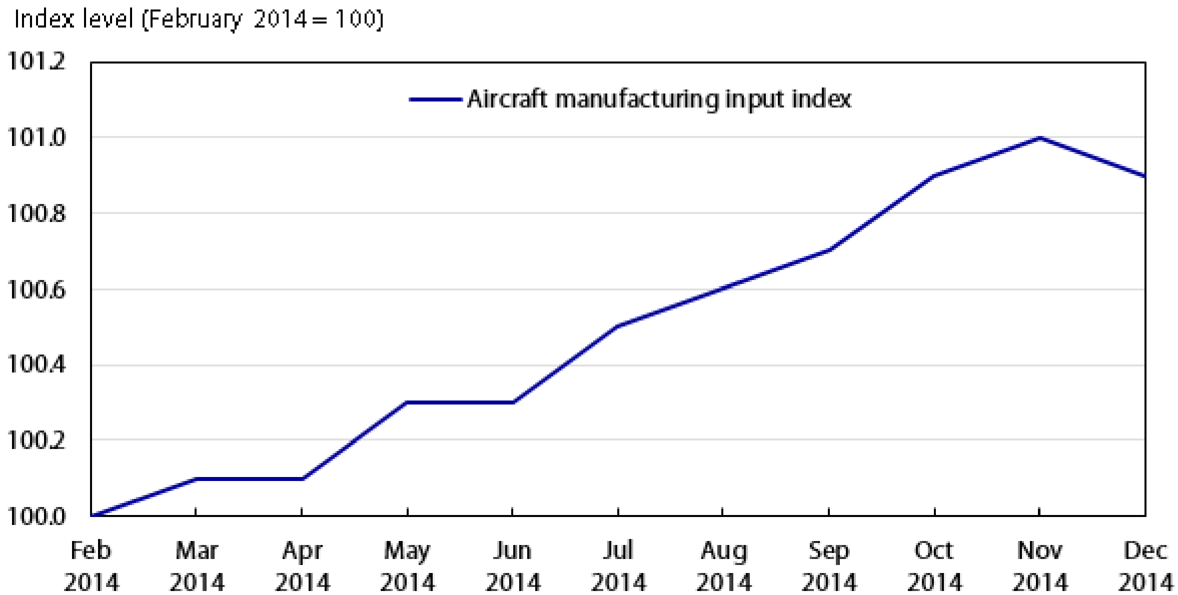
Source: U.S. Bureau of Labor Statistics.

# Data analysis

This section examines 2014 monthly data for the input indexes of two industries—aircraft manufacturing (NAICS 336411) and plastics product manufacturing (NAICS 326100). The analysis begins by examining trends in the input indexes and determining the specific inputs that contributed most substantially to those trends. The analysis then compares movements in the industry input indexes with movements in their corresponding industry output indexes. Aircraft manufacturing and plastics product manufacturing were chosen for analysis because they are goods-producing industries. In general, labor, which is not included in PPI inputs to industry indexes, accounts for a smaller share of total industry inputs in goods-producing industries than in services or construction industries. The choice of goods-producing industries therefore allows for a more meaningful comparison between input and output indexes. An input index for a goods-producing industry generally covers more of total industry inputs than does an input index for a service or construction industry.

*Inputs to aircraft manufacturing.* The PPI for inputs to aircraft manufacturing (excluding capital investment, labor, and imports) measures price change for domestically produced inputs purchased by the aircraft manufacturing industry. The majority of inputs included in the industry's input index are goods, which account for approximately 77 percent of the overall index. Services make up the remaining 23 percent of the index. Within goods, products other than foods and energy account for 76 of the total 77 percent of inputs, and energy accounts for the remaining 1 percent. The most heavily weighted goods inputs are aircraft parts and equipment (other than engines) and aircraft engines and engine parts, each making up 26 percent of the overall index and one-third of goods inputs. Other important goods inputs include integrated microcircuits; aeronautical, nautical, and navigational instruments; metal valves (except fluid power); and hot and cold rolled steel. Among services, trade services account for 12 percent of the total 23 percent of services inputs, transportation services contribute 2 percent, and services less trade and transportation make up 9 percent. Within services inputs, parts and supplies for machinery and equipment wholesaling are the most heavily weighted, accounting for approximately 10 percent of overall inputs and about 85 percent of trade inputs. Other heavily weighted service inputs include legal services, long distance motor carrying, and engineering services.[19]

**Figure 1. PPI for inputs to aircraft manufacturing (NAICS 336411), February–December 2014**

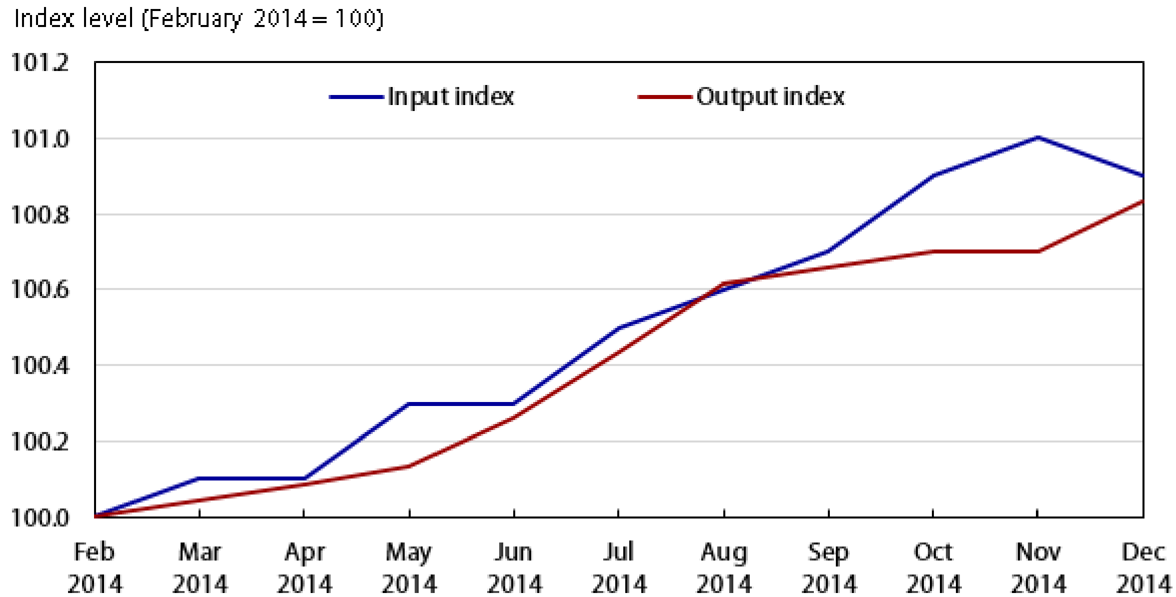



Source: U.S. Bureau of Labor Statistics.

From February 2014 through December 2014, the PPI for inputs to aircraft manufacturing rose 0.9 percent. During this period, the index rose at a relatively linear rate, showing mostly small monthly increases and rising 0.09 percent per month, on average. The index fell only once within the sample period. (See figure 1.)

The 0.9-percent rise in the overall input index for aircraft manufacturing can be traced to increasing prices for both goods and services inputs. Prices for goods inputs moved up 0.5 percent, and prices for services inputs advanced 3.5 percent. The increase in goods input prices was due to a 0.5-percent rise in prices for goods less foods and energy. Rising prices for aircraft parts and equipment (other than engines), aircraft engines and engine parts, and aluminum mill shapes accounted for the majority of the increase. By contrast, energy input prices fell 4.1 percent. Among services inputs, prices for trade services advanced 4.0 percent, transportation and warehousing prices rose 0.9 percent, and prices for services less trade, transportation, and warehousing increased 1.2 percent. Increasing prices for parts and supplies for machinery and equipment wholesaling led the advance in the index for services inputs to aircraft manufacturing.

Figure 2. Input and output price index comparison for aircraft manufacturing (NAICS 336411), February–December 2014




Source: U.S. Bureau of Labor Statistics.

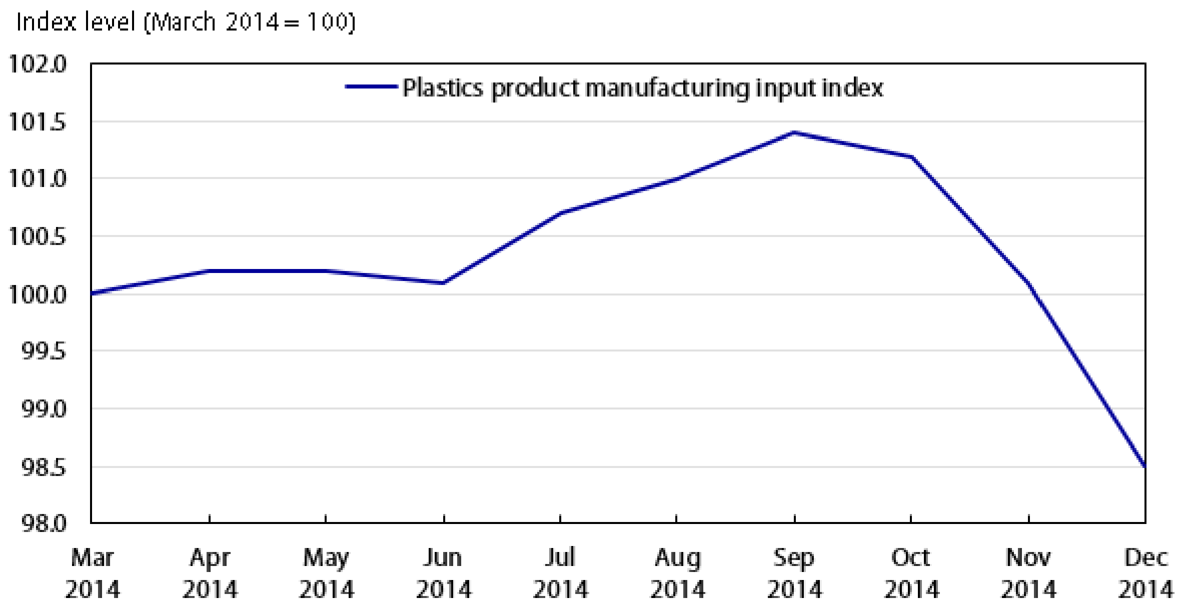
PPI input indexes can potentially be used to examine the relationship between input and output prices. Although the sample period for our industry example is too short for formal econometric analysis, an informal comparison of the prices is possible. Figure 2 displays the PPI input and output indexes for aircraft manufacturing. For comparison purposes, both indexes were rebased to equal 100 in February 2014.

Figure 2 indicates that the trends in the input and output indexes for aircraft manufacturing were very similar over the entire sample period. From February 2014 through December 2014, the input index increased 0.9 percent and the output index rose 0.8 percent. It is important to note, however, that the sample period is short, and future trends in the input and output indexes may be less similar. The monthly movements in the indexes appear to be less related than the movements over the entire sample period. The input index experienced more volatility than the output index: the standard deviation in the 1-month percent change of the input index was 0.1 over the sample period, whereas the standard deviation in the output index was 0.06. The available data, albeit limited, support the hypothesis that there is a relationship between the input and output indexes for aircraft manufacturing. Once more data become available, further analysis examining the causal lag–lead relationship between the indexes could be conducted.

*Inputs to plastics product manufacturing.* The PPI for inputs to plastics product manufacturing (excluding capital investment, labor, and imports) measures price change for domestically produced inputs purchased by the plastics industry group. In contrast to the PPI for inputs to aircraft manufacturing, which measures price change for inputs to a single industry, the index for inputs to plastics product manufacturing measures price change for inputs to an industry group (NAICS 326100). PPI chose to calculate an input index for the group, as opposed to indexes for individual plastics product manufacturing industries, because inputs consumed across these individual industries are similar. The industry group includes the following 11 industries: plastics bag manufacturing (NAICS 326111); plastics packaging film and sheet (including laminated) manufacturing (NAICS 326112); unlaminated plastics film and sheet manufacturing (NAICS 326113); unlaminated profile shape manufacturing (NAICS 326121); plastics pipe and pipe fitting manufacturing (NAICS 326122); laminated plastics plate, sheet (except packaging), and shape manufacturing (NAICS 326130); polystyrene foam product manufacturing (NAICS 326140); urethane and other foam product (except polystyrene) manufacturing (NAICS 326150); plastics bottle manufacturing (NAICS 326160); plastics plumbing fixture manufacturing (NAICS 326191); resilient floor covering manufacturing (NAICS 326192); and all other plastics product manufacturing (NAICS 326199).

Goods account for approximately 79 percent of the inputs included in the PPI for inputs to plastics product manufacturing. Services inputs account for approximately 20 percent of the index, and maintenance and repair construction contributes less than 1 percent. Within goods, goods less foods and energy account for 73 of the total 79 percent of inputs, and energy represents the remaining 6 percent. The most heavily weighted goods inputs are thermoplastic resins and plastics materials, thermosetting resins and plastics materials, industrial electric power, and paper boxes and containers. Within services, trade services account for 12 of the total 20 percent of services inputs, transportation services make up 5 percent, and services less trade and transportation account for 3 percent. The most heavily weighted services inputs include chemicals and allied products wholesaling, long distance motor carrying, and rail transportation of freight and mail.

**Figure 3. PPI for inputs to plastics product manufacturing (NAICS 326100), March–December 2014**




Source: U.S. Bureau of Labor Statistics.

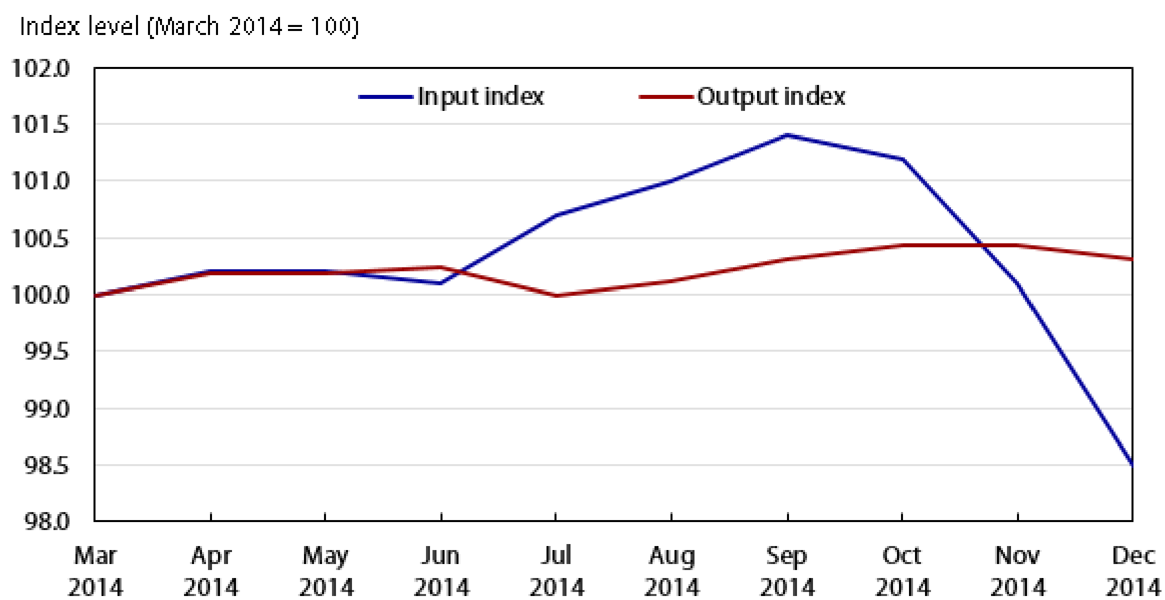
Figure 3 presents the index for inputs to plastics product manufacturing (excluding capital investment, labor, and imports) from March 2014 through December 2014. In contrast to the index for inputs to aircraft manufacturing, which rose slowly over the period, the input index for plastics experienced periods of stability, increase, and decrease. For analysis purposes, the sample is subdivided into three periods: March through June, June through September, and September through December.

From March 2014 through June 2014, the index for inputs to plastics product manufacturing remained relatively stable, increasing 0.1 percent. Within the overall index, prices for goods remained unchanged, largely moderating a 0.8-percent rise in the services inputs index. Among goods input prices, rising prices for goods less foods and energy were offset by falling prices for energy. Within services inputs, prices for trade services led the overall increase, rising 1.1 percent. Prices for transportation and warehousing services and prices for services less trade, transportation, and warehousing increased 1.0 percent and 0.2 percent, respectively. The increase in trade services was driven primarily by margins for chemicals and allied products wholesaling, which rose 3.2 percent from March 2014 through June 2014.

The index for inputs to plastics product manufacturing rose 1.3 percent from June 2014 through September 2014. The increase was primarily the result of goods prices, which rose 1.5 percent over the period. Prices for services inputs also increased, moving up 0.5 percent. Among goods, input prices for goods less foods and energy rose 1.8 percent. By contrast, energy input prices fell 1.4 percent. Prices for thermoplastic resins and plastics materials increased 2.8 percent and accounted for the majority of increase in prices for goods inputs to the plastics industry. Higher prices for thermosetting resins and plastics materials also contributed to the gain.

From September 2014 through December 2014, the index for inputs to plastics product manufacturing fell 2.9 percent. Over this period, prices for goods led the decline in the overall index, falling 3.6 percent. In contrast, the index for services inputs inched up 0.1 percent. Prices for goods less foods and energy and prices for energy both contributed to the decline in the goods input price index, falling 3.2 and 9.2 percent, respectively. Within goods, prices for thermoplastic resins and plastics materials fell 4.2 percent, the index for primary basic organic chemicals decreased 23.4 percent, and prices for unleaded regular gasoline declined 32.4 percent. Among services inputs, prices declined for trade services; transportation and warehousing services; and services less trade, transportation, and warehousing.

Figure 4. Input and output price index comparison for plastics product manufacturing (NAICS 326100), March–December 2014




Source: U.S. Bureau of Labor Statistics.

To conclude the analysis, figure 4 compares the input and output price indexes for plastics product manufacturing.

From March 2014 through December 2014, the input and output price indexes for the plastics industry group exhibited differing rates of change, as prices for outputs rose 0.3 percent and prices for inputs declined 1.5 percent. However, over the same period, there appears to be a relationship between the indexes' turning points (i.e., months in which an index changes direction). Both the input and output indexes remained relatively flat in the beginning of the sample period; however, in July 2014, the input price index began to rise and, 1 month later, the output index turned up. The input index continued to rise from July through September and turned down in October. The output index increased from August through October, leveled out, and turned down in December. While the sample period is clearly too short to draw any conclusions with respect to the causal relationship between input and output prices for plastics product manufacturing, the data presented in figure 4 support the notion that output prices follow input prices with a short lag. In addition, the correlation between the 1-month percent change in the output index and the lagged 1-month percent change in the input index is .65 over the sample period. The correlation in unlagged 1-month percent changes for the input and output indexes is only .26.

## Conclusions

With the release of data for January 2015, the PPI program expanded its coverage of net inputs to industry indexes and updated the methodology used to calculate those indexes. Coverage enhancements include the addition of more construction industries and expansion into the goods and services sectors of the economy. Methodological improvements include the construction of inputs to industry indexes from commodity-based PPIs and the addition of services and construction inputs. These updates represent the first substantial changes to PPI inputs to industry indexes since the 1980s, when input indexes for construction were introduced.

When using PPI net inputs to industry indexes, data users should keep in mind two important limitations. First, these indexes do not include all inputs purchased by an industry; labor, capital investment, and imports are excluded. Second, the indexes are not constructed from buyers' prices, but from PPI output indexes used as proxies for buyers' prices. A buyers' price index measuring industry inputs would be constructed from prices collected directly from the purchasing industry. The main advantage of a buyers' price index is its ability to capture substitutions to cheaper input sources. For example, an automobile manufacturer may switch from using a domestically produced fuel injection system to using a comparable, and cheaper, imported fuel injection system. The input index for automobile manufacturing would not capture this price decrease, but a buyers' price index would. Note, however, that some evidence has shown that PPI's output price indexes respond to competitive pressures from cheaper inputs.[20] Buyers' price indexes would also capture buyer-born taxes and fees, which are not reflected in the current PPI inputs to industry indexes.

One potential area for future work is to combine PPI input indexes with wage and import data, an approach that would produce a more complete representation of industry input costs. A second area for future work is to further examine the relationships between industry input costs and output prices, especially after additional data on PPI input indexes become available.

SUGGESTED CITATION

Lori Hoglund, Jayson Pollock, and Jonathan C. Weinhagen, "New PPI net inputs to industry indexes," *Monthly Labor Review,* U.S. Bureau of Labor Statistics, October 2015, https://doi.org/10.21916/mlr.2015.40.

## NOTES

1 Monthly issues of the *PPI Detailed Report* are available electronically at https://www.bls.gov/ppi/ppi_dr.htm. PPI data are also available through the Bureau of Labor Statistics data-retrieval tools, at https://www.bls.gov/ppi/getdata.htm.

2 John F. Early, "Improving the measurement of producer price change," *Monthly Labor Review*, April 1978.

3 See "Expansion of Producer Price Index," *PPI Detailed Report*, January 1986, pp. 4–5.

4 Coverage is based on 2007 Economic Census value of shipments.

5 Jonathan C. Weinhagen and Bonnie H. Murphy, "New wherever-provided services and construction price indexes for PPI," *Monthly Labor Review*, August 2009, https://www.bls.gov/opub/mlr/2009/08/art2full.pdf.

6 For information on the FD–ID aggregation system, visit https://www.bls.gov/ppi/fdidaggregation.htm.

7 The BEA use table is located at https://www.bea.gov/industry/io_annual.htm.

8 Ricky L. Stewart, Jessica Brede Stone, and Mary L. Streitwieser, "U.S. benchmark input–output accounts, 2002" *BEA Methodology Papers*, October 2007, p. 19, https://www.bea.gov/scb/pdf/2007/10%20October/1007_benchmark_io.pdf.

9 Value-of-shipments data can be downloaded from the Economic Census website at https://www.census.gov/programs-surveys/economic-census.html.

10 Currently, the reference year for both Economic Census and I–O data is 2007; however, because Economic Census data become available before I–O data, the Economic Census portion of the weight will be updated before the I–O portion. For the period between updates, the reference year will not match for the two portions of the weight.

11 For an overview of value weights and quantity weights, see "Producer Price Index manual: theory and practice," (International Monetary Fund, 2004), pp. 90–91, https://www.imf.org/external/np/sta/tegppi/con0.pdf.

12 PPI wherever-made weights are primarily based on Economic Census value-of-shipments data. Since PPI does not disclose its weight data, all examples of data for the wherever-made value of shipments in this article are based on publicly available data from the Economic Census. All Economic Census and BEA dollar values presented here are in thousands.

13 The BEA "Make of commodities by industries" table is located at https://www.bea.gov/industry/io_annual.htm.

14 For an overview of the PPI methodology, see chapter 14, "Producer prices," *BLS handbook of methods* (U.S. Bureau of Labor Statistics, 2014), https://www.bls.gov/opub/hom/pdf/homch14.pdf.

15 Cutoffs are based on percentage of total use of a commodity from the BEA use table.

16 PPI uses a similar 0.5-percent cutoff to construct the FD–ID indexes.

17 These three industries were the first analyzed by PPI. On the basis of this initial analysis, PPI decided to implement the cutoff rule in future analyses for other industries.

18 See page 190 of the July 1986 *PPI Detailed Report* for an overview of the previous methodology used for calculating indexes for material and supply inputs to construction. (The document is available upon request through email, at ppi-info@bls.gov, or by phone, at 202-691-7705.) These indexes are now calculated with the methods outlined in this article.

19 Relative importance data for PPI net inputs to industry indexes are available upon request through email, at ppi-info@bls.gov, or by phone, at 202-691-7705.

20 Maureen P. Doherty, "The behavior of the Producer Price Index in a global economy," *Monthly Labor Review*, August 2012, https://www.bls.gov/opub/mlr/2012/09/art2full.pdf.

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The behavior of the Producer Price Index in a global economy, *Monthly Labor Review*, September 2012.

New wherever-provided services and construction indexes for PPI, *Monthly Labor Review*, August 2009.

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Statistical methods | Producer price index | Industry studies

Monthly Labor Review

October 2015

# A more highly educated labor force makes everyone better off . . . right?

*Peter C. Fisk*

The unemployment rate for people with at least a bachelor's degree is typically much lower than the rate for people with less education. So having the degree is generally beneficial to the individual's employment status and economic condition, and metropolitan areas often strive to attract a more highly educated labor force on the assumption that doing so will benefit the local labor market as a whole. But is that assumption correct? What is the actual effect on a metropolitan area's labor market when the college-educated share of its labor force increases?

Those are the key questions explored in "Will talent attraction and retention improve metropolitan labor markets?" by Stuart Andreason (Federal Reserve Bank of Atlanta, working paper 2015-4, April 2015).

"Improvement" is an inherently subjective term. The paper defines it by comparing measures of four factors: earnings per job, the unemployment rate, the poverty rate, and relative changes in income inequality. Increases in growth, opportunity, and equality are thus regarded as improvements in a metropolitan labor market. "Talent" is identified by the share of the labor force that has obtained at least a bachelor's degree.

The paper uses an outcomes-based cluster-discriminant analysis. The author notes that previous literature has sought to explore the issue by using microeconomic cost–benefit analysis to sum the potential benefits experienced by individuals rather than by studying place-based changes. He also states that previous studies have been unable to adequately capture the overall effect on local labor markets because those studies were focused on measuring single factors, such as per-capita income or unemployment rates.

Andreason's study looks at the 78 U.S. metropolitan areas that had the highest absolute growth from 1990 to 2010 in the proportion of the population with a bachelor's degree or higher; these are the metro areas that should show the greatest improvements in labor market outcomes—if currently prevailing beliefs on the matter are valid. But the study finds no clear evidence that an increase in the share of the labor force with at least a bachelor's degree improves metropolitan labor market outcomes. On the contrary, the analysis concludes that a metro area's increase in holders of bachelor's degrees results generally in one of two sets of local labor market outcomes:

1. Earnings per job increase, but inequality, unemployment, and poverty rates rise.
2. Income inequality growth is low and unemployment and poverty rates decline, but earnings per job are stagnant or negative.

The findings have potentially major implications regarding which strategies metropolitan areas should choose in seeking to improve their labor market outcomes and which longstanding strategies may need revision.

Monthly Labor Review mlr BLS

BLS

October 2015

# Digitization changes everything: improving economic measurement in an era of radical innovation and transformation


**Martin Fleming**

Martin Fleming is a chief economist and vice president of Business Performance Services, IBM Corporation.

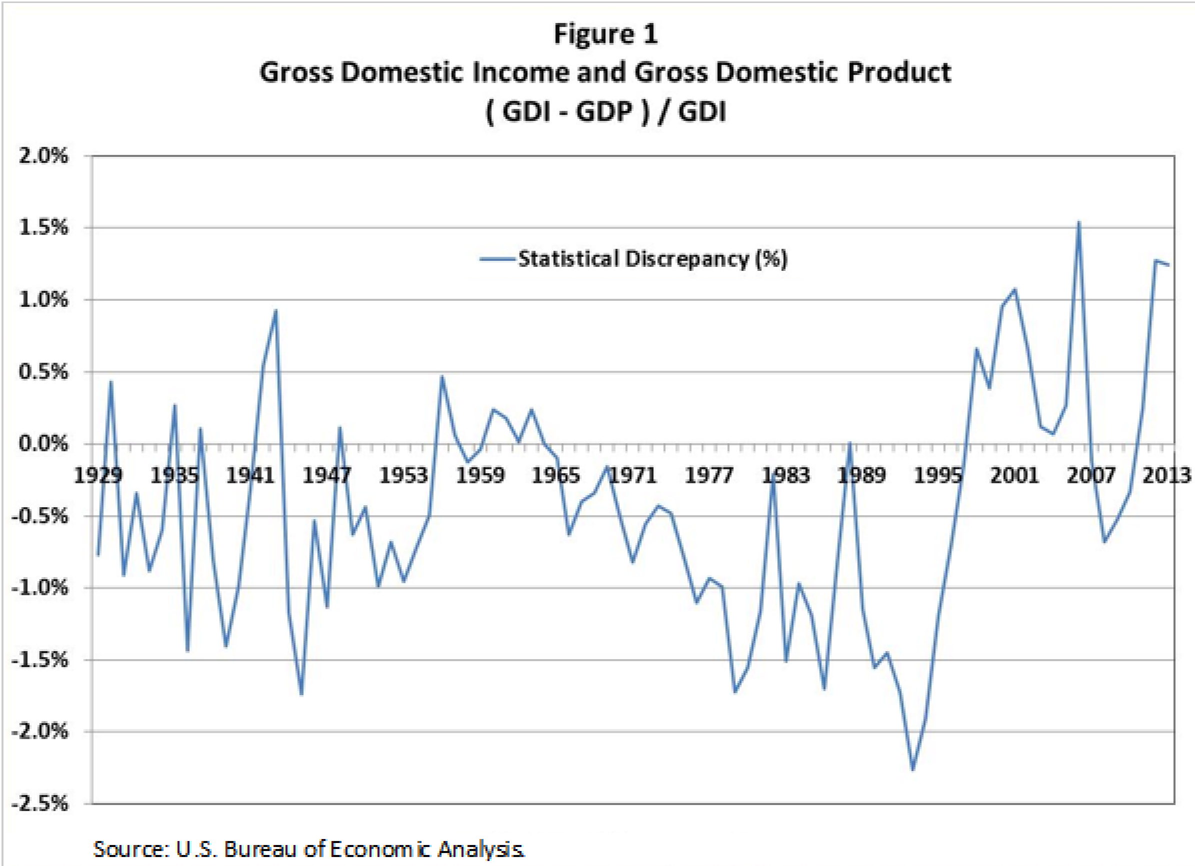
*Editor's note: This essay is part of a series being published to help commemorate the Monthly Labor Review's centennial (July 1915–July 2015). The essays—written by eminent authorities and distinguished experts in a broad range of fields—cover a variety of topics pertinent to the Review and the work of the Bureau of Labor Statistics. Each essay is unique and comprises the words and opinion of the author. We've found these essays to be enlightening and inspirational. We hope you do as well.*

The digitization of goods and services has fundamentally transformed how business is transacted. Traditional economic measures worked well in the industrial era, yet they fall short in measuring economic value in the present era of radical innovation. For example, with the substantial upfront investments in software development, economic activity is more appropriately measured by income earned than spent.

Digital services— i.e., search and social media—create value, yet users access them for free. Music and book services are available at lower prices, causing income loss to musicians, authors, and publishers. These significant shifts caused by digitization raise important questions. For economists, one major challenge is how to measure economic activity in an era with fewer physical objects to count.[1]

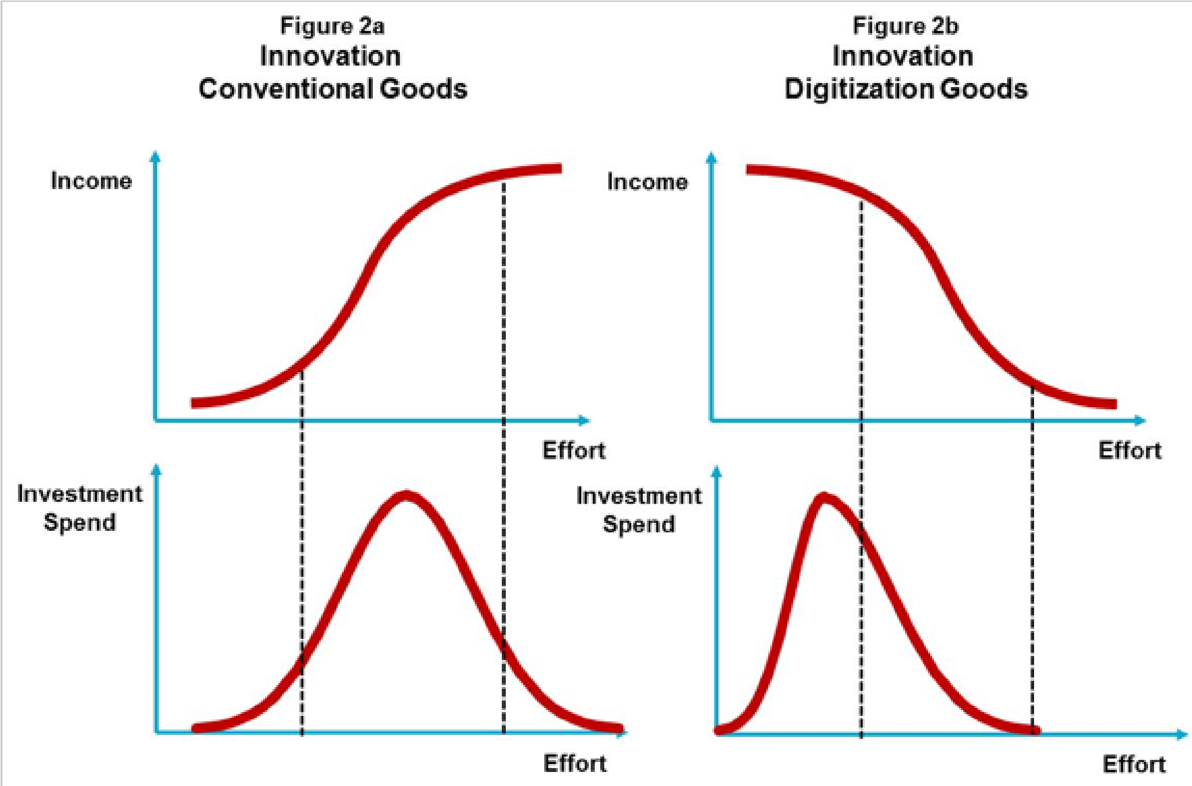
Gross domestic product (GDP) relies on the ability to measure expenditures. It is well suited for agriculture and manufacturing, but less so for services, software, and intellectual property. Gross domestic income (GDI) measures income by summing labor and capital income earned in producing output. Gross value added (GVA) measures the value each industry adds. Conceptually, all three measures will arrive at the same total; however, there are statistical discrepancies.

Figure 1 shows the difference between GDI and GDP over a period of 84 years. For the past 15 years, estimates of income have exceeded estimates of spending by an average of 0.4 percent. The shift from a negative to a positive gap suggests that, as technology has evolved, spending has become more difficult to track.[2]




The challenge facing economic measurement is that the nature of economic activity and the innovation process have fundamentally changed. With conventional goods, more effort resulted in increased value. The "time to value" was short and innovation cycles tended to be fairly brief.

The S-curve relationship between effort and result demonstrates that success and income generation arrives with a suddenness that is often difficult to anticipate.[3] As success occurs, capital investment is often required to build scale and production volume. (See figure 2a.)




Historically, learning-by-doing was an important method of value creation. Economic historians have observed these dynamics in the power loom, steamship, steel, and typesetting industries.[4] As newly created products were sold with a known price, the nominal value of spending was an effective way to measure innovative activity. The digitization of goods has turned the innovation and value creation process on its head. For digitized goods, the majority of effort occurs before users see the offering. The S-curve is reversed, with the maximum effort and the greatest income earned before the product or service reaches users. (See figure 2b.) This is typical of most software development. Innovation often requires substantial capital investment before success is realized. Measuring economic activity by monitoring spending is less effective for software and intellectual property, where the income is earned during the development process.

Economic measurement needs to understand where income is generated and value is created. Monthly payroll, wage rate, benefits, and price data allow for estimation of income generation. Private sector payroll providers have the data necessary to measure labor income. The monthly Bureau of Labor Statistics payroll survey and Internal Revenue Service income tax data, combined with private sector data, could provide a more accurate view of innovation, growth, and economic activity.

Business and political decisionmakers need a reliable view of global economic activity. As innovation and technology evolve, the challenge is to think differently about economic activity, now and in the future.

SUGGESTED CITATION

Martin Fleming, "Digitization changes everything: improving economic measurement in an era of radical innovation and transformation," *Monthly Labor Review,* U.S. Bureau of Labor Statistics, October 2015, https://doi.org/10.21916/mlr.2015.41.

## NOTES

1 See Anna Breman and Anna Fellander, "Diginomics: new economic drivers," translation of "Diginomics—nya ekonomiska drivkrafter," published in Swedish in *Ekonomisk Debatt*, October 2014, https://www.swedbank.se/idc/groups/public/@i/@sc/@all/@lci/documents/publication/cid_1621507.pdf.

2 For a detailed treatment of these measurement issues, see Jeremy J. Nalewaik, "The income- and expenditure-side estimates of U.S. output growth," *Brookings Papers on Economic Activity*, spring 2010, pp. 71–127.

3 For a discussion of S-curve innovation, see Richard Foster*, Innovation: the attacker's advantage* (Summit Books, April 1986).

4 See James Bessen, *Learning by doing: the real connection between innovation, wages, and wealth* (Yale University Press, forthcoming, April, 2015). Bessen's work traces an S-curve for the 19th-century power loom industry.

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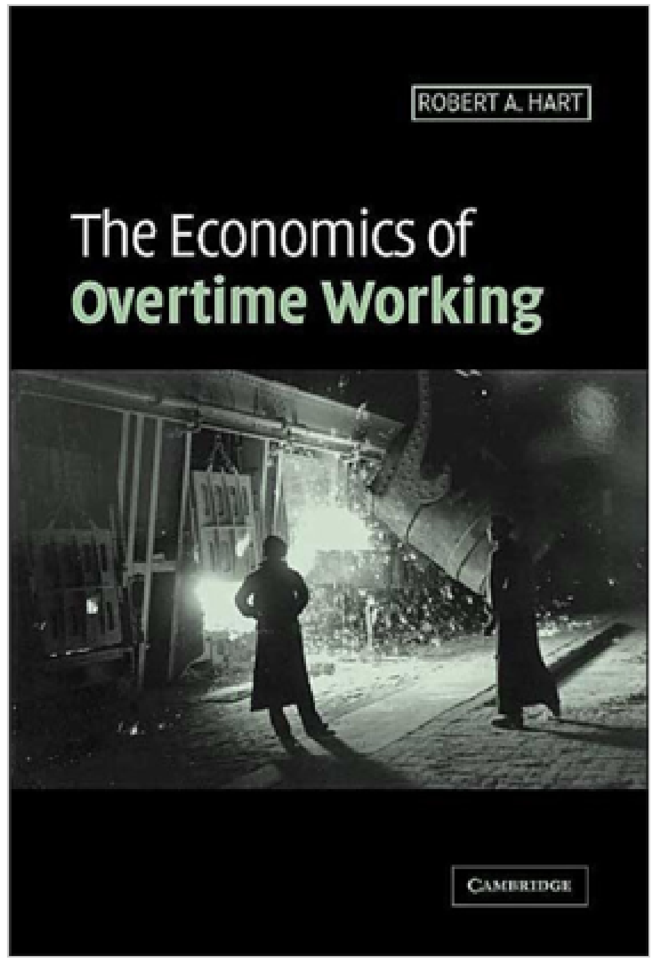
October 2015

# Working overtime: who really benefits?

*The Economics of Overtime Working*. By Robert A. Hart, New York: Cambridge University Press, 2004, 167 pp., $75.00/hardback.

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In *The Economics of Overtime Working*, Robert Hart, labor economist and professor of economics at the University of Stirling in Scotland, United Kingdom, presents comprehensive theoretic studies on overtime work and how it affects the labor market. Using comparative assessments of labor supply versus labor demand, he showcases a variety of models constructed from evidence collected in the United States, Western Europe, and Japan. The work extends far beyond a mere summary of existing research, to enliven the topic and inform the reader as well as set the stage for debate.

Choosing this book brought back not-so-fond memories of my days working on a farm. My first two jobs were picking cucumbers and cropping tobacco. Many days went beyond the standard work hours, with absolutely no overtime benefits. Sadly, these working conditions still exist.

I must say that I was intrigued by all of the research, studies, collaborations, and debates on the effects of overtime. As I dissected the book, my interest level rose further as I read how economists have viewed overtime as it occurs in a standard nine-to-five job versus how it is perceived on the farm of my younger days. According to the former, anything over 40 hours a week is defined as overtime and if one works on a holiday, one gets paid double time. But that view is by no means universal.

Overtime work is work in excess of standard contractual hours. One example of standard time is a 35-hour workweek consisting of five 7-hour weekdays. Under this standard, an individual who worked a 50-hour week would have accrued 15 hours of overtime. For the vast majority of workers, overtime hours are remunerated at a different rate of pay from standard hours. A premium of time and a half applies to most overtime workers in the United States. For a minority of workers, overtime hours are remunerated at the same rate as standard hours or even at a reduced rate.

Hart cites Brechling as the first to develop in detail the workers–hours demand model, in 1965. Brechling treated output, capital, technology, and factor prices as exogenous to the firm that seeks to minimize its costs. The firm produces output at the lowest cost combination of workers and average hours per worker. For the United States, an economy with mandatory overtime rules, this model concerns the employment effects of a rise in the overtime premium.

Over the years, many scholars have raised strong points regarding working overtime, says Hart. In 1988, Hart and Wilson investigated the issue on the basis of estimated conditional factor demand schedules. The work of DeBeaumont and Singell in 1999 showed that separating industries in the estimation of returns is a fruitful way to proceed. In 1993, Black, Chapman, and Chatterji emphasized the distinction between wage rates and earnings in their evaluation of regional earnings growth in the United Kingdom between 1974 and 1991. By 2000, Hamermesh and Trejo had found yet more support for the work-sharing effects of overtime legislation.

Different attitudes toward work and leisure—prompted by such factors as personal characteristics, family circumstances, and peer group influences—may induce individual suppliers of labor to search for the job length–wage earnings combination that optimizes their utility.

According to Hart, in the literature on the interrelationship among overtime, the demand for it, and production, overtime is treated as one of the firm’s most important intensive margin responses. Changes in overtime hours bring production, labor cost, and wage effects. With respect to the last of these, overtime plays a key role in the study of the cyclical behavior of real hourly earnings.

As discussed by Leslie in 1991, changes in the amount of overtime working occur along two main channels. First, average overtime per overtime worker fluctuates. Second, the ratio of overtime to total workers also varies. Therefore, the total change in overtime working would be expected to result mainly, though not only, from changes in these two components.

Perhaps the most frequently quoted example of an attempt to control the maximum number of standard work hours and the minimum number of overtime work hours is the U.S. Fair Labor Standards Act (FLSA), which sets a standard weekly hours limit of 40 and a minimum premium of time and a half times the standard hourly rate. The daily and weekly lengths of standard hours are often fixed by collective bargaining. In fact, in many instances they are set exogenously to the firm, at national or industrial levels.

“Why do firms pay an overtime premium?” asks Hart. He gives us three reasons. First, governments may attempt to reduce the health and social costs of excessive work demands by imposing high labor costs on firms’ marginal daily or weekly hours beyond acceptable norms. Second, labor unions may require high marginal rates as compensation for potential adverse effects on their members’ welfare. Third, overtime premiums satisfy unanticipated increases in product demand while minimizing hiring and firing costs.

The United Kingdom, says Hart, is an economy with no imposed rules governing the timing and payment of overtime hours. Overtime agreements tend to be undertaken at the company level, with different companies offering different premium rates.

Workers express a broad range of reasons for their decision to work overtime. Hart cites a 1998 British Workplace Employee Relations Survey in which one-fifth of 26,000 employees surveyed reported that they worked overtime because they needed the money. An even larger percentage (24 percent) worked overtime because their job required them to do so. Ten percent claimed that they did not want to let their colleagues down, and 5 percent worked overtime because they like the job they do.

We know that overtime working is an important labor market phenomenon in economies with either weak or nonexistent overtime regulations. Even under the relatively strong regulations in the United States, which imposes high marginal rates of overtime pay, up to 20 percent of workers receive a premium before maximum standard workweek hours are reached. That is, they receive an overtime-like premium, based on established custom and practice, before they even begin working overtime.

Is working overtime here to stay? Undoubtedly, many firms view overtime as a useful means of dealing with unanticipated economic events, including fluctuations in product demand and in rates of absenteeism, as well as breakdowns in production or the organizational workflow. Overtime work designed to accommodate unforeseen, usually short-term events is likely to remain a permanent feature of the labor market scene.

On August 23, 2004, the Employment Standards Administration issued new overtime regulations that affect the exempt status of some workers covered by the FLSA. The change in regulations caused the exemption status of some jobs to be reclassified, thereby affecting the eligibility of those jobs for overtime pay. In response to the new regulations, the National Compensation Survey is reviewing all jobs currently being sampled to ensure that all changes in company overtime practices are properly recorded for the survey. (For details, see Secretary of Labor Thomas E. Perez, “Wages: overtime pay” (U.S. Bureau of Labor Statistics), http://www.dol.gov/dol/topic/wages/overtimepay.htm.)

So, the question remains: Who really benefits from working overtime? The employee? The employer? Both? No one? The answer, per Hart, is “It depends.” Both parties benefit when a good product is made and employees are well compensated. No one benefits if there is no demand for the product and the pay doesn’t cover travel expenses. Employees seldom benefit when working overtime takes away from family time. Everyone will benefit when well-compensated and happy employees produce a cost-effective product that is in high demand.

This book is a must-read for anyone fascinated with the policies, formulas, and demands that center around overtime. It is also a must-read for those seeking a crash course in the many facets of workers’ commitments to overtime work. I recommend this book highly.

Monthly Labor Review
October 2015

# A best way to help low-wage workers?

Edith S. Baker

It is often argued (and not without justification) that an increase in the minimum wage will reduce overall employment among low-skilled workers. But verifying this hypothesis and, if it is true, measuring the amount by which employment is reduced is not a simple task. Nonetheless, Jeffrey Clemens and Michael Wither tackle this task for the period of the recession of 2007–09 in their paper "The minimum wage and the Great Recession: evidence of effects on the employment and income trajectories of low-skilled workers" (National Bureau of Economic Research working paper 20724, December 2014). In fact, they go even further, breaking down low-wage workers into a number of earnings categories (the number depends on the purpose involved) and investigating the effects of increases in the minimum wage on the wages of workers in each of those categories, as well as on the employment of low-skilled workers and their ability to escape poverty and move into jobs with middle-class earnings. Finally, the authors contrast the effects of increases in the minimum wage with increases in the Earned Income Tax Credit (EITC).

Between July 23, 2007, and July 24, 2009, the federal minimum wage rose from $5.15 to $7.25 per hour. The stated aim of an increase in the minimum wage is to raise the wages of workers with earnings below that level, and Clemens and Withers find that, during the Great Recession, that is exactly what happened for workers earning below $7.50 per hour before the implementation of the $7.25 federal minimum: in states whose minimum wage was below the federal government's at the time, workers who reported earning between $5.15 and $7.25 per hour in any given month during the period in question were almost twice as likely to be within that range in July 2008 than were workers in states that had already raised the minimum wage on their own; by November 2009, workers who had been earning between $5.15 and $7.25 in states without a raised minimum wage were now earning as much as workers in states that had raised the minimum wage. The story, however, was different for those reporting earnings between $7.50 and $10.00 per hour prior to the implementation of the $7.25 federal minimum in states affected by it: these workers saw their wages largely unchanged.

The same two groups also saw different outcomes with regard to employment. Those earning below $7.50 per hour before the implementation of the federal wage increase experienced a 4.3-percentage-point decline in employment from August 2009 to July 2010. Two years later, the situation got worse: the decline increased to 6.3 percentage points. Among those affected in this group of earners were teenagers and food service workers: those two groups combined saw their employment decrease by 2 percentage points 1 year after the federal minimum-wage increase and 3.9 percentage points 2 years later. In contrast, workers earning between $7.50 and $10.00 per hour before the federal increase saw no effect on their employment (as, in fact, did those earning above $10.00 per hour). Clemens and Withers draw the following conclusion from their analysis: although minimum-wage legislation does achieve its stated aim of raising the wages of those at the bottom of the earnings distribution, it also reduces the employment of low-skilled workers by measurable amounts. The latter reference to measurability is what is particularly interesting: the literature is filled with those who argue the issue one way or the other, but few, according to the authors, can claim the robustness achieved by their methodological approach of using monthly individual-level data from the Survey of Income and Program Participation.

Finally, Clemens and Withers' analysis indicates that the increased wages and the decreased employment effectively cancel each other out, so that if one of the purposes of an increase in the federal minimum wage is to raise people out of poverty, then that purpose is not achieved. Similarly, the authors find that a rise in the minimum wage reduces the likelihood that workers earning less than $7.50 per hour will reach earnings of $1,500 per month (a wage many consider to be the threshold value of a lower middle class income) by 4.9 percentage points, or 24 percent. Thus, raising the federal minimum wage reduces the mobility of low-skilled workers significantly. A more efficient way of increasing the purchasing power of these workers, without the side effects of reducing their unemployment, their chances of getting out of poverty, and their likelihood of progressing to a middle-class income level, is the EITC, which the literature has found to increase the employment of low-skilled adults and the income available to their families, to significantly reduce economic inequality and poverty, and even to improve the academic performance of children of recipients.