

The Creation of a New Middle Class?: A Historical and Analytic Perspective on Job and Wage Growth in the Digital Sector, Part I

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Introduction

In a January 2017 report, “A Historical Perspective on Tech Job Growth,” we explored the parallels between big industrial job creators of the early 1900s and today’s tech leaders. We showed that companies such as Amazon, Apple, Google, Facebook, and Microsoft are creating jobs at a historically rapid pace. Amazon, in particular, has reached 300,000 jobs faster than any other company in U.S. history.¹ Moreover, these companies show no signs of slowing their employment growth. Amazon promised in January 2017 to add 100,000 full-time workers in the U.S. over the next 18 months.² Google expanded its workforce by almost 17 percent in 2016 alone.

In this paper, we turn our attention to the impact of this job growth on wages and living standards. Our historical benchmark, once again, comes from Ford, General Motors, General Electric, DuPont, and other great industrial companies of the first half of the 20th century. These firms were able to adopt new production and distribution techniques faster and more successfully than their rivals. As a result, these “frontier firms” were able to accomplish what had seemed impossible at the time: create hundreds of thousands of jobs while paying good wages and offering consumers lower prices than their rivals.

The key to this win-win situation was productivity. High-productivity firms would be able to cut prices, which would expand demand and benefit consumers. Expanded demand would create more jobs at higher pay. The result was the creation of a new middle class of factory workers who could afford to buy the products they made.

Yet, today, skeptics worry that digital-enabled productivity gains are not yielding the same virtuous circle as the productivity gains of the past.³ They point out that digital companies do not seem to be generating enough jobs to make up for the slow growth of jobs in the rest of the economy. Indeed, the current concern is that digital disruption will eliminate millions of traditional jobs in sectors such as retail and transportation.

Moreover, even when digital companies are creating hundreds of thousands of jobs, critics blame them for the “missing middle”—the lack of jobs requiring mid-level skills accessible to many Americans, and paying mid-level wages. Some worry these companies are creating work only for highly-trained and specialized software developers. Other digital leaders—in particular, Amazon—are being accused of hiring workers into low-wage temporary positions.⁴

In this paper we address both of these concerns directly. Using data from the Bureau of Labor Statistics, we make the case that the high-productivity digital firms are starting to generate a new middle class. It’s a virtuous circle. Consumers flock to those firms because they offer lower prices and better service. Workers migrate there from low-productivity firms because the high-productivity firms offer better wages for the same occupations—and, often, steadier hours and better benefits.

This shift of jobs from low-productivity low-wage firms to high-productivity firms paying better wages is clearly causing some disruption policymakers must address. Nevertheless, if this new pattern continues, it will raise real wages across the economy and rejuvenate the middle class.

This paper is divided into two parts. Part I, presented here, focuses on the overall digital sector—ecommerce, in particular. Part II, in a following paper, examines job

and wage patterns in the telecom and tech industries and shows how these industries are contributing to the new middle class.

Here are our main findings:

Job Creation

- **Work is shifting to the high-productivity digital sector.** For example, since 2007, hours worked by production and nonsupervisory employees in the digital sector have risen by 8.5 percent compared to a 3.4 percent increase in the physical sector. This continues a 20-year pattern.
- **The ecommerce sector is adding jobs much faster than the general retail sector is losing them.** We define the ecommerce sector to include what the government calls the “electronic shopping” industry (NAICS 4541) and “general warehousing” (NAICS 49311), in order to pick up the tremendous growth of fulfillment centers and similar establishments. We define the general retail sector to include those retailers that compete most directly with ecommerce, including electronics stores (NAICS 443142); clothing, shoes, and jewelry stores (NAICS 448); sporting goods, hobby, musical instrument, and book stores (NAICS 451); and general merchandise stores, including department stores and supercenters (NAICS 452).

We found that the ecommerce sector added 355,000 jobs from 2007 to 2016—more than enough to compensate for the 51,000 jobs lost in the general retail sector. From 2013 to 2016, the combination of ecommerce and general retail added roughly 373,000 jobs. To put this in historical perspective, the best three-year stretch for job growth in general retail in the

past 25 years was a 374,000-job gain from 1997 to 2000.

- **Wage and salary payments to ecommerce workers have increased by almost \$18 billion since 2007, in 2016 dollars.** By comparison, real wage and salary payments to workers in general retail have risen by less than \$1 billion over the same period.

Pay

- **Production and nonsupervisory workers earn higher pay in the digital sector.** Average hourly wages for production and nonsupervisory workers in the digital sector in 2016 were \$25.73 per hour, or the equivalent of \$53,509 for a full-time year.⁵ That's 29 percent higher than average hourly wages for productivity and nonsupervisory workers in the physical sector.
- **Production and nonsupervisory workers in the digital sector are seeing significant pay increases.** Real hourly wages for production and nonsupervisory workers in the digital sector have been rising at a 1.2 percent annual rate since 1996. In the physical sector, real hourly earnings for production and nonsupervisory workers in the physical sector have been rising at only a 0.6 percent annual rate since 1996. The same pattern holds true since 2007 as well.
- **Workers earn higher pay in ecommerce compared to general retail.** Average hourly earnings in ecommerce, including fulfillment centers, are \$21.13 per hour. That's 27 percent higher than the \$16.65 per hour in general retail. Production and nonsupervisory workers in ecommerce earn an average of \$17.41 per hour, compared to \$13.83 in general retail—a 26 percent

premium.

- **Workers in mid-skill occupations such as office and administrative support; sales; and installation, maintenance, and repair get paid significantly more in the digital sector.** On average, office and administrative support workers get paid 10 percent more in the digital sector. Installation, maintenance, and repair get paid 12 percent more. And sales and related occupations get paid 68 percent more, on average, in the digital sector.
- **Workers in mid-skill occupations such as office and administrative support, sales, and customer support get paid significantly more in the ecommerce sector.** Office and administrative support workers get paid 28 percent more in the ecommerce sector compared to general retail. Sales and related occupations get paid 69 percent more in ecommerce. Customer service representatives get paid 17 percent more in the ecommerce sector.
- **Ecommerce has entered a virtuous circle, with faster productivity growth enabling smaller increases in gross margins than in general retail, even as the sector pays higher wages.** We estimate that margins in the ecommerce sector have risen at half the rate as in general retail. If we include warehousing, the producer price of ecommerce has fallen since 2007.

Geographic Distribution

- **The gains from rising digital payrolls are spread across the country.** Between 2007 and 2015, wage and salary payments to workers in the digital sector rose by more than 10 percent in 30 states, adjusted for inflation, with no obvious regional pattern in digital sector growth.

Between 2007 and 2015, the digital sector produced bigger wage and salary increases than the physical sector, adjusting for inflation, in 30 states—including much of the Midwest and the South.

- **The gains from rising ecommerce payrolls are spread across the country.**

From 2007 to 2015, real ecommerce wage and salary payments to workers increased by more than 20 percent in 32 states, including the District of Columbia. Some big gainers included Tennessee, South Carolina, and Kentucky.

From 2007 to 2015, the combination of ecommerce and general retail produced rising real wage and salary payments in 39 out of 51 states (including the District of Columbia).

The Historical Paradigm for Middle-Class Growth

In recent years, economists have conclusively demonstrated there are large and persistent productivity differences between companies in the same industry.⁶ In other words, some companies are simply much better at using the same inputs. A recent OECD report called these high performers “frontier firms.”⁷

Recent research also suggests that aggregate gains in productivity are driven by the shift of workers and market share from low-productivity laggards to high-productivity frontier firms.⁸ It would be great if every company could up their game, but existing businesses often have a tough time adopting new technologies and ways of doing things.⁹ Expecting a donkey to suddenly become a racehorse is unreasonable. If you want to travel faster, you are better off shifting your saddle.

Looking back, we can see this process at work in the first half of the 20th century. From 1919 to 1955, manufacturing productivity more than tripled, while real earnings for factory workers soared.¹⁰

The jumping off point, of course, was Henry Ford’s 1914 move to double the daily wage for workers at his Highland Park factory to \$5 per day, accompanied by his introduction of new production techniques that dramatically increased production and reduced the cost of producing the Model T. The price of a Model T Touring Car fell from \$950 in 1908 to \$360 in 1916.¹¹

Ford’s combination of high productivity, high wages, and low prices attracted both workers and customers and enabled Ford to create jobs at a spectacular rate. He went from 14,000 workers in his Highland Park factory in 1914 to 36,000 workers in 1917. By 1955, when the economy was starting to settle into normalcy after the

Great Depression, World War II, and the Korean War, Ford Motor employed more than 180,000 workers.

Other high-productivity “frontier firms,” to use the OECD terminology, were showing equally dramatic gains in employment over that same period. General Motors went from 86,000 employees in 1919 to more than 600,000 workers in 1955. IBM’s workforce went from 3,000 workers to 56,000, while DuPont went from 32,000 to 87,000 workers. Meanwhile, General Electric went from roughly 50,000 workers in 1914 to 215,000 in 1955.¹²

On average, these five frontier firms alone more than quintupled their employment between 1919 and 1955. That growth far exceeded overall manufacturing employment, which increased by 50 percent over the same stretch.¹³ As these firms expanded their workforce, the net effect was to replace low-wage jobs with jobs that offered middle-class incomes, lifting real earnings and living standards for the country as a whole. By 1955, factory workers came to epitomize the American middle class.

Job Creation in the Digital Sector

Is the same virtuous circle at work today for digital companies? Skeptics worry that digital companies are not generating jobs fast enough to make up for the lost jobs in the rest of the economy. Second, they are concerned that the digital boom is only generating high- or low-end jobs while leaving out the middle-skill, middle-pay jobs.

In this section we will address the first of these issues. First we note that the industrial classification scheme used by government statisticians is not designed to measure the crosscutting activities of the modern knowledge economy. For example, the BLS reports there are roughly 200,000 jobs in an industry called “Internet publishing and broadcasting and web search portals.” It would be easy to assume that this industry category encompasses all of the jobs created by Google and Facebook.

However, the BLS assigns jobs by establishment, not by company, where an establishment is defined as a single location producing a single good or service. So a company such as Google—which provides search services, develops software, runs a network of data centers, sells advertising, lays fiber, and delivers an astonishing amount of video each day—may report its U.S. employees in multiple industries.

Similarly, Apple designs computers and smartphones, develops software, and runs retail and online stores, so its domestic employment may appear in multiple industries. Amazon is known as an ecommerce site, but it also runs huge databases and operates fulfillment centers (which probably are being reported in the industry

category for general warehousing).

It gets worse. Call centers have their own industry category, so a company's call center employment might show up in a different category than the company itself. Workers for online travel sites such as Expedia might be reported in the Internet industry or in the industry for "All Other Travel Arrangement and Reservation Services." Etsy, the online marketplace, might be reporting its jobs under data hosting, electronic shopping, or any of a number of other industries.

Because of this ambiguity in how digital jobs are reported, we use a broad definition of the digital sector, as originally outlined in our 2016 paper.¹⁴ We divide the private sector into digital and physical industries, where the digital industries are listed in Table 1.

Digital industries tend to be industries where the output can be easily digitized—or an essential part of the transaction with customers can be done digitally. These include Internet, tech and software industries; telecom and broadcasting; ecommerce; content industries such as journalism and entertainment; and a variety of financial, professional, and technical activities.

By contrast, the physical industries—such as manufacturing, transportation, health care and construction—are not easily digitized. As a result, the digital sector, as defined in Table 1, accounts for roughly 25 percent of private sector jobs, but 65-70 percent of info-tech investment.

By at least one measure, workers in the digital sector are significantly more productive than workers in the physical sector. In 2015, the total value-added generated in the digital sector per full-time equivalent worker was 26 percent

higher than the total value-added generated in the physical sector per full-time equivalent worker. We note that this gap was only 19 percent in 2000, so it's been widening over time.

Table 1: Industries in the Digital Sector

Tech

Computer, communications, and electronics manufacturing
 Computer, peripheral, and software wholesalers*
 Software publishing
 Data processing, hosting and related services
 Internet publishing and web search
 Computer systems design

Telecom and Broadcasting

Wired and wireless telecommunications
 Satellite telecommunications
 Television and cable

Ecommerce

Electronic shopping and mail order*
 General warehousing*

Content

Print and internet publishing
 Video, movies, and music production and distribution

Financial, professional, and technical activities

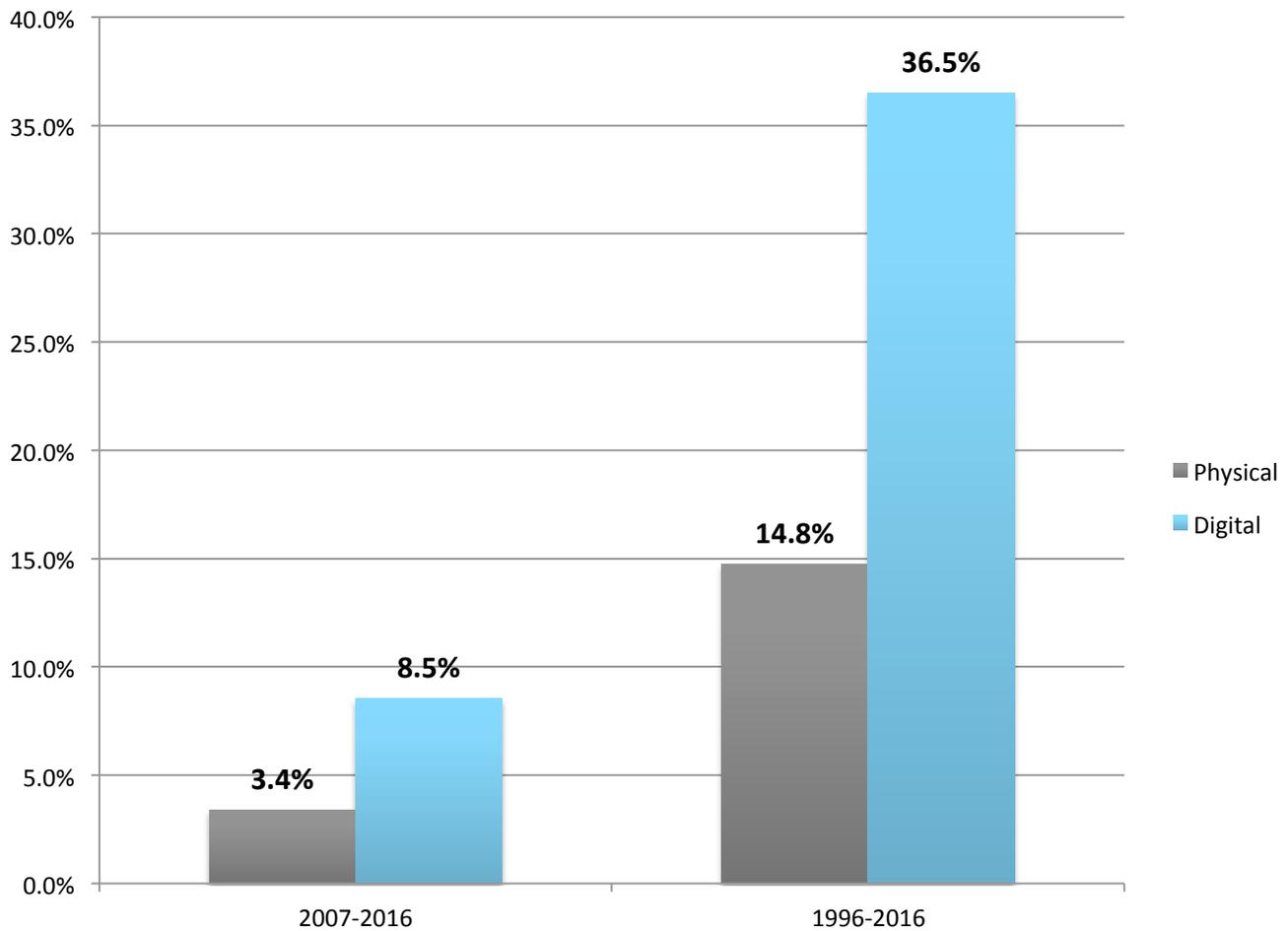
Professional and technical activities (including accounting, engineering, design, market research, advertising)
 Finance and insurance**
 Management of enterprises
 Administrative support (including call centers, travel agencies, and temporary agencies)

*These industries expand the definition of the digital sector over Mandel (2016).

**Depending on the data set, we sometimes use the broader category of financial activities.

Data: Center for Emerging Employment (PPI)

**Figure 1: Digital Sector Growing Faster
(percentage change in hours worked by production and nonsupervisory employees)**



Data: BLS, Center for Emerging Employment (PPI)

We calculate that, based on BLS data, both work hours and jobs have been growing much faster in the digital sector than in the physical sector. For example, Figure 1 shows that the growth rate of hours worked by production and nonsupervisory employees is more than twice as fast in the digital sector as in the physical sector.

Within the digital sector, one of the fastest growing areas is ecommerce. As noted above, the government's industry classification includes an industry labeled "electronic shopping and mail-order houses" (NAICS 4541). However, an examination of the state-level data suggests that this industry classification does not pick up the fulfillment centers used by Amazon and others. For example, Amazon reports 12,000 employees in Kentucky as of February 2017.¹⁵ But the BLS reports only 2,640 workers in the NAICS 4541 industry in Kentucky as of 2015. By contrast, the general warehouse industry (NAICS 49311) had more than 23,000 workers in Kentucky.

Moreover, over the past several years, there has been an unprecedented surge in employment in the general warehouse industry, coinciding with the boom in ecommerce. Indeed, some of the biggest increases in general warehouse employment are found in states such as Indiana, Kentucky, Pennsylvania, and Tennessee, where Amazon has built fulfillment centers and reports employing thousands of workers.

For that reason, we include general warehousing in the ecommerce sector. We choose not to include truck drivers as part of the ecommerce sector because they are typically not employed by the ecommerce companies.

We contrast jobs in the ecommerce sector with jobs in what we call "general retail"—industries that compete directly with online sellers. For the purposes of this paper, we defined "general retail" to include general merchandise stores, such as department stores, warehouse stores, and supercenters; clothing and clothing accessory stores; sporting goods, hobby, and book stores; and electronics stores.

Table 2: Defining the Ecommerce and General Retail Sector

Ecommerce

Electronic shopping and mail-order houses
General warehousing and storage

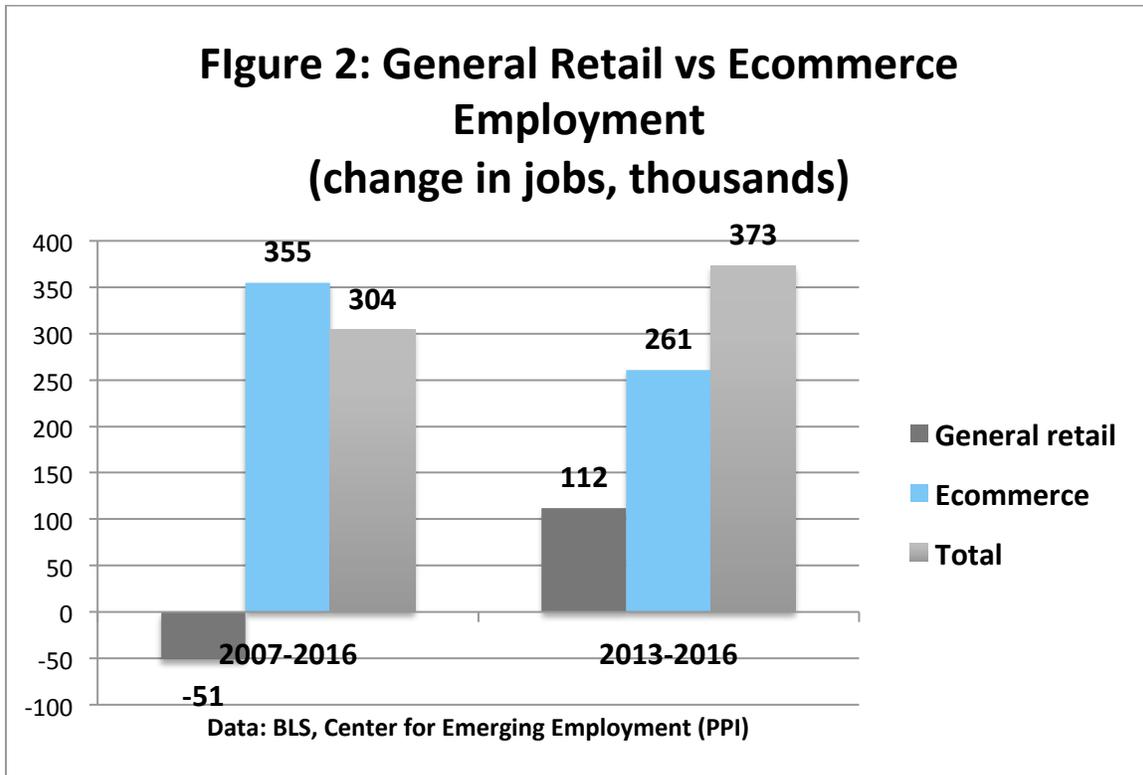
General Retail

General merchandise stores (including department stores, warehouse stores, and supercenters)
Clothing and clothing accessory stores
Sporting goods, hobby, book stores
Electronics stores*

*Depending on the particular data set, it is sometimes necessary to use the broader category of electronics and appliance stores.

Data: Center for Emerging Employment (PPI)

In recent years we have seen a shift of jobs from the general retail sector to the ecommerce sector, as ecommerce has become more important. Figure 2 compares job growth in ecommerce with job growth in general retail. We can see that, from 2007 to 2016, there was a small decrease in general retail jobs. But those jobs didn't disappear. Instead, they were shifted to the ecommerce sector; plus, many more were created. From 2007 to 2016, there were 355,000 new jobs created in the ecommerce sector. In total, there was a net increase of 304,000 jobs in the combined ecommerce/general retail businesses.



Even more remarkable is the job creation during the three-year period from 2013 to 2016. Combined, ecommerce and general retail added a total of 373,000 jobs over that stretch. That roughly equals the best three-year stretch for job creation by general retail in the 1990s (1997-2000).

These results do not support the criticism that the rise of ecommerce is destroying jobs. Instead, it appears to be creating more jobs. This counter-intuitive outcome makes more sense when you think about how ecommerce actually operates in practice. A consumer previously had to take a significant amount of time to drive to the shopping mall, walk through the aisles of the store to identify the shirt they wanted, stand on line to pay, and then drive home. Ecommerce moves these formerly non-market activities into paid work in order to increase convenience and allow consumers to use that time for other, more pleasurable activities.

What about the quality of these new jobs in ecommerce? Later in this paper, we

will compare wages in the ecommerce and general retail sectors in detail. To foreshadow that analysis, jobs in the ecommerce sector pay 27 percent more per hour than jobs in the general retail sector.

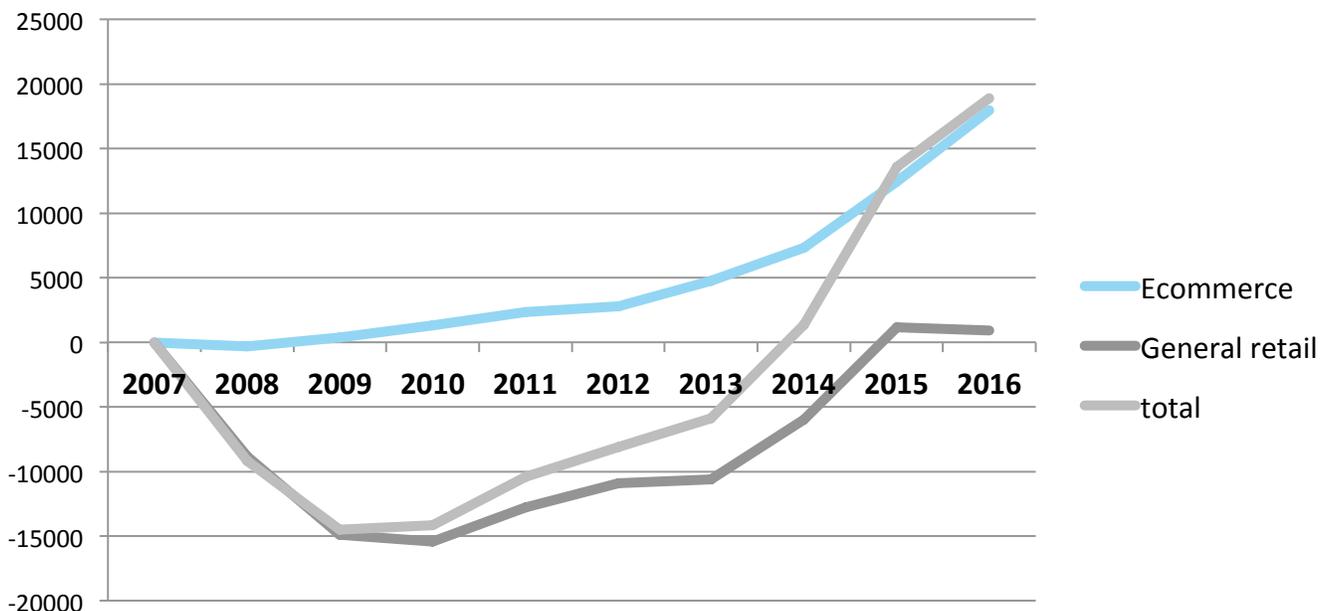
But, rather than looking at averages, which can be misleading, it is useful to examine the aggregate total of wages and salaries paid out by the ecommerce sector with the aggregate total of wages and salaries paid out by the general retail sector. If the shift to ecommerce is about cutting labor costs, as critics allege, then we would expect the aggregate wages and salaries in ecommerce to rise by less than the decline in general retail aggregate wages and salaries.

Figure 3 shows the change in aggregate wages and salaries in ecommerce and general retail, adjusted for inflation and compared to 2007. We can see that real wages and salaries in general retail fell sharply during the recession and recovered only slowly. As of 2016, they are only about \$1 billion above their 2007 level, measured in 2016 dollars. By contrast, real wages and salaries in the ecommerce sector barely dipped in the recession and are now almost \$18 billion above their 2007 level, measured in 2016 dollars.

In total, the combined wages and salaries in ecommerce and general retail have risen by almost \$19 billion since 2007, measured in 2016 dollars. That suggests the shift to ecommerce is improving the quality of jobs rather than reducing it.

Figure 3: General Retail Pay Recovers, Ecommerce Pay Soars

(Change in real wages and salaries since 2007, millions of 2016 dollars)

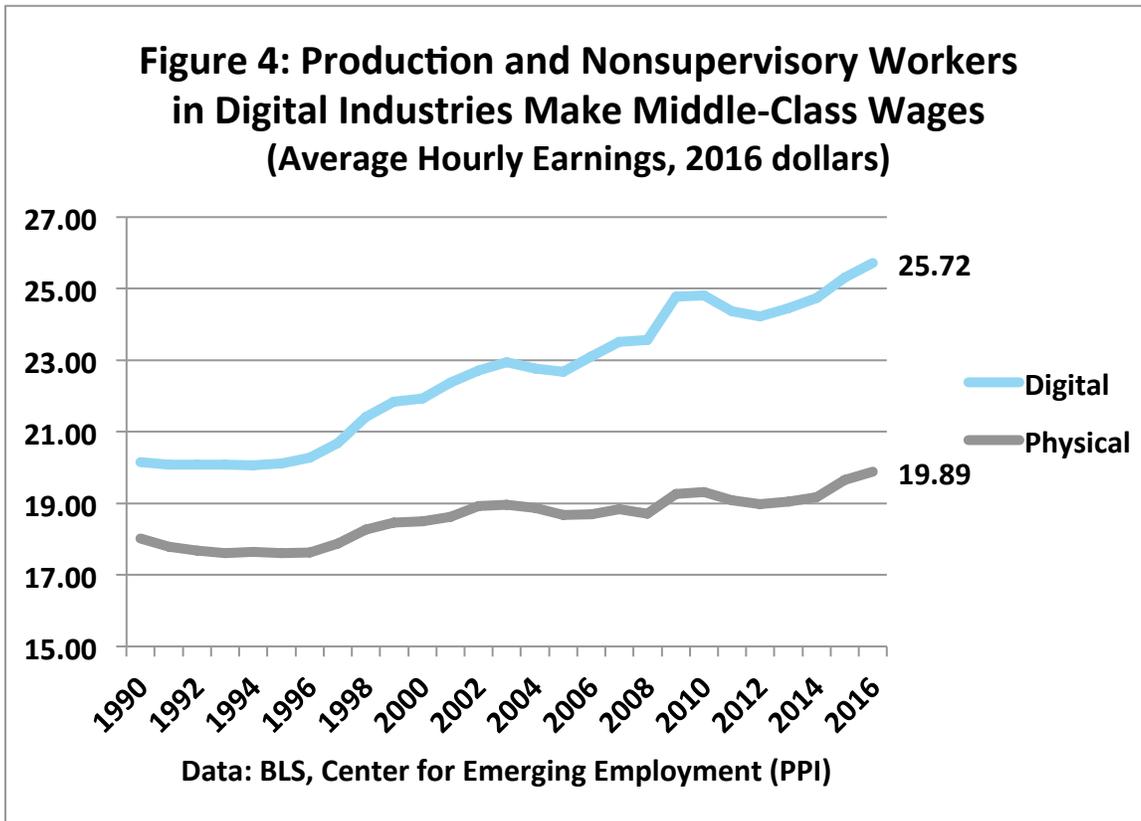


Calculated from weekly payrolls assuming 52 weeks in year
Data: BLS, Center for Emerging Employment (PPI)

Relative Pay

Is the digital boom creating middle-class jobs? So far we have shown the expansion of the digital sector compared to the physical sector—and the ecommerce sector relative to the general retail sector. In other words, workers are shifting from older, slow-growing industries to newer industries that are investing heavily in information technology.

But what kind of jobs are they getting? We start by using BLS data to calculate average hourly earnings for production and nonsupervisory workers in the digital and the physical sectors, adjusted for inflation.



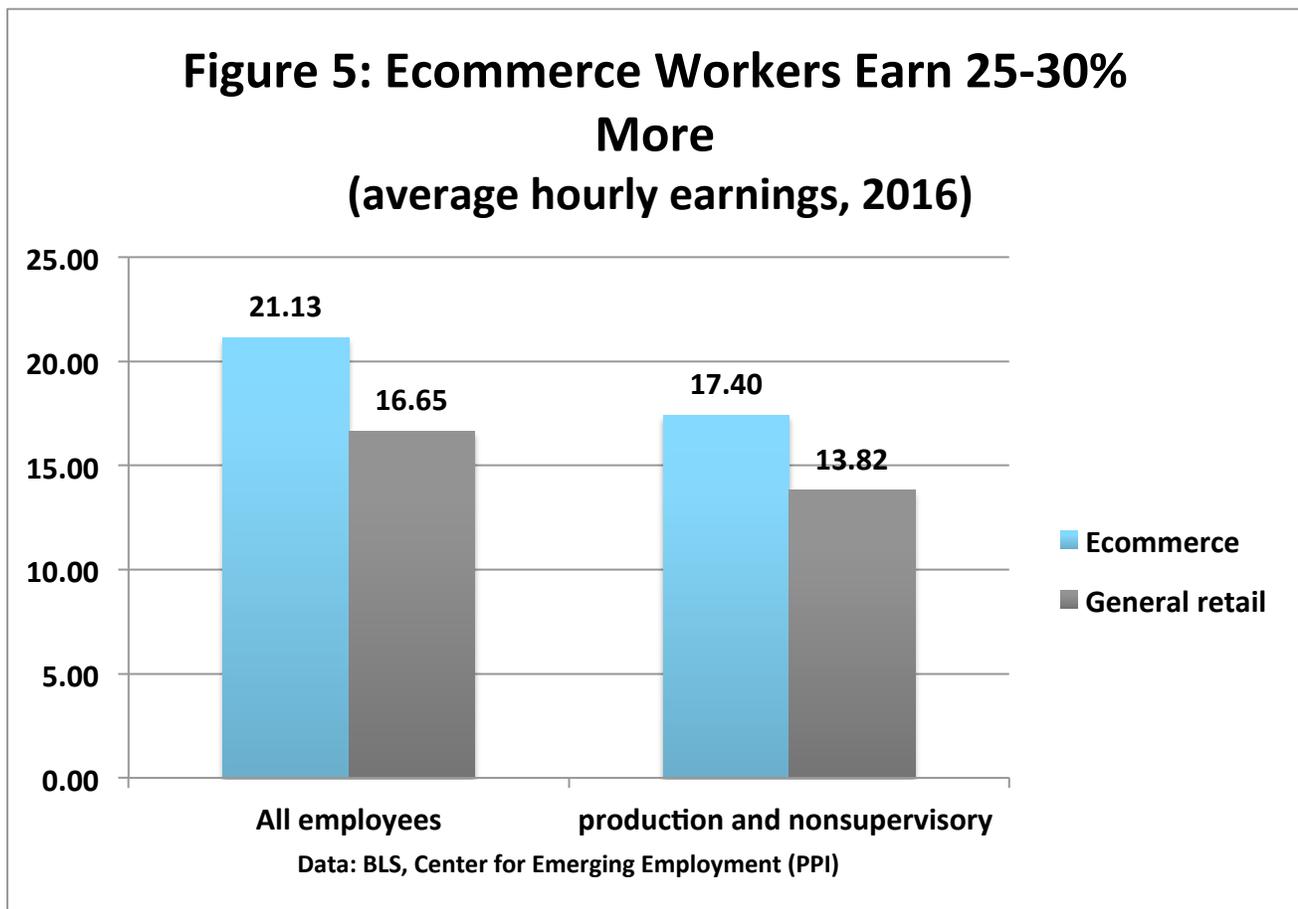
In 2016, the average hourly wage in the digital sector was \$25.72, which is roughly 29 percent higher than the \$19.89 earned in the physical sector (Figure 4).

Moreover, real hourly earnings are rising at a 1.2 percent annual rate in the digital sector, roughly twice as fast as the 0.6 percent annual rate in the physical sector.

Here's how to make sense of these numbers: Workers in the digital sector are averaging middle-class wages. Moreover, real wages in the digital sector are rising at a historically reasonable rate.

By contrast, workers in the physical sector are deep in a hole. At the current rate their wages are increasing, workers in the physical sector would take 40 years to

catch up to the wages being paid to workers in the digital sector today. But that calculation—which assumes workers stay in the physical sector—underscores the potential benefits of shifting to higher-productivity employers.



We can do a similar comparison between the wages being paid to workers in the ecommerce sector and in the general retail sector. Averaging over all employees, the pay premium for working in the ecommerce sector as opposed to the general retail sector is 27 percent (Figure 5). For production and nonsupervisory workers, average hourly earnings are 26 percent higher in the ecommerce sector compared to the general retail sector.

Of course, we must point out the obvious here—we have not yet actually shown that workers in the same occupation get paid more in the digital or ecommerce sectors compared to the physical or general retail sectors. The wage premium could reflect a bifurcated workforce, with a mix of high-wage and low-wage jobs, with nothing in between.

So now we focus on the pay in different occupational categories. (This analysis is based on May 2015 data from the Occupational Employment Statistics from the Bureau of Labor Statistics.) In particular, we look at mid-skill occupations such as office and administrative support; sales and related occupations; and installation, maintenance and repair occupations.

Table 3. Digital Industries Pay More for Mid-Skill Occupations

	Hourly mean wage, May 2015		Digital premium (percent)
	Digital	Physical	
Office and administrative support	18.14	16.42	10%
Sales and related	31.74	18.93	68%
Installation, maintenance, and repair	24.14	21.54	12%
Computer and math	43.18	36.85	17%

Data: BLS, Center for Emerging Employment (PPI)

We see that, in these middle-skill jobs, digital industries pay more than physical industries on average. For example, firms in the digital sector employed almost 8 million workers in office and administrative support occupations in 2015. These workers earned 10 percent more in the digital sector than in the physical sector, in part because digital firms are more productive and can afford to pay more. That 10 percent is worth 15 years of wage gains at current rates.

Similarly, firms in the digital sector pay 12 percent more, on average, for installation, maintenance and repair occupations, and 68 percent more for sales occupations.

Table 4. Ecommerce Pays More for Mid-Skill Occupations

	Hourly mean wage, May 2015		Ecommerce Premium (Percent)
	Ecommerce	General Retail	
Office and administrative support	16.36	12.81	28%
Sales and related	20.75	12.28	69%
Customer service	15.63	13.36	17%
Computer and math	36.92	27.18	36%

Data: BLS, Center for Emerging Employment (PPI)

We can do a similar analysis comparing pay for mid-skill occupations in the ecommerce sector versus general retail. For example, customer service representatives get paid 17 percent more, on average, in the ecommerce sector. This suggests that pay levels for similar occupations are higher in ecommerce.

The Amazon Critique

One of the oddities of the current debate over jobs is that ecommerce giant Amazon has come under attack for replacing low-paid jobs with better-paying jobs. For example, one recent article wrote:

While Amazon is adding jobs, retailers such as Macy's (M) and Sears are slashing staff and closing stores, partly due to increased competition from the online retailing giant, LaVecchia points out. "Amazon is destroying more jobs than it creates," she said. "It employs fewer people than other companies for the same amount of sales."

This, of course, is the very definition of higher productivity, which should lead to higher pay for workers in the ecommerce industry. And that's what appears to happen. Amazon reports: "We pay our fulfillment center employees 30 percent more than traditional retail stores." While there is no way to independently verify these figures, they are generally consistent with the wage premiums between the ecommerce and general merchandise stores reported by BLS.

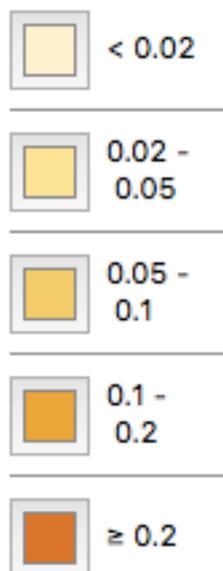
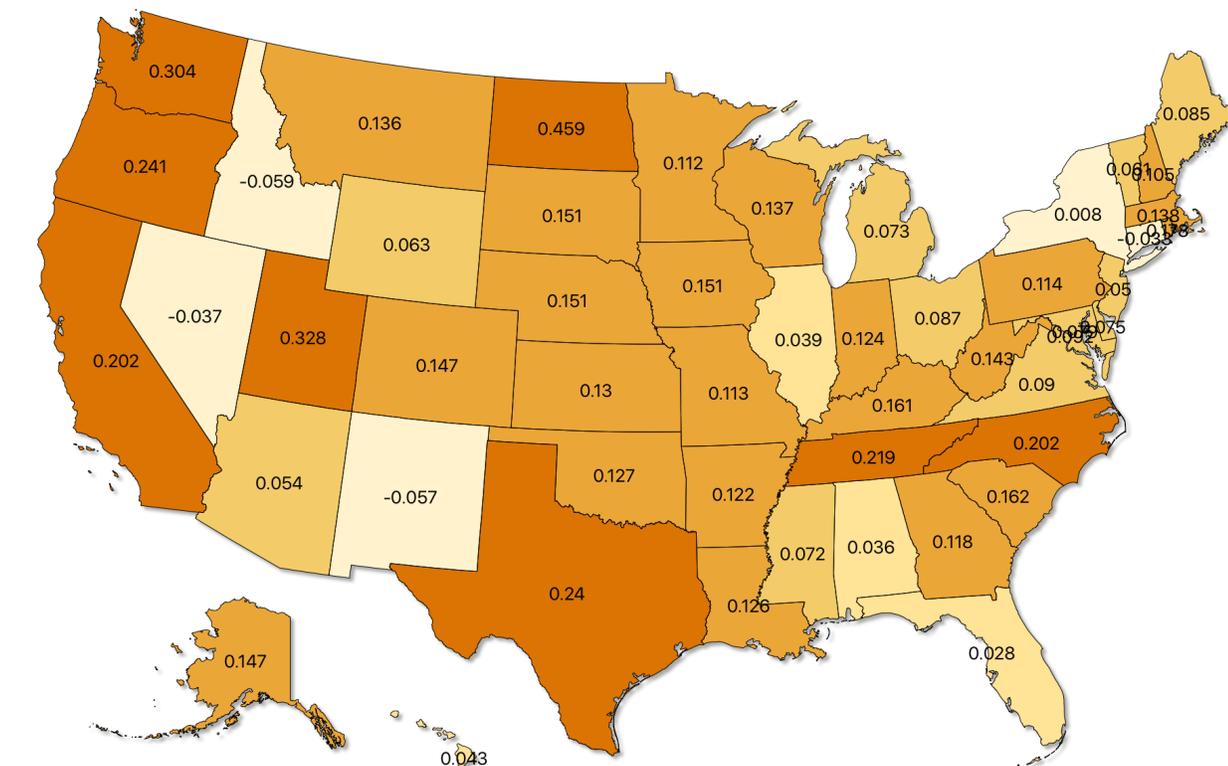
Moreover, it is peculiar that activists are trying to present conventional jobs in the retail sector as desirable. That's odd, considering that general merchandise stores—including department stores and discount retailers—pay only \$12.28 per hour, on average, for production and nonsupervisory workers. Real wages in this industry have fallen since 2007.

To all appearances, Amazon is following in the footsteps of industrial giants such as General Motors and General Electric: high-productivity enterprises that can afford to pay higher wages and gradually enable workers to shift to these higher paying opportunities.

Geographic Distribution

To the degree that the digital boom is creating a new middle class, it's important to know whether the gains are geographically concentrated. Data from the Bureau of Labor Statistics enable us to assess the economic impact of the digital and ecommerce sectors on a state-by-state basis. We start by calculating, for each state, the percentage change in real wage and salary outlays by the digital sector since 2007.

Figure 6: Percentage Change in Real Wage and Salary Outlays in the Digital Sector, 2007-2015

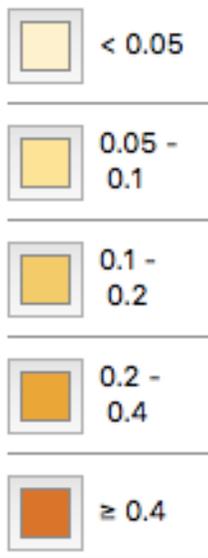
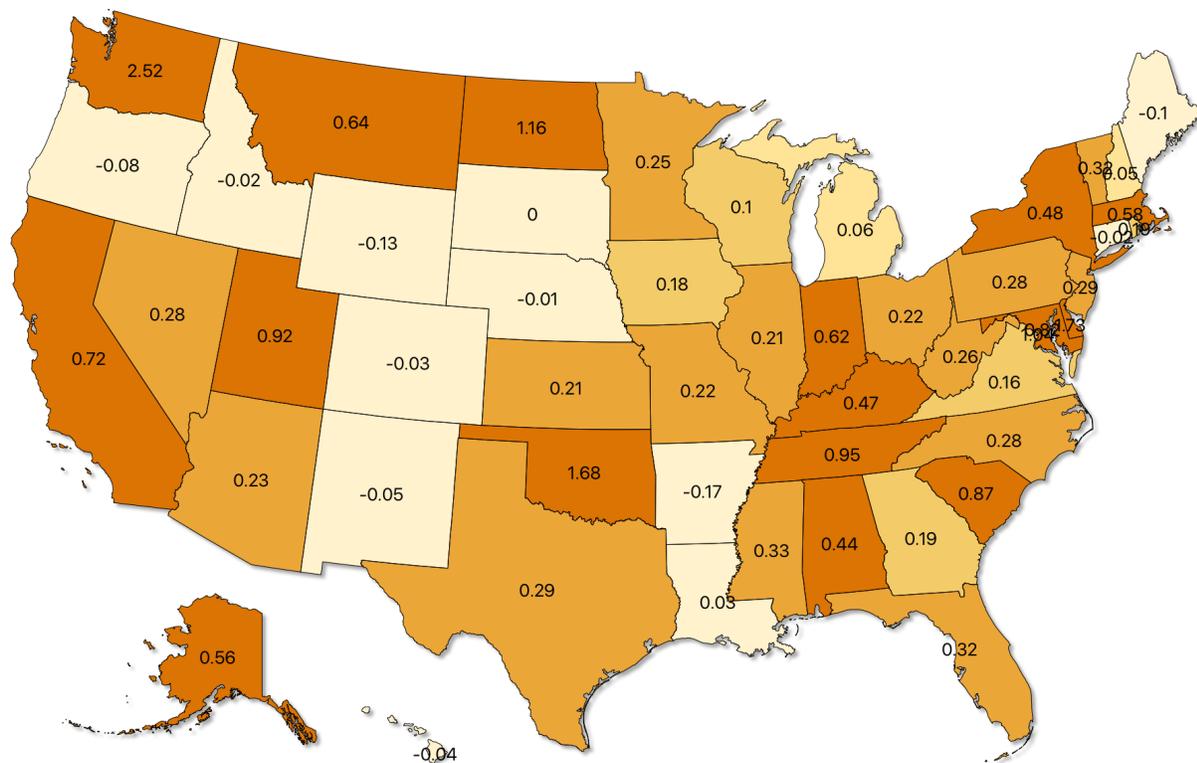


The states colored dark brown in Figure 6 have more than a 20 percent increase in digital sector pay since 2007. Not surprisingly, the Pacific Coast states have fast-growing digital sectors, as does Texas. Less anticipated are the big gains in Tennessee and North Carolina, which are driven in part by ecommerce expansion and by a growing tech sector.

But the gains are even more widespread than that. As the map shows, 30 states have more than a 10 percent gain in real digital pay from 2007 to 2015. They are spread across the entire country, from Georgia through Kansas and up to Washington. In fact, there is no obvious regional pattern in digital sector growth.

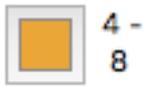
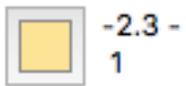
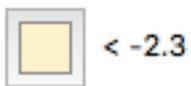
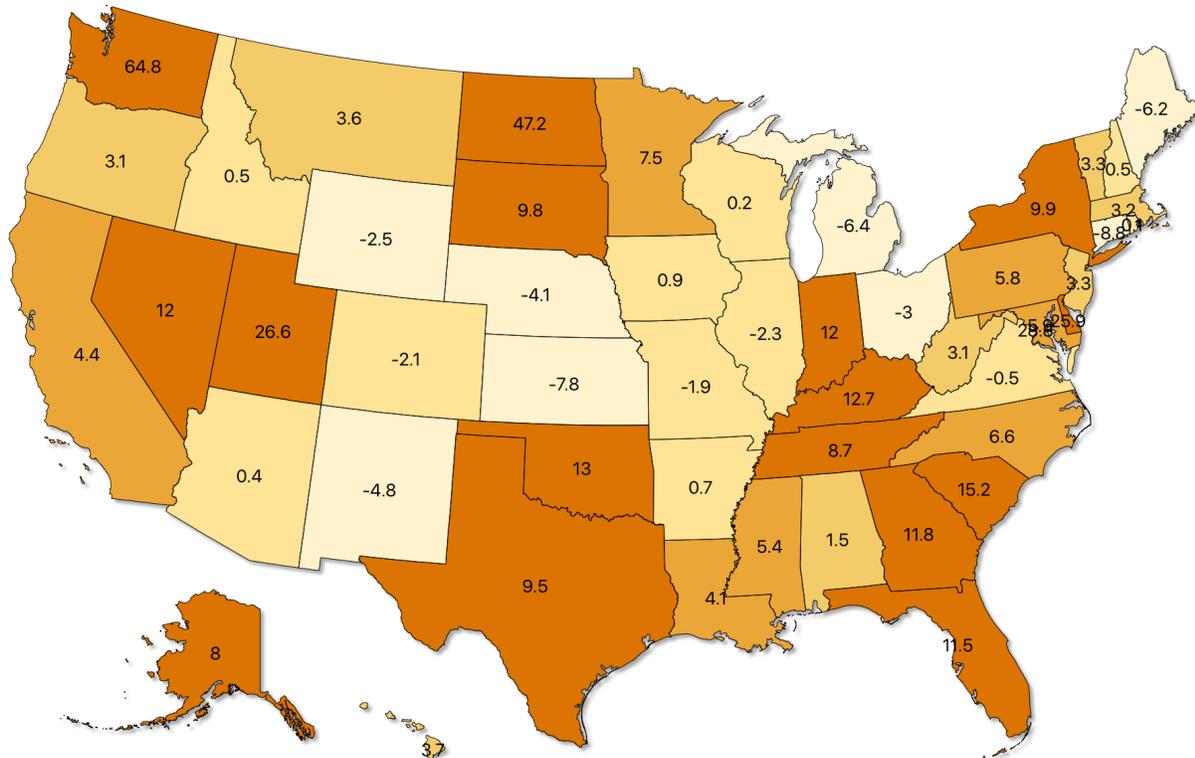
The same cannot be said for the next map. Figure 7 identifies the states where the gain in real digital wages and salaries exceeds the gain in real wages and salaries in the physical sector. We see a strongly regional pattern, where the Pacific states have a relatively strong digital sector, as do the Midwest and Southern states—perhaps reflecting the weakness of the physical sector.

Figure 8: Growth of Ecommerce Real Wages and Salaries, 2007-2015



Our final map combines the real wage and salary spending for both the ecommerce and general retail sectors (Figure 9). Top performers include Washington state, Delaware, and Kentucky, but not California or Massachusetts. In other words, the benefits of ecommerce show no sign of being concentrated in any one region of the country.

Figure 9: Growth of Real Wages and Salaries for Combined Ecommerce and General Retail, 2007-2015



Better Jobs for Workers, Lower Prices for Consumers

We've made the case in this paper that the successful companies in the digital sector have reached a size where they are having a major employment impact. They are offering higher wages. Thus, the number of better-paying jobs grows and begins to raise living standards.

Indeed, we are beginning to see the shape of a new middle class: mid-pay, mid-skilled administrative and customer support; sales; and installation, maintenance, and repair positions. The process could and should continue for years or even decades. Indeed, in an earlier paper, we estimated that only about 25 percent of the economy had been digitized.

What about the benefits to consumers? Prices in the digital sector have risen only 0.8 percent per year—far slower than the 2.4 percent rate of price increases in the physical sector. In other words, even slow income growth enables Americans to have a rising standard of living for digital products and services.

The ecommerce situation is interesting. The BLS tracks producer prices for retail industries, which it measures as gross margins.¹⁶ Between 2007 and 2016, gross margins in ecommerce rose by 4.6 percent. By comparison, gross margins in general retail rose by 9.7 percent—more than double the increase. This difference reflects, in part, slower cost increases in ecommerce because of faster productivity growth. In addition, a 2014 report from the BLS notes that “margins for the electronic and mail-order shopping industry group have been shrinking, likely because of increased competition in the e-commerce market. Brick-and-mortar retailers, by contrast, have broadened their margins to cover their rising rent and marketing expenses.”¹⁷

In other words, as far as we can determine, the growth of ecommerce is shifting workers from low-paid jobs at retail stores to better-paid jobs in ecommerce. This is exactly what we would expect given the rapid growth of productivity in ecommerce—part of the gains go to customers in the form of slower growth of retail margins, and part of the gains go to workers.

Coda

This paper (Part I) analyzed job and wage patterns in the digital sector and the ecommerce sector. In Part II, we will examine job and wage patterns in the telecom and tech industries, showing how these industries are contributing to the new middle class. Then we will address policy prescriptions.

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- ³ <http://www.pewsocialtrends.org/2015/12/09/1-the-hollowing-of-the-american-middle-class/>
- ⁴ "Amazon and Walmart are hiring, but how good are these jobs?," January 19, 2017. <http://www.cbsnews.com/news/amazon-walmart-retail-hiring-wages/>
- ⁵ Assuming 2,080 hours in a full year.
- ⁶ Chad Syverson. 2011. "What Determines Productivity?" *Journal of Economic Literature* 49:2, 326–365
- ⁷ Dan Andrews, Chiara Criscuolo and Peter N. Gal. 2015 "Frontier Firms, Technology Diffusion and Public Policy: Micro Evidence from OECD Countries," OECD
- ⁸ Foster, Lucia, John Haltiwanger, and C. J. Krizan. 2006. "Market Selection, Reallocation, and Restructuring in the U.S. Retail Trade Sector in the 1990s." *Review of Economics and Statistics*, 88(4): 748–58.
- ⁹ That structural problem is the whole point of Clay Christenson's *Innovator's Dilemma*
- ¹⁰ Census Bureau, 1975. *Historical Statistics of the United States* Chapter D, page 162, 166.
- ¹¹ <http://www.autonews.com/article/20030616/SUB/306160722>
- ¹² This data is mostly pulled from contemporary annual reports. We pick 1919 to avoid World War I and the downturn of 1920-21, and 1955 as the initial return to a normal economy after the Korean War, World War II, and the Great Depression.
- ¹³ An important caveat: The employment figures from the annual reports include overseas jobs as well as jobs outside of manufacturing, so we can't do a direct comparison.
- ¹⁴ "Long-term Productivity Growth and Mobile Broadband: The Road Ahead" <http://www.progressivepolicy.org/issues/economy/long-term-u-s-productivity-growth-and-mobile-broadband-the-road-ahead/>
- ¹⁵ Amazon reports employees per state here <https://www.amazon.com/p/feature/nsog9ct4onemec9#IN>
- ¹⁶ Producer prices for retail industries track "changes in prices received, less the acquisition price of goods." <https://www.bls.gov/opub/btn/volume-1/wholesale-and-retail-producer-price-indexes-margin-prices.htm>
- ¹⁷ <https://www.bls.gov/opub/btn/volume-3/trends-in-producer-prices-between-e-commerce-and-brick-and-mortar-retail-trade-establishments.htm>