

THE ECONOMY GOES TO COLLEGE

The Hidden Promise of Higher Education in the Post-Industrial Service Economy

Anthony P. Carnevale & Stephen J. Rose



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GEORGETOWN UNIVERSITY



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ABSTRACT

The U.S. economy has undergone a fundamental transition from an industrial economy centered around high school-educated workers to a post-industrial service economy in which the typical middle-class worker has at least some postsecondary education or training. Roughly 20 percent of the rising demand for college-educated workers derives from a shift in economic consumption from less education intensive goods production to more education intensive services – from high school-educated blue collar workers in industries like manufacturing to college-educated white-collar workers in industries like finance, information technologies, healthcare, business services, education, and government.

But most of the upskilling and increasing college wage premium, the difference in earnings between college graduates and high school graduates, is accounted for by huge changes not in what we consume, but in *how* we produce more complex kinds of value added in what we consume. We have moved from an industrial economy based on the mass production of low-cost standardized goods and services to a more complex mix of economic value added. Cost efficiency is still a core concern but economic value has expanded to include much higher levels of quality, variety, customization, convenience, timeliness, innovation, and novelty as well as a growing sensitivity to social responsibility.

To deliver on this new value mix, institutional structures have also shifted away from the two dominant organizational forms in the industrial era. The signature organizational format was the vertically integrated top-down behemoths of

big business and big government. These densely bureaucratic giants delivered on standardized goods and services at least cost but failed to deliver on quality, innovation, customization, convenience, and speed. The second organizational format typical of the industrial era was the fragmented delivery structure of services such as education and healthcare that had difficulty delivering cost efficiency or consistent quality.

Organizational networks that maximize efficiency, innovation, and direct customer or client involvement are displacing both the vertically integrated industrial hierarchies and the fragmented structures in service industries. Networks allow cars to be assembled with precision parts from a hundred suppliers worldwide and customized for individual car buyers; healthcare can be customized through networked specialists, and education can be delivered anywhere anytime. These networks of production and service delivery tend to be driven by measured performance standards focused more on outcomes than inputs or unmeasured reputational value. Everything from baseball to learning and earning by college major gets measured for effect. The diversity of capabilities possible in network structures allows a more complex mix of value added.

The more expanded performance standards as well as the new learning networks require workers with both broader and deeper knowledge, skills, and abilities both for entry level jobs and to keep up with the accelerated pace of lifelong learning necessary on the job.

The increasing scope of economic value produced by production and service networks would not be possible without information technology – i.e., the computer in all its manifestations. Spending on information technology as a percentage of all business fixed investment has grown from near zero after World War II to nearly 50 percent today. Information technology makes many new forms of value added possible. It monitors quality in production and in the use of goods and services. Information technology provides the flexibility to tailor goods and services to smaller markets and even to individual customers. In addition, by integrating producers and consumers into economic networks, it helps create an environment in which goods and services can be delivered globally or locally in a convenient and timely manner.

Modern information technology is ultimately biased in favor of highly skilled workers because it complements more than it substitutes for skill. Computer technology automates repetitive tasks but leaves non-repetitive tasks and higher levels of human interaction to workers who in turn require higher levels of cognitive and non-cognitive competencies.

In order to understand the value chains in these economic networks, we have drilled down below the surface data on jobs, earnings, and educational attainment into the real economy. This type of economic analysis allows us to get underneath the hood of the nation's economy to reveal every phase of the usually unseen value chain that underlies the production, distribution, and retailing of every good or service. Our findings are based on an historical analysis of the annual input-output (I-O) tables produced by the Department of Commerce's Bureau of Economic Analysis between 1997 and 2007.

Key to our study is the in-depth analysis of what workers actually do on the job ("functional analysis"), which shows that managerial or professional office work has become the central core of these new production and service networks. The key growth in U.S. employment has come in offices and non-office settings like hospitals and schools that provide higher-skill services; nearly two-thirds of Americans now work in these higher-skill workplaces.

- Between 1967 and 2007, the share of high-skill managerial and professional jobs grew by more than 13 percentage points, from 22 percent to 35 percent of total U.S. employment.
- And contrary to conventional wisdom, the good jobs in the middle haven't been "hollowed out" by the collapse in manufacturing; despite de-industrialization, the share of middle-skill jobs declined only modestly from 39 percent to 36 percent of the overall workforce. Mid-skill jobs have declined only slightly, but have shifted from high school-educated industrial workers toward industrial technicians and service workers with at least some college.
- Over that time, the share of low-skill jobs actually fell from 39 percent to 29 percent of the workforce.

The emergence of the post-industrial production and service networks is both a good news and a bad news story. Workers with some college education have greater choice as consumers and higher earnings as workers but workers with high school or less have been left behind both as consumers and as workers. And the divide between college haves and have-nots has become a significant structural cause of growing earnings inequality.

INTRODUCTION

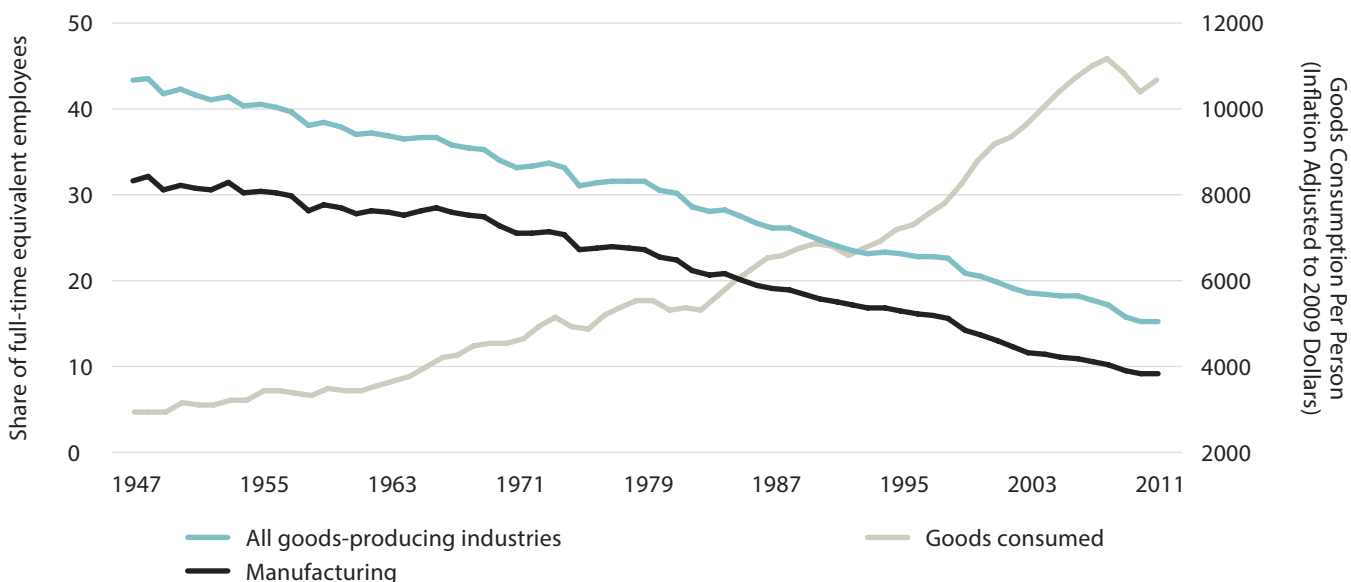
The transition from a manufacturing to a service economy led to the parallel shift from a high school to a college economy.

This report explores the crucial transformation of the United States from an industrial to a post-industrial economy, with a particular focus on the shifting skill levels and incomes of American workers. It shows the increasing value of postsecondary education in today's economy and examines how workers have fared as the nation's focus has shifted from manufacturing to the delivery of services like healthcare, education, and finance and business services. In 1947, more than 40 percent of U.S. employment was in goods-producing industries (manufacturing,

mining, agriculture, and construction). By 2011, this share had dropped to less than 15 percent (Figure I).

Despite this sharp decline in the share of goods-producing workers, goods production in the United States has *not* been in free-fall. A vast increase in productivity allowed goods-producing employers to increase output dramatically without hiring more workers. Between 1947 and 2011, goods in America almost quadrupled, increasing from \$3,000 per person to \$11,000 per person in inflation-adjusted dollars. These huge productivity gains meant employment in goods-producing industries remained flat at 26 million even as the

FIGURE I. The employment share of goods-producing industries plummeted while productivity soared.



Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Department of Commerce, Bureau of Economic Analysis, 1947-2011.

overall U.S. workforce surged from 57 million workers in 1967 to 139 million in 2011. America created 82 million new jobs during those 40 years and all of them were in service industries.

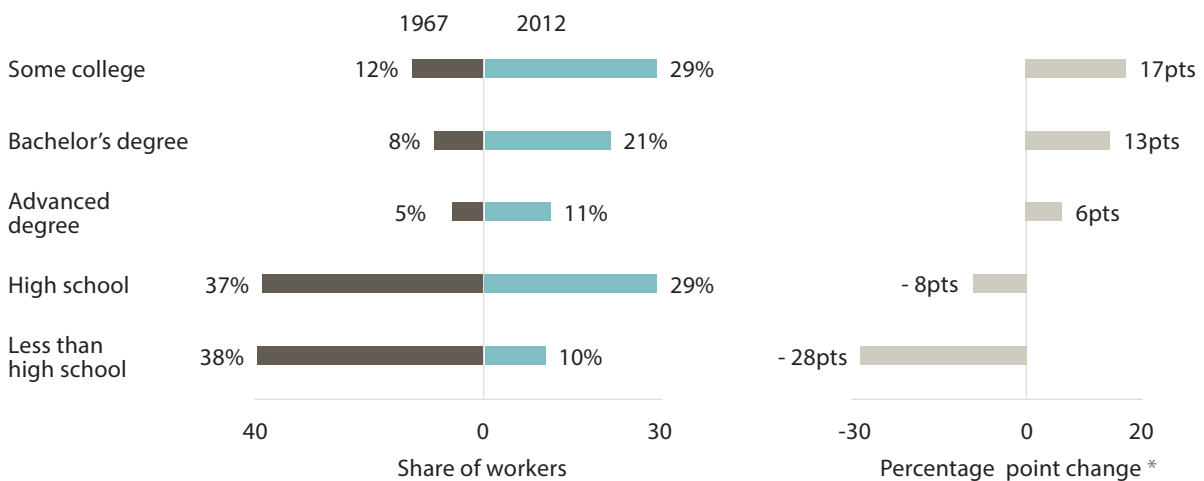
What are we to make of this new post-industrial service economy? Many are worried. They see an economy out of balance, with low-skill, low-pay, and dead-end service jobs replacing the good manufacturing jobs of the past. They wonder where the middle-class jobs of the future will come from.

And yet, at the same time that we've been hearing this narrative of national decline, the education level of America's workforce has skyrocketed. In the 45 years between 1967 and 2012, the proportion of high school dropouts fell from 38 percent of adults to just 10 percent, while

those with a four-year college degree or more rose from 13 percent to 32 percent. Looking at postsecondary education as a whole, those with at least some college went from one-quarter of adults to 61 percent of the workforce (Figure II).

This is a remarkable upgrading in the skills of America's workers. And demand is apparently high for these elevated levels of skill, as employers are paying substantially more for workers with postsecondary education.¹ The college wage premium – the difference between the average wage of college- and high school-educated workers – has spiked since 1973. By 2007, that difference had reached 82 percent for men, compared to 38 percent in 1973. The story was similar for women, with the college wage premium rising from 50 percent to 75 percent over that time.

FIGURE II. Between 1967 and 2012, the share of high school dropouts in the workforce declined by 28 percentage points, while the share of workers with at least a Bachelor's degree increased by 19 percentage points.



Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Census Bureau, *Current Population Survey*, 1967-2012. * Values may not sum to total due to rounding.

How does this picture of a service economy rich with high-skill, high-wage jobs jibe with the popular portrait of a declining manufacturing economy stricken with low-skill, low-wage “McJobs?” How do all those highly educated workers fit into those low-skill slots? The answer is they don’t. This report traces in detail where these educated workers do fit into America’s new service economy and what they’re doing.

In short, the shift in America’s workforce has not been from factories to fast-food outlets. Rather, the key growth in U.S. employment has come in offices and non-office settings like hospitals and schools that provide higher-skill services; nearly two-thirds of Americans now work in these higher-skill workplaces.

The U.S. economy’s largest and fastest growing sectors – business services, finance, healthcare, and education – are service sectors that have been clamoring for more educated workers and powering the dramatic upskilling of America’s occupational structure. The rising value of education and training – especially postsecondary education and training – has been caused by the ongoing growth in these post-industrial service jobs. Advances in information technology and the rise of complex consumption and production networks have also been key factors in America’s economic growth since the 1960s. This expansion of technology has only increased the demand for educated workers who can utilize that technology.

Using Input-Output Analysis to Understand the Role of Education in Value-Added Chains

These striking findings are rooted in an innovative input-output (I-O) analysis of the U.S. economy developed for this report – a type of economic analysis that allows us to get underneath the hood of the nation’s economy. **Our analysis utilizes two key data sources: input-output tables compiled by the U.S. Bureau of Economic Analysis that measure all economic activity in the United States; and comprehensive surveys of U.S. workers in the March Supplements of *Current Population Survey* (CPS) that detail workers’ educational and occupational backgrounds.**

The analysis of the I-O tables reveals every phase of the production, distribution, and retailing of a good or service; this is the usually unseen value chain that underlies every good or service. With I-O analysis, we can see all the links in that value chain,

including the vital business-to-business transactions that take place before the final sale to the consumer. It’s the changes in those business-to-business relationships – which are usually the longest part of the value chain – that have been the main engines of change in the post-industrial service economy.

To see how those changes are impacting American workers, we then conduct a workforce analysis that looks at the Bureau of Labor Statistics (BLS) surveys of U.S. workers in tandem with the I-O tables. This workforce analysis uncovers the skill and education levels of workers involved at each step in the value chain of a good or service. (The workforce analysis is broken into two parts – an “occupational analysis” and a “functional analysis” – which are defined later in the report.)

This comprehensive look at the workforce offers crucial insights into why some American workers have been doing so well in our post-industrial economy while others are falling so far behind.

The analysis in this report is focused most heavily on the years after 1967. That's partly because of limitations in the I-O data before 1967, but also because during the 30 "golden years" after World War II the U.S. economy still retained many of the characteristics of the manufacturing era. Even though the share of goods-producing workers began declining in 1947, up until the mid-1970s many large firms were still involved in monopolistic market arrangements with other large firms, which kept prices and profits high. In this environment, American unions still had substantial power and extracted high wages and benefits from major employers. That price-setting power in turn lifted the pay of workers in other highly unionized industries in construction and transportation.

The high growth and low unemployment of that era proved unsustainable, however, and that economic model began crumbling during the mid- and late-1970s. Those years of high inflation and slow growth were then followed by a double-dip recession in 1979 and 1981. That downturn was driven largely by the high interest rates set by Federal Reserve Chairman Paul Volcker, who was committed to wringing inflation from the economy. Although few knew it at the time, the economy after 1983 would not return to its old ways, as the pay and percentage of jobs in goods-producing industries would be progressively squeezed.²

Since the economic tumult of the late 1970s and early 1980s, there has been a pronounced rise in the wages of high-skill, college-educated workers and a troubling decline in the pay of workers without a college degree. In previous research, we demonstrated that the growing gap between the supply of college talent and employer demand has driven the wage gap between the educational haves and have nots. That research showed that employer demand for college-level talent has been rising at about 3 percent a year since the early 1980s while the U.S. education system has only been increasing the production of college-level talent by roughly 1 percent annually.

Employers have raised wages to chase an undersupply of college talent. The rising share of baby boomers with college degrees was easily absorbed by an economy that required more advanced skills than ever before. Indeed, far from being overeducated for their jobs, our research indicates that today's workers are, if anything, undereducated for the skill demands of the new post-industrial service economy.

Our research shows that new technologies and the production and service networks they enable have brought about a sea change in both the entry-level skills employers seek and in the lifelong learning needed in today's workplaces. The transition from an industrial to a post-industrial economy has resulted in a shift from an economy rooted in high school-level skills to an economy anchored in postsecondary education and training. This shift is evident in the 10 mutually reinforcing trends detailed below.

Ten skill-biased trends have defined the post-industrial economy.

The findings in this report allow us to identify 10 trends in the post-industrial economy that have been driving the creation of *more* – not fewer – high-skill jobs in the U.S. workforce. This is the counterintuitive logic of our new service economy that many Americans have had trouble grasping. They look at the declining percentage of manufacturing jobs in America – and the wrenching change that has wrought in many lives – and assume that manufacturing’s decline has coincided with a deskilling of the U.S. workforce. But that has not been the case. Although advances in technology have increased productivity and thus reduced the demand for manufacturing workers, the growing importance of technology in the overall economy has *increased* the demand for educated workers who can utilize it. This increasing demand for highly educated workers arguably has been the defining feature of our post-industrial economy. The 10 trends below show in detail what has been driving the upskilling – not the deskilling – of the American workforce.

First, the transition to a skill-intensive service economy is rooted in increased productivity in the extractive (i.e., farming and mining) and manufacturing sectors. The result has been: a dramatic increase in output and a parallel decline in employment shares in these goods-producing sectors; increased educational requirements for the jobs that remain in these sectors; and a productivity dividend that has allowed consumption to shift away from these relatively low-education sectors.

Agriculture, for example, has gone from employing 80 percent of the U.S. labor force in 1800, to 40

percent in 1900, and to less than 2 percent in 2000. At the same time, agricultural output over the past 200 years has increased by at least 20 times per worker. Similarly, the sharp drop in the share of manufacturing jobs since 1950 has been accompanied by a dramatic rise in output per worker. Technological advances have been key drivers of this growth in productivity, which has meant that even in these relatively low-education sectors there has been an increase in workers’ education levels.

The productivity increases in agriculture and manufacturing have made food and many other goods much less expensive. That has freed consumers to spend more heavily on other goods and services, as is detailed in the next trend.

Second, the changes in Americans’ consumption patterns have led to the expansion of sectors with more highly educated workers. The dramatic productivity gains in agriculture and manufacturing have allowed Americans to reduce their spending in these sectors, which have relatively low-educated workforces. Between 1947 and 2007, food and clothing dropped from 46 percent of immediate consumption to just 18 percent. Over the same period, spending on healthcare increased from 5 percent to 20 percent of total consumption. There were also substantial gains in the business services, education, and government sectors, which all have highly educated workforces.

As the agricultural and manufacturing shares of the economy have declined, the extractive and industrial products like food and clothing, which have less educated workforces, have declined in importance while services like education,

healthcare, information, finance, and business services (all of which have highly educated workers) have increased as a share of total consumption.

Consumption patterns have not only shifted toward service industries that already had higher levels of postsecondary education, but the demand for postsecondary workers also has grown the most in these same industries. For example, the share of healthcare workers with a high school education or less declined by 43 percentage points between 1967 and 2007, (from 74 percent to 31 percent) while the share with some college increased by 19 percentage points (from 18 percent to 37 percent) and the share with a Bachelor's or graduate degree jumped 24 percentage points (from 8 percent to 32 percent).

This shift in consumption patterns accounts for roughly 20 percent of the upskilling that's occurred in the U.S. workforce since 1967.

Third, the upskilling of America's workforce is mostly driven by changes not in what we produce, but by changes in how we produce it – i.e., by changes in “production recipes.” Production recipes are the complex mix of inputs needed to provide a good or service, and they have been changing dramatically throughout the U.S. economy. Many of these changes are somewhat hidden because they involve the growth of business-to-business intermediate sales or structural changes within firms as more employment is concentrated in front-office functions and less in direct production.

These new production recipes require more complex value-added chains that shift more work toward employees with at least some postsecondary

education. Even the value-added networks that produce basic commodities like food are a case in point: today, farmers account for only 5 percent of the value added in food production. Almost 20 percent of the value added in the food network comes from the bankers, insurance firms, advertisers, and other business services involved in bringing final food output to the table.

The food network is also a classic example of the shift from unpaid household labor to commercialization in service functions and the increase in education and training that has accompanied that shift. We've come a long way from an agrarian society in which a substantial share of food was produced, prepared, and eaten at home; to an industrial society in which food was produced commercially, sold to households, and primarily prepared and eaten at home; to a more complex post-industrial economy in which nearly half our spending on food and drink is consumed away from home. Twelve percent of food value comes from grocers and 16 percent from restaurants. And while there may have been nothing better than grandma's home cooking, the commercial production and preparation of food that has replaced grandma's fare requires many workers with considerably more education and training.

Eighty percent of the upskilling in the overall American economy is accounted for by changes in production recipes.³

Fourth, increasing wealth from productivity growth has empowered consumers to demand more sophistication in the creation and delivery of goods and services. Competition in a growing number of industries has led

firms to shift away from producing low-cost standardized goods and services and to embrace quality,⁴ customization, convenience, innovation, social responsibility, and brand consistency.

In today's economy, plain vanilla is no longer good enough. Variety and the customization of goods and services have become key competitive principles. New cars now come with a dizzying array of options, and the old world of three TV networks has been replaced with thousands of cable channels. Increasingly, consumers have neither the time nor patience for shoddy goods or second-rate services. They want quality goods and services tailored to their needs. In American manufacturing, for example, defect rates had become uncomfortably high, but they dropped quickly with the adoption of new technologies, new carefully measured quality standards, and workers skilled in quality control.

Consumer tastes have grown more demanding and diversified due to a mix of economic and demographic forces. As Americans have gotten richer, a smaller share of their income has gone to the basics of food, clothing, and shelter. That's allowed them to buy a wider variety of goods and services – and these aren't utilitarian purchases, so consumers are looking more and more for quality, convenience, and sophistication. On the demographic front, the entry of women into the workforce has been a key factor in the changing structure of the American family. As a result, personal tasks like child care that were traditionally performed at home are increasingly being commercialized. The commercialization of such services inevitably expands market standards beyond price competition. And that's happening with many

other goods and services, too, as Americans' purchasing decisions are being driven more and more by ethical, environmental, and health concerns.

As consumers have demanded more from companies, those companies have demanded a deeper and broader set of skills from their workers: not just cognitive skills, but interpersonal skills and other non-cognitive competencies. Employers have raised entry-level educational requirements for their workers and expect them to engage in lifelong learning on the job.⁵ Producing today's high-quality goods and services requires employees to have a deeper knowledge of their fields of study and a better understanding of applications on the job. Growing demands for variety and customization require the flexibility to master short production runs and various consumer interactions. Greater expectations of convenience, customer service, and social responsibility require empathy for the customer or client. The endless quest for innovation requires deep domain knowledge, critical thinking skills, creativity, and a tolerance for change.

Fifth, the increasing scope of economic value would not be possible without the rise of information technology – i.e., the computer in all its manifestations. Spending on information technology as a percentage of all business fixed investment has grown from near zero after World War II to nearly 50 percent today. Information technology makes many new forms of value added possible. It monitors quality in production and in the use of goods and services. Information technology provides the flexibility to tailor goods and services to smaller markets and even to individual customers. In addition, by integrating producers and consumers into

economic networks, it helps create an environment in which goods and services can be delivered globally or locally in a convenient and timely manner.

Modern information technology is ultimately biased in favor of highly skilled workers because it complements more than it substitutes for skill.⁶ In the workplace, information technology is both a substitute for and a complement to human skill. Computer technology automates repetitive tasks but leaves non-repetitive tasks and higher levels of human interaction to workers who in turn require higher levels of cognitive and non-cognitive competencies. Virtually all workers now have non-routine interactions with more powerful and flexible technology. Computers have become more like an artisan's tool reflecting complex human input and less like the single-purpose mass-production machines characteristic of the industrial economy.

Today, for every task surrendered to automation, new opportunities are generated for exploiting the technology's capabilities. Moreover, the more flexible and powerful the machinery, the more employees, work teams, and organizations must increase their skills to fully deploy its technical capabilities. These more flexible and powerful technologies work best in combination with more flexible and highly skilled workers to deliver quality, variety, customization, convenience, brand consistency, speed, and innovation at the lowest cost.

Sixth, widely distributed information technology allows the shift to complex learning networks driven by widely shared information, measured outcome standards, and direct consumer participation – making these new networks

the dominant form of organization for both consumption and production in all industries. These flexible networks use information technology to integrate production, minimize cost, and engage customers. The growth of networks of production and service delivery has gradually displaced the two dominant institutional forms typical of the industrial economy.

The signature institutional format in the industrial era was the massive vertically integrated company where absolute authority at the top of the managerial pyramid was transmitted through tiers of middle managers to compliant workers at the point of production or service delivery. In the interest of top-down control, job assignments were carefully circumscribed and tasks were carefully matched to single-purpose technologies that automated skill in the interest of efficient mass production of standardized goods and services. The ideal industrial organization was both vertically and horizontally integrated. At the peak of the industrial era, the Ford Motor Company famously shipped sand, iron ore, and coal into one end of its mammoth River Rouge plant and finished cars out the other. The central role of organizational development and technology was to reduce cost, not to add quality, variety, customization, convenience, or persistent innovation.

The second dominant organizational form of the industrial era – which persists in some sectors today – is the chaotic structure of service industries like healthcare and education. These fragmented structures tend to operate without cost efficiency and the benefit of scale; productivity is low, prices vary widely and are relatively high, and individual service organizations (such as small businesses,

hospitals, and schools) offer face-to-face services (from doctors, lawyers, and teachers, for instance) that are too isolated to deliver consistent quality, innovation, convenience, or cost efficiency across a broad array of providers. Value in services tends to be reputational or based on the characteristics of the provider more than the outcome of the service. In higher education, for example, accreditation is based more on the number of PhD faculty, the high school test scores of entering students, and the physical plant of the campus, and less on transparent measures of outcomes like the learning and socialization of current students and the career advancement of alumni.

Networks of institutions and individuals that foster direct consumer participation and measured outcomes are displacing both the top-down industrial behemoth and the fragmented model of service delivery. Today automakers can respond to an online request from an individual customer for a unique option package and then assemble that car with parts delivered just in time from thousands of intermediate suppliers worldwide. The fragmented structures of key services like healthcare are gradually being integrated by network-based price and outcome standards. Our K-12 educational institutions are increasingly disciplined by measured standards. And although our postsecondary institutions are still crisscrossed by dozens of fields of study, they are also on a path toward adopting measured standards for access, price, and the economic value of different majors.

In general, networks allow the creation and consumption of more complicated forms of value added. A single organization is rarely able to produce

different kinds of value added at competitive prices. One organization may be good at mass production but require partner institutions to handle customer service and innovation. Cost and efficiency concerns also argue for networks. While individual employers try to maintain core competitive assets, they have powerful incentives to contract out specialty functions such as business services, information technology, and human resources. More flexible and extended networks also allow individual employers to share risk and cost with other institutions and to expand or contract their peripheral commitments depending on market conditions.

As production networks have gone global, there's been a sense in America that the imported goods we consume are the products of low-skill labor and include few if any U.S. inputs. But a 2007 study of Apple's iPod – whose parts are made and assembled almost entirely overseas – shows that its value chain has many links in the United States.⁷ The study examined the value chain of Apple's fifth-generation 30-gigabyte iPod, whose packaging noted it was "Assembled in China." And yet only \$4 of the iPod's \$299 final price was attributed to its assembly and testing, and less than half its cost went to overseas inputs. By contrast, \$80 of the final price went to its licensing fee for design and intellectual property – a fee that reflected the high-skill labor of Apple's American-based designers and engineers. Altogether, at least 55 percent of the iPod's final price went to U.S. companies involved in its design, wholesaling, or retailing.

Seventh, networks are a crucible for learning in the economy and tend to increase entry-level skill requirements and lifelong learning

requirements at all levels of the workforce.

Workers not only need greater knowledge to get their jobs, but they also need critical-thinking skills to do the problem solving and innovating that are increasingly required on the job. Both institutions and workers now rush to catch up to, keep up with, and get ahead of consumer demand.

In the post-industrial era, both learning and innovation have become more diffused in production and service networks. The industrial era was driven by major inventions brought to market by firms like General Electric, General Motors, IBM, Kodak, and Xerox. While bringing inventions to market is still characteristic of many industries – pharmaceuticals and chemicals, for example – post-industrial expansion is notable for using existing science and technology in ever more complicated learning networks. Google, for instance, creates new wealth by developing networks made from available technology in collaboration with its users.

In the old-line firms, orders flowed from the top down. Learning from frontline personnel and customers rarely flowed back up the hierarchy. A key characteristic of the high-performing product and service networks of today is that they're integrated and effective learning communities. By contrast, the highly fragmented service industries like postsecondary education do lots of teaching and learning at the interface with their students and clients, but capture very little of that knowledge across their institutional and disciplinary networks and thus fail to innovate.

Effective economic networks increasingly include education and training both at the entry level and

as engines of lifelong learning. Small changes in skill requirements on a job create a demand for more formal and informal training for the workers doing that job. And when skill changes grow great enough, they are passed back into the education system either as an increase in general learning requirements or in more occupation-specific kinds of learning. Technological change, for example, has increased the need for general learning in math as well as more specific occupational preparation in computers, engineering, and the sciences.

As particular learning requirements are passed back into the education system, employers and individuals experience them as higher entry-level education requirements. At the same time, the sheer pace of change on the job has encouraged employers to increase general level skills at the entry level so that employees can keep up with change. Employers want and employees need reserve skills to adapt to change.

Eighth, business-to-business services, which employ highly educated workers, are the hidden hand transforming production and consumption recipes. Business services are what hold together the value-added chains in production and consumption networks. Business services include a wide variety of professional functions such as consulting, accounting, management, and legal services as well as clerical services and finance.

The business services super sector has replaced manufacturing as the U.S. economy's largest industry cluster. Furthermore, there has been a remarkable reversal in fortunes: in 1967, manufacturing was responsible for 31 percent of all value

added in the economy and the business services sector accounted for just 12 percent; by 2007, manufacturing declined to 16 percent of all value added and business services jumped to 26 percent; the percentage decline in manufacturing almost exactly equaled the rise in business services.

Ninth, managerial and professional office workers with postsecondary degrees are central in the post-industrial networks of production and service delivery. As this report will show, the new division of labor has led to 44 percent of the U.S. workforce being employed in offices. The rise of office work has displaced the great outdoors and the factory floor as the dominant venues for work, especially for workers with a postsecondary education. Our communities are organized more and more around the gravitational pull of offices. Office buildings define the skyline of our cities. The office has even taken up residence in our homes, with home offices occupying a room of their own or commanding any flat space near a chair.

Office-based work plus high-skill services now employ 64 percent of the workforce – up from 50 percent in 1967 – and those workers receive 74 percent of overall compensation. In contrast, the low-end service economy of retail, food, and personal services has remained roughly stable at just below 20 percent of the labor force, and workers in that sector receive just 11 percent of compensation. Eighty-five percent of those with a Bachelor's or graduate degree now work in an office or in high-skill professional services.

Tenth, the growth of the office/high-skill service economy has significantly increased the share of high-quality managerial and professional

jobs relative to middle-skill and low-skill jobs.

In 1967, just 21 percent of jobs were in high-skill managerial and professional occupations. By 2007, these jobs had increased to 35 percent of the overall workforce. Meanwhile, low-skill jobs have plummeted from 42 percent to 31 percent of the overall workforce and are clustered in occupations that are declining rather than growing (e.g., unskilled blue-collar and service/sales positions). Jobs in the middle-skill range have not been hollowed out. Jobs in middle-skill occupations (skilled blue-collar, supervisory, and clerical workers) fell only slightly from 37 percent to 34 percent.



Ultimately, these 10 mutually reinforcing trends have one effect in common: they all point toward the increasing importance of education – with postsecondary education as the capstone – in the nation's post-industrial economy. In the United States, gross domestic product (GDP) per capita has increased from \$22,000 in 1967 to \$49,000 in 2012 (in 2009 dollars). Over that period, the share of workers with at least some postsecondary education increased from 25 percent to 65 percent of the U.S. workforce and their contribution to U.S. output grew from 36 percent to 77 percent of the total value added from labor. It has become clear that in the future, young adults will have to have some sort of postsecondary credential (including certificates) if they're going to earn middle-class salaries.

On balance, as we argue in our concluding chapter, the post-industrial service economy is a hopeful story. It suggests that the limits to economic growth are, as yet, not in sight. The

expanded kinds of economic value on offer in the post-industrial service economy are still relatively new and there is considerable unmet demand for them even in the most advanced economies, let alone in developing nations that have yet to realize the full potential of the agricultural and industrial revolutions. In addition, an economy that relies more on services relies less on backbreaking labor, and a more efficient post-industrial economy uses less energy and fewer scarce materials extracted from the Earth.

But there is a dark side to the post-industrial service economy. Our data only reinforces a broader concern over the growing income inequality and declining social mobility that's occurred in recent decades. Our findings suggest that class- and race-based inequality in access and success in postsecondary education limits access to learning and earning on the job. In theory, education is the preferred solution to growing inequality and declining mobility, but in fact it may be operating as a more and more important mechanism for reinforcing the intergenerational reproduction of privilege.

Young people born into families in the right neighborhoods with the best schools are best able to negotiate the pre-K through 12th grade education system and gain preferred access to postsecondary institutions and fields of study that put them first in line for jobs with the most formal and informal training as well as the most powerful and flexible technology. In the post-industrial economy, it is the complementarity between preparatory education off the job and learning and state of the art technology on the job that drive the cumulative differences in lifetime earnings.

The sweeping changes that come with the post-industrial service economy have not benefited all workers and consumers. A substantial share of experienced workers who benefited from the industrial economy has been left behind both as workers and as consumers – a fact that many argue has become a drag on growth in the post-industrial economy. Deepening inequality threatens to become an increasingly serious impediment to growth. And ultimately, the post-industrial service economy will be judged by its capacity to expand choices for all workers and consumers.

In general, the race and class inequality associated with the post-industrial economy does not spring from personal bigotry but from education and economic mechanisms that, in theory, are race- and class-neutral. But in fact, those mechanisms reliably produce unequal opportunity among classes as well as between whites and other racial and ethnic groups – especially among African Americans and Latinos.⁸ Policy solutions do exist, however, and they come with deep historical legitimacy.

Solutions to growing race and class inequity can be found in the venerable grand bargain that Western nations struck early in the industrial era. Then, these newly emerging democracies struggled to reconcile the conflict between the values of democratic citizenship and economic markets. While democracy presumes equality, markets are driven by the pursuit of wealth and the accumulation of vast fortunes. The essential bargain these nations reached was that some part of the growth dividend from capitalism would be shared to ensure that all people could lead decent lives.

The British economist Alfred Marshall put forward the seminal statement on this grand bargain in a speech to the Cambridge Reform Club in 1873. Marshall argued that markets would become the paymaster for a constant expansion in publicly funded education and social services. This arrangement would guarantee all citizens full membership in society, while preserving free markets and legitimizing the economic differences those markets generate.

“The question,” Marshall said, “is not whether all men will ultimately be equal – that they certainly will not – but whether progress may not go on steadily, if slowly, till, by occupation at least, every man is a gentleman,” valuing education and leisure more than the “mere increase in wages and material comfort.”⁹

In 1949, British sociologist T. H. Marshall, no relation to Alfred, updated that formulation in his essay “Citizenship and the Social Class.”¹⁰ Marshall argued that the West was still making “pretty good soup” from the “disparate elements” of capitalism and democracy and should continue with the effort. He asserted that citizens must have “a modicum of economic welfare and security ... to share to the full in the social heritage and to live the life of a civilized being according to the standards prevailing in the society.” This ideal of citizen equality, he wrote, was most heavily bolstered by “the education system and the social services.” Marshall’s 1949 essay proved seminal because it became the widely recognized summation of the argument for the massive postwar expansion of both public education and the welfare state.

Once again, we are struggling to reconcile the conflicts between democracy and capitalism. The transition to a post-industrial service economy has again raised the cost to maintain the social contract. We are overwhelmed by the public costs of easing retirees onto the off-ramp of the economy while investing in education that helps the young onto the on-ramp of their careers – all while trying to expand basic supports in health-care and maintain a livable wage for workers.

On balance, the United States has favored education over the more redistributive tools of the welfare state that Europe has embraced. America has always looked to education to help reconcile democratic citizenship with class differences and various forms of diversity. Education has been the preferred route to economic success since the closing of the frontier and the preferred route to good jobs in the post-World War II era. What is new in the post-industrial service economy is that education is not just the preferred path, but by far the most heavily traveled path to middle-class earnings.

Most Americans welcome our increasing reliance on education because, in theory, it allows us to expand opportunity without surrendering individual responsibility. After all, we each have to do our own homework to make the grades and ace the tests. Because it promises opportunity based on individual merit, education has become the nation’s increasingly popular alternative to an expansion in the directly redistributive programs associated with the welfare state.

Fair enough? Not really. In a society in which people start out unequal, educational

attainment measured by test scores and grades can become a dodge – a way of laundering the found money that comes with being born into the right tax bracket or ZIP code.

But even though the relationship between education and economic opportunity does not guarantee social justice, it does provide new possibilities for progressive policies, political solidarity, and social progress. The broad social consensus on the legitimacy of education as the arbiter of economic opportunity provides a starting point for analysis and dialogue. Economic trends are likely to broaden the current consensus and become a spur to action in promoting policies that strengthen education as a point of leverage for increasing opportunity.

“The Economy Goes to College” is divided into four sections and a concluding chapter. In Part 1, we analyze 11 final output categories of the U.S. economy that include all the goods and services America produces for consumption, investment, and export. By examining the economy through the lens of these final output categories, one gets a highly detailed view of America’s shift from a goods-producing industrial economy to a service-based post-industrial one. It reveals that over the past 40 years the fastest-growing output categories, such as business services and healthcare, are service-intensive and employ large and rising numbers of highly educated workers.

In Part 2, we examine the U.S. economy through the prism of “production recipes,” which are the mix of all the contributions to the production of a good or service. Production recipes include a measure of the skill levels of all the workers contributing

to a good or service, so they can reveal trends in the educational mix of workers in each output category. Our production recipe analysis shows that output categories with rising shares of economic activity, such as healthcare, tend to have production recipes with large numbers of college-educated workers. Conversely, declining categories such as food tend to have production recipes with higher concentrations of less-educated workers.

In Part 3, we build upon the input-output analysis with a detailed exploration of America’s occupational structure. Drawing on data from hundreds of different occupational categories that span the entire U.S. economy, the report groups the American workforce into three occupational tiers: elite managerial and professional jobs; middle-skill jobs; and low-skill jobs. A study of these tiers clearly shows that it’s not the low-skill, low-wage tier that’s been rising most rapidly, but rather the managerial and professional tier that’s shown the most robust growth.

In Part 4, we take the occupational analysis one step further to do a “functional analysis” – a close look at what workers actually do on the job. Five functional areas are identified: office work (administrative, finance, and real estate); high-skill services (mostly in healthcare and education); low-skill services and retail sales; manual labor in industry; and primary production (farming, mining, and fishing). Again, the sense of an imploding economy that produces no good jobs is refuted. Rather, the functional analysis tracks the rise of a dynamic office/high-skills “super sector” that includes the bulk of America’s workforce and includes a rich supply of high-paying jobs.

The report's conclusion acknowledges that despite the rise of America's high-skill workforce there are serious problems with our economy that must be confronted. It focuses on the alarming income inequality that has arisen in America as the nation has shifted to a post-industrial economy that places a premium on education. It details the chasm that's opened between highly compensated college-educated workers and those with a high school diploma or less whose pay has been falling. This wage gap is shown to be driven by two forces: the growing disparity between managers and professionals and the rest of the labor force; and the growing disparity within occupations that's led to college-educated workers earning more than their less-educated counterparts.

Finally, the conclusion looks soberly at the strengths and weaknesses of today's post-industrial economy and addresses some of the claims about its future. Some technological optimists see a dazzling new world where smart machines will do everything from drive cars to diagnose and cure our diseases. Others take a pessimistic view of that new world and insist that many, if not most, workers will be made redundant. Still others believe that we have largely exhausted the benefits of the computer revolution and are doomed to slow growth for the foreseeable future. We resist these utopian and dystopian impulses and predict a future America with a healthy, technology-rich service economy

and a labor force that resembles the one we have now. That said, the economic inequality that plagues many workers today need not persist. By pursuing policies that significantly expand postsecondary education and training, America can help ensure that the great wealth of our post-industrial economy is much more widely shared.

THE 11 CATEGORIES OF FINAL OUTPUT

U.S. consumption and production have shifted to economic sectors that have large and rising shares of workers with postsecondary education.

Basic human needs do not vary much over time. Food and drink, housing and healthcare: for thousands of years societies were judged by their ability to satisfy those needs efficiently and fairly. But as economies have grown more efficient, we've been able to focus less on *needs* and more on *wants*. And it's the dramatic expansion and evolution of those wants – and how our economy fulfills them – that explains so much of the change in post-industrial America.

This part of the report looks at how U.S. consumption patterns have been shifting, and how that shift has caused certain economic sectors to grow and others to decline. And through our innovative input-output analysis – which tracks the education levels of workers in each sector – we can see that it's the education-intensive sectors that have been expanding most rapidly.

In the United States, economic growth has allowed much of the population to move beyond meeting simple needs with simple products. In 1947, real disposable income per capita was \$9,000; it climbed to \$20,000 in 1967, and then to \$36,000 in 2011 (in 2005 inflation-adjusted dollars). Consequently, consumption patterns have shifted as well: from standardized goods in the postwar era to customized goods and high-quality services today (Figure 1.1). This

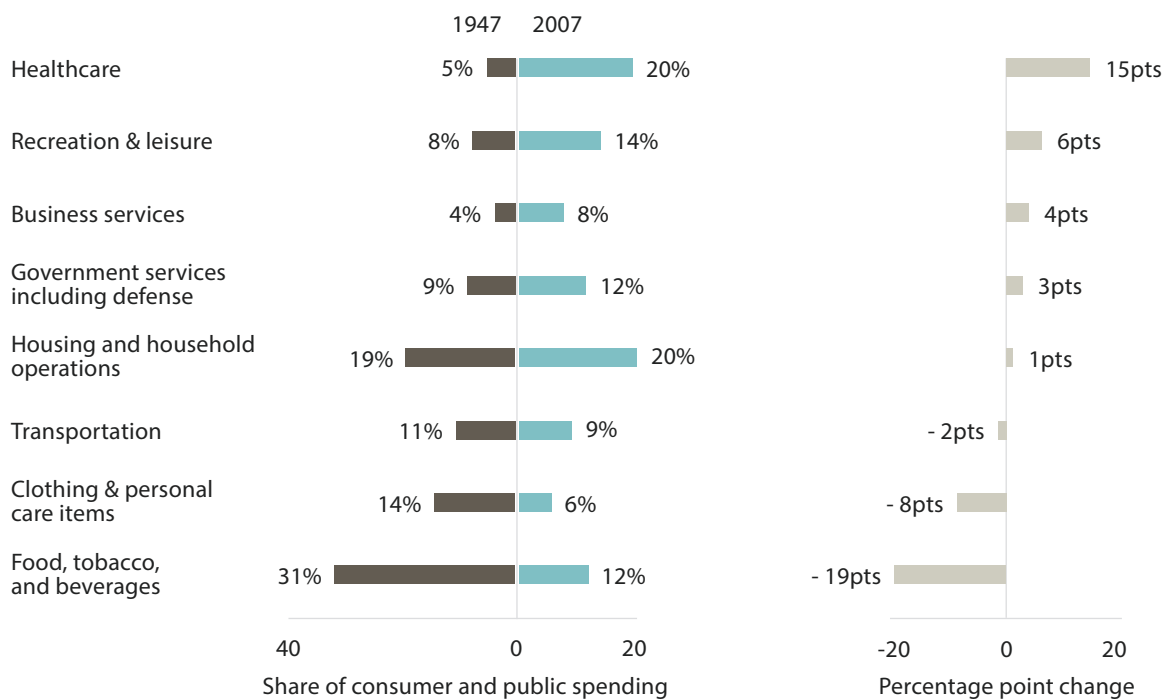
shift has sharply increased the demand for more highly skilled labor, a trend that is shown below.

Fundamentally, these changes are driven by the opportunities opened by increasing productivity. A clear example of the new service economy providing the consumption of *quality* goods and services at relatively low prices is the telephone: As recently as the 1950s, many people had party lines and long-distance calling was very expensive. Today, our smart phones connect us to the Internet and one modest price can cover worldwide calling. Given the explosion of the online world, people now use phones to do much more than just periodically call a relative or friend.

Between 1947 and 2007, consumption shifted away from manufacturing and extractive industries toward service industries.

In 1947, 45 percent of consumer spending went to the basic necessities of food, drink, and clothing – goods that primarily required low-skill workers to produce. By 2007, the more economical production of these goods and the dramatic rise in living standards meant that outlays on these basic necessities dropped to just 18 percent of overall consumer spending – a much smaller share of the pie than in 1947. Spending on transportation, another low-skill sector, went down a percentage point and a half over the time period.¹¹ While these slices have gotten smaller, the size of the pie has nearly quadrupled – going from \$8,400 (in 2005 dollars) per person in 1947 to \$32,700 in 2007.

FIGURE 1.1 Food and clothing were responsible for 45 percent of consumption in 1947 and just 18 percent in 2007.



Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts*, 1947-2007.

Among consumption categories in which the share of spending rose, healthcare led the way, growing from 5 percent of spending in 1947 to 20 percent of private consumer and government spending in 2007. Other gainers were recreation (going from 8 percent to 14 percent), business services (doubling from 4 percent to 8 percent), government (going from 9 percent to 12 percent), and housing (growing slightly from 19 percent to 20 percent).¹² With the exception of recreation, the growing sectors had high levels of well-paid managers and professionals.

Production recipes show growing sectors have high education levels.

One of the key analytical tools in this report is the production recipe, which is the complex mix of all the contributions that go into providing a good or service. By looking at production recipes, we can see all the workers involved in the provision of a good or service – and we can track the education levels of all those workers. By breaking that information down by sector, we can then get a precise measure of the education level of the workers in each economic sector.

Output categories of final consumption

The categories of consumption listed below are eight of the 11 final output categories analyzed in this report. “Final output” is everything produced in the United States for consumption, investment, or export. These eight consumption categories include all the products (except for imports) consumed by private or public buyers in the United States. They account for the vast majority of America’s economic output and are referenced throughout this report.



Food: This category includes food (both consumed at home and away from home), non-alcoholic drinks (soft drinks, juices, and water), alcoholic beverages for off-premise consumption, and tobacco. Spending on food and drinks constitutes over 80 percent of the total, with tobacco accounting for 6 percent, and alcoholic beverages slightly more than 10 percent. It should be noted that there has been a large shift within food and drink from in-home consumption to eating out: away-from-home consumption was 18 percent of food and drink spending in 1950; 21 percent in 1967; and 44 percent in 2007. Also, food and drink options both at home and away from home have expanded enormously.



Clothing and personal care items: In 2007, 51 percent of the spending in this category was on clothing, a notable decline from 63 percent in 1967. (In 2007, 65 percent more was spent on women’s and girls’ clothing than on men’s and boys’.) Nine percent of expenditures in the category was for shoes, and 42 percent was for personal care (hair salons, gyms, etc.), toiletries, jewelry, and watches. In this category, style and how it changes constantly drive a high proportion of the sales.



Housing and household operations: In 2007, 51 percent of spending in this category was imputed rent paid by homeowners and 14 percent went for rental payments. In terms of household operations, utilities accounted for 12 percent of spending in this joint category, with 23 percent for furnishings, appliances, dishes, glassware, etc. Few remember that the suburban surge following World War II was in developments like Levittown where a typical starter house was slightly less than 1,000 square feet. Today, new homes average about 2,300 square feet and there are many more modern conveniences and upgrades.



Transportation: The bulk of spending in 2007 in this category was for the maintenance of private automobiles – 34 percent for gas and oil and 34 percent for repairs, replacements, insurance, and finance charges; 23 percent was for new car and truck purchases, leaving just 9 percent for air travel and other forms of transportation. Instead of the big four American companies of the 1950s (GM, Ford, Chrysler, and American Motors), the market is composed of many worldwide companies offering hundreds of models and numerous features.



Healthcare: Forty-seven percent of spending in this category was for care in hospitals, nursing homes, and one's own home; 22 percent went to physicians and dentists; and 15 percent went for drugs and medical devices. Most of these expenditures were covered by insurance or the government rather than by individuals; the net administrative cost of private insurance was responsible for 7 percent of healthcare spending (which, according to a McKinsey report, was five times the level in European countries). There has been a vast improvement in health outcomes with many more diseases treatable now than in the past.



Recreation: This area consists of a diverse collection of purchases (e.g., sporting equipment) and activities (e.g., payments for sporting events, recreational activities, and museums). Also included in this category are spending on religious activities and other nonprofit social service agencies. The options here have exploded as the travel horizons of consumers span the globe and include such things as adventure and ecological travel.



Business services to individuals: The major services consumed in 2007 were: financial services for which a fee was charged (30 percent – e.g., brokerage accounts and mortgage fees), financial services which were imputed and a fee wasn't paid (29 percent – ATM and counter services for checking accounts that are nominally free but the banks earn their money by loaning money without having to pay interest), life insurance (10 percent), and payments for other legal, accounting, and professional services (20 percent). As America has gotten wealthier, more families have sizable amounts of personal wealth and have required more services from financial organizations to manage and protect these assets.



Government services: Most government spending is not included in this category. First, payments for Social Security, Medicare, Medicaid, and other transfer programs are not considered "production" in the federal statistics used in our analysis but just a moving around of money between people. Second, all government provision of healthcare services (e.g., public hospitals and clinics) is moved into our healthcare category of consumption (described above), while all education spending is moved into our education category, which is considered part of investment and not consumption. Third, government investment in roads, structures, and equipment is included in fixed investment (another investment category). This leaves only government administration (including courts and legislative bodies) and provision of public services (parks, police, fire, defense, etc.) to be included in this government services consumption category.

Data limitations prevent us from going all the way back to 1947, but we can trace the education levels of workers from 1967 through 2007 to show the remarkable amount of educational upgrades within many production recipes.

As Table 1.2 shows, the share of all workers with at most a high school diploma fell by 42 percentage points, from 77 percent in 1967 to 35 percent in 2007. Consequently, the share with at least some postsecondary schooling increased by the same amount, with the share of Bachelor's degree-holders growing by 22 percentage points (from 11 percent to 33 percent) and the share of those

with some college or a two-year degree growing by 19 points (from 12 percent to 32 percent).

While education levels increased greatly among workers in the extended networks of every output category, the gains were not equal and the starting and ending points were not the same. As Table 1.2 shows, the food and clothing and personal care networks had the highest percentages of workers with at most a high-school diploma in both periods. Overall, 35 percent of U.S. workers had only a secondary education or less in 2007. But that year, 52 percent of food workers had at most a high school diploma, while 47 percent of clothing workers did.

TABLE 1.1 The share of workers with a high school diploma or less declined across output categories between 1967 and 2007.

Final output categories	Change in share of workers (percentage points) by educational attainment, 1967-2007		
	HS or less	AA/SC	BA+
Business services to individuals	-49	20	29
Clothing and personal care	-44	25	19
Education	-20	7	13
Exports	-47	19	28
Food	-35	21	14
Government	-50	19	31
Healthcare	-43	19	24
Housing and household operations	-48	24	24
Fixed investment	-46	20	26
Recreation	-43	19	24
Transportation	-39	20	19
Total	-42	19	22

Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts* and U.S. Census Bureau, *Current Population Survey*, 1967-2007.

In contrast, more dynamic sectors saw substantial gains in the number of highly educated workers. For example, from 1967 to 2007, the share of healthcare workers with some college increased by 19 percentage points to 37 percent and the share with a Bachelor's or graduate degrees rose 24 percentage points to 32 percent.

The biggest change in educational attainment took place in the government sector, which saw its share of the workforce with at most a high school diploma fall by 50 percentage points (from 79 percent in 1967 to 29 percent in 2007). That was matched by the biggest rise in the share of

workers with a Bachelor's degree (from 7 percent to 38 percent). This shows that office-type functions (research, administration, program evaluation, etc.) have become more advanced and are rarely staffed by those without some postsecondary education. Therefore, it is not surprising that the business services sector also had a comparably large drop in the share of workers with a secondary education or less.

By 2007, the output categories with the lowest share of high school-only workers were education (a highly educated sector even in 1967), government, business services, and healthcare.

TABLE 1.2 The share of workers with at least a Bachelor's degree increased the most in government, growing from 7 percent to 38 percent between 1967 and 2007.

Final output categories	Share of workers by educational attainment (%)*					
	HS or less		AA/SC		BA+	
	1967	2007	1967	2007	1967	2007
Business services to individuals	80	31	14	34	5	34
Clothing and personal care	91	47	7	32	2	21
Education	40	20	15	22	45	58
Exports	84	37	12	30	4	32
Food	87	52	10	31	3	17
Government	79	29	14	32	7	38
Healthcare	74	31	18	37	8	32
Housing and household operations	87	39	10	34	3	27
Fixed investment	84	38	12	32	4	30
Recreation	82	39	12	32	6	30
Transportation	83	44	13	33	4	23
Total	77	35	12	32	11	33

Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts* and U.S. Census Bureau, *Current Population Survey*, 1967-2007.

*Values may not sum to 100 due to rounding.

Finally, it is important to recognize that Tables 1.1 and 1.2 include all 11 of our final output categories – our eight consumption categories, as well as our education and fixed investment categories (which are treated as a joint investment grouping), and exports. While education is a unique industry that has always had a very high level of workers with Bachelor’s and graduate degrees, in 1967 the production networks of fixed investment and exports were heavily reliant on manufacturing products and hence had a very high concentration of workers with at most a high school diploma (both were then at 84 percent versus an economy-wide average of 77 percent). As these categories gradually shifted from making products to providing more services, the education levels of the workers in their networks were bound to be significantly higher in 2007 than in 1967. Indeed, both fixed investment and exports had massive declines in the share of high school-only workers (dropping 46 and 47 percentage points, respectively) and large increases in the share of those with a Bachelor’s degree or graduate degree (rising 28 and 26 percentage points, respectively).

The manufacturing industry that once defined the American economy has declined, giving rise to the finance and business services industries.

In the preceding sections of Part I, we looked at the U.S. economy through the lens of the 11 final output categories. In the section below, we look at the U.S. economy through a different lens – the lens of industries. This industrial lens let’s us focus on different aspects of our post-industrial economy. Perhaps most crucially it allows us to identify manufacturing as a single industrial sector, and to compare it directly against a combined

business services industrial sector. This provides powerful insights into the changes that have taken place in the U.S. economy in recent decades.

The rise of the business services sector is emblematic of the shift from vertically integrated institutions to competitive networks and it has become a super sector for employing postsecondary talent.

The rise of business services networks and the decline of stand-alone vertically integrated institutions reflect the shift from an industrial economy to a post-industrial service economy. In the industrial economy vertical integration was the ideal because it subjected the entire value added chain to centralized top-down managerial control. But as networks integrated by performance standards displaced vertically integrated institutions, institutions held on to their core competitive capabilities while offloading nonessential functions to contractors or institutional partners. The result has been the phenomenal growth of the business services industry as it has become a super sector for the employment of workers who have postsecondary education or training.

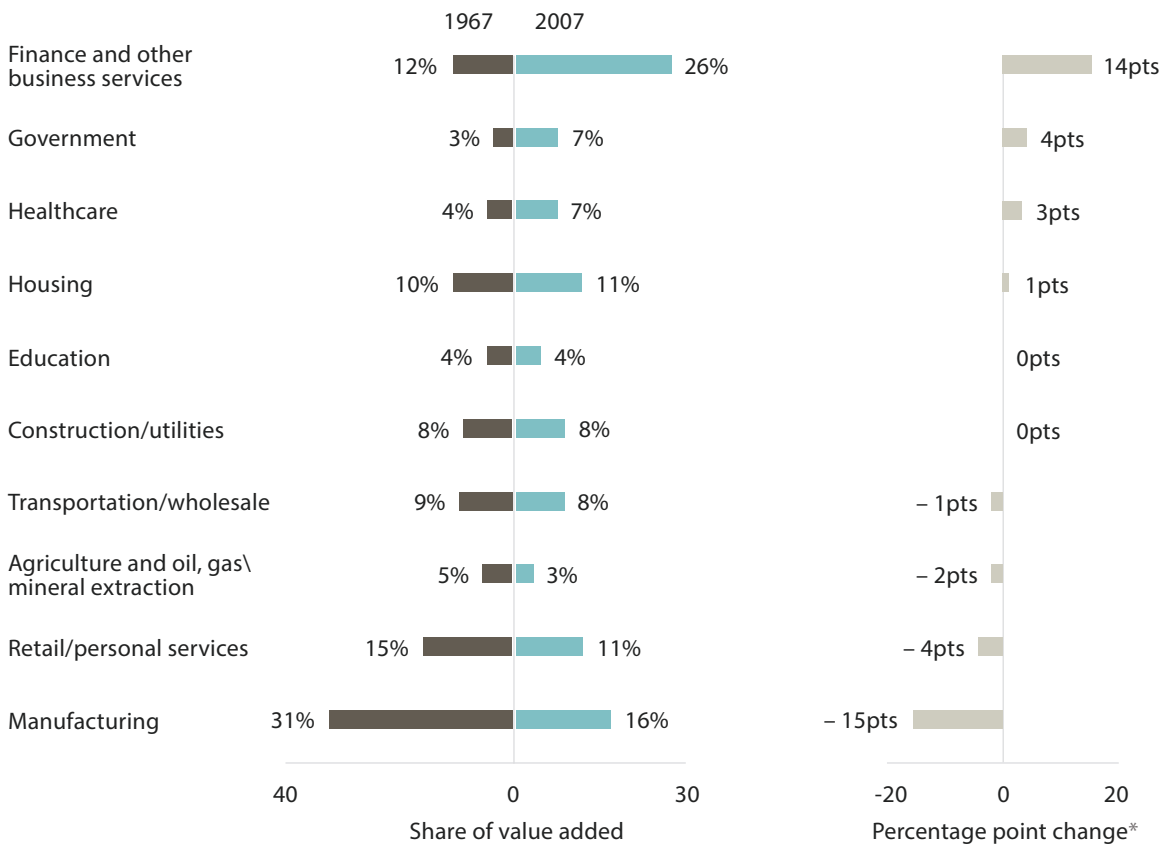
The business services industry now plays a dominant role in the American economy, and it includes a wide variety of tasks:

- Professional services such as consulting, legal services, accounting/bookkeeping, architecture, design, and scientific and technical research;
- Administrative and support services, such as employment services, facility support (including security and building maintenance), office equipment maintenance, and courier services; and
- Finance, insurance, and related activities.

This indeed has become a super sector and replaced manufacturing as the largest industry cluster in the United States (Figure 1.2). In fact, there was a remarkable reversal involving the two sectors. In 1967, manufacturing was responsible for 31 percent of all value added in the economy while business services accounted for just 12 percent; but by 2007, manufacturing declined to 16 percent of all value added while business services jumped to

26 percent. The percentage point decline in manufacturing almost exactly equaled the rise in business services. So, manufacturing went from being two-and-a-half times larger than business services in 1967 to less than two-thirds its size in 2007. It is also important to note that the share of front office employment in the U.S. manufacturing sector has increased dramatically, meaning that manufacturing jobs are much less geared to producing

FIGURE 1.2 Between 1967 and 2007, there was a big twist: the manufacturing industry’s importance to the economy declined; finance and other business services took its place.



Source: Georgetown University Center on Education and the Workforce analysis of U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts*, 1967-2007. *Values may not sum to total due to rounding.

products and much more focused on managing production networks – overseeing everything from research, to suppliers, to final sale and promotion.

As Table 1.3 shows, the shift in industry importance is closely related to education levels. The industry sectors that grew tended to have low levels of high school-only workers and high levels with at least a Bachelor's degree, and the industries that declined tended to have low educational attainment. Obviously this is not a complete match because education, which has the highest levels of education, had a modest gain in its value added share. Conversely, manufacturing had high levels of workers with at most a high school diploma but also modestly high levels of workers with Bachelor's

degrees and higher; once again, this is due to the large front-office component of this industry.

One way to understand the reversal of fortune between the manufacturing and business services industries is to look at their shifting contributions to the production recipes of each of our 11 final output categories. Figure 1.3 shows the declining share of manufacturing employment in the production recipes of each output category from 1967 to 2007. Not surprisingly, manufacturing had a small presence in both 1967 and 2007 in education, healthcare, and business services to individuals. Housing, recreation, food, and transportation had modest manufacturing shares in 1967, but they all saw sizeable declines so that manufacturing

TABLE 1.3 The finance and other business services sector, whose value increased the most between 1967 and 2007, has one of the largest concentrations of college-educated workers among industries.

Industry	Share of workers by educational attainment (%)*			Change in value added share since 1967 (percentage point)
	HS or less	AA/SC	BA+	
Finance and other business services	26	28	46	15
Healthcare	26	36	38	4
Government	24	35	41	3
Housing	30	34	36	1
Education	16	19	64	0
Construction/utilities	60	26	14	0
Transportation/wholesale	48	30	22	-2
Agriculture/mining/fishing	62	23	15	-2
Personal services/retail	50	32	19	-4
Manufacturing	49	26	25	-15

Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts* and U.S. Census Bureau, *Current Population Survey*, 1967-2007.

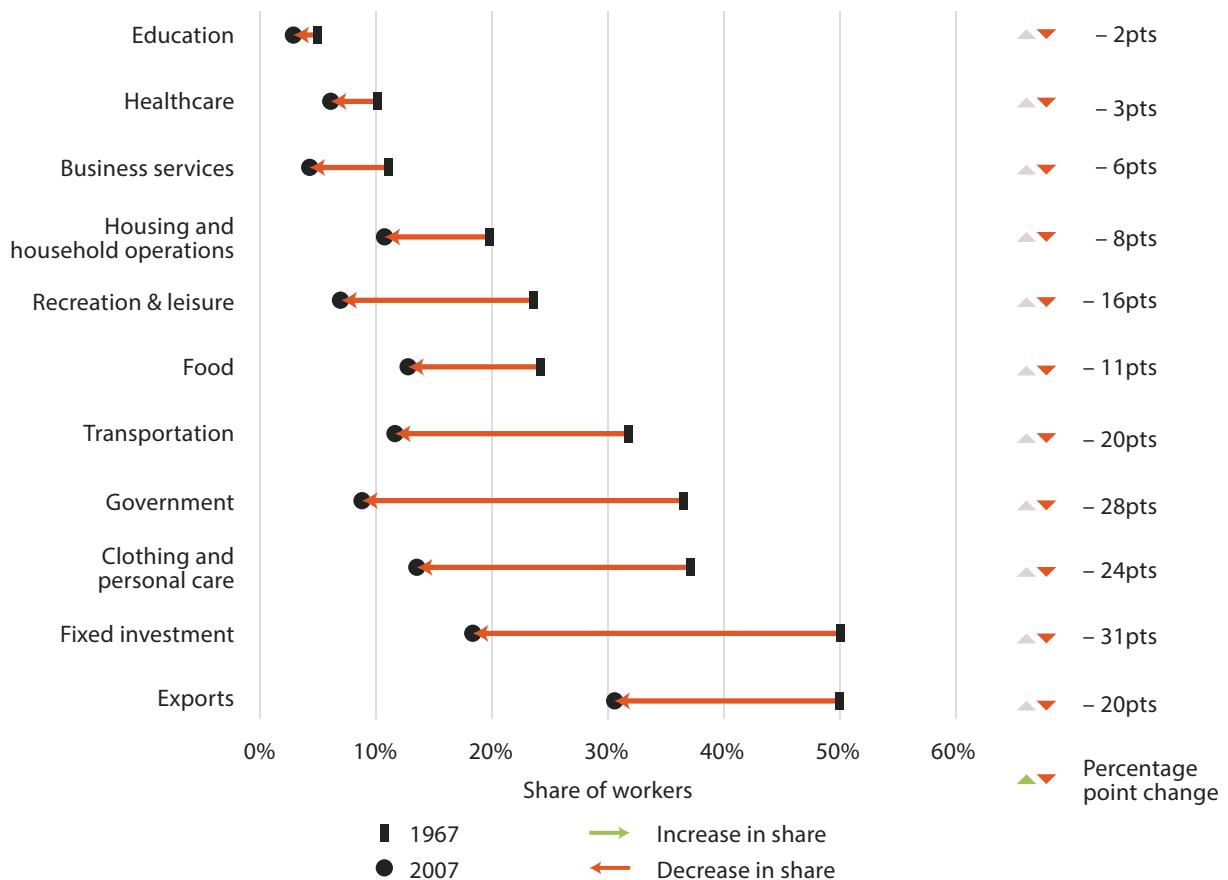
*Values may not sum to 100 due to rounding.

accounted for less than 15 percent of employment in all these final output categories. Government spending on manufacturing products was unusually high in 1967 because of arms purchases for the Vietnam War; and by 2007, the manufacturing share of government plummeted to 9 percent.

Other output categories with high manufacturing content in 1967 were clothing, fixed investment,

and exports. For clothing, a massive outsourcing of production to low-wage foreign platforms and a corresponding hike in productivity reduced the contribution of American manufacturers by 2007 to just 13 percent of the extended value chain in this category. Fixed investment shifted as well when software purchases became important and were classified as a business investment if bought by businesses. Finally the only output

FIGURE 1.3 Between 1967 and 2007, manufacturing employment declined across final output categories.



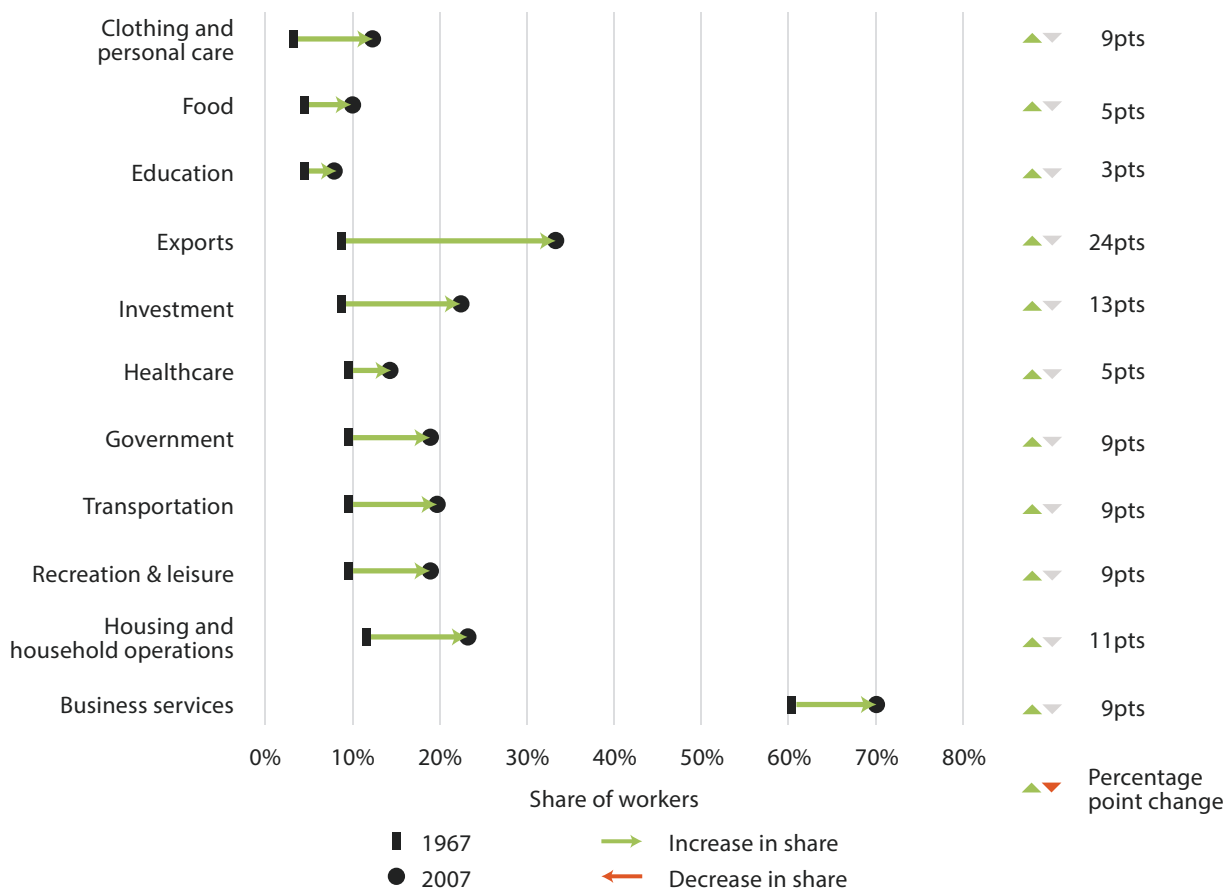
Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts* and U.S. Census Bureau, *Current Population Survey*, 1967-2007.

sector that still had a manufacturing presence greater than 20 percent of employment in 2007 was exports. But this bright spot is hard for many people to see because most of these exported products are large machines such as planes and construction equipment used by foreign businesses.

The business services super sector presents an entirely different picture. Figure 1.4 shows that the

employment share of the business services industry grew substantially within each output category. Business services in 1967 contributed a small share of the direct and indirect workforces of every output category except one, business services sold to individuals. The employment share of this business services super sector increased by at least 9 percent in each output sector except for food, education, and health-care. The biggest gainer isn't even visible to the

FIGURE 1.4 Between 1967 and 2007, business services employment grew across final output categories.



Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts* and U.S. Census Bureau, *Current Population Survey*, 1967-2007.

typical consumer: it's the export sector, and growth in this sector was driven by the rapidly rising export of professional and financial services, and by the heavy reliance on business services to coordinate, finance, and administer the export of other goods.

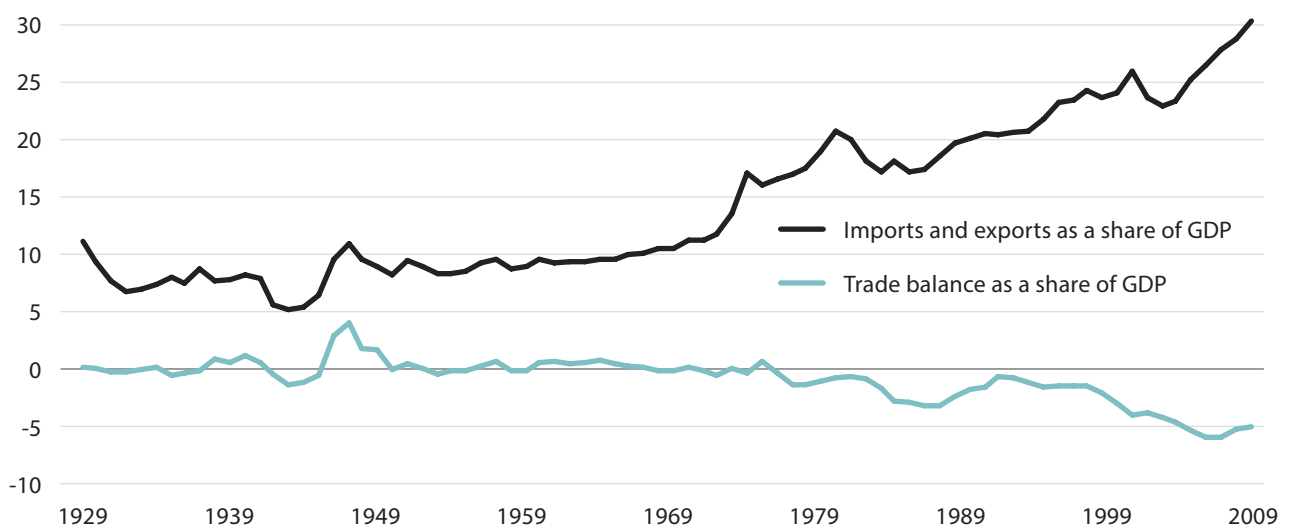
Growing international trade contributes to the increasing value of postsecondary education in U.S. exports.

The shift from lower- to higher-education industries has occurred even in exports.¹³ The value added for exports in 1967 was dominated by manufacturing with a 48 percent share, while agriculture and extractive industries accounted for 10 percent, and business services for just 9 percent. By 2007, the manufacturing share had been halved to 24 percent, agriculture and other

primary production industries declined to 3 percent, and business services rocketed to 25 percent.

Technological advances in transportation and communication have made the world a much smaller place, allowing for global networks of both production and consumption. This increasingly global division of labor means that imports and exports as a share of the economy have skyrocketed. As Figure 1.5 shows, from 1929 through 1969, the value of imports and exports were each about 5 percent of GDP and 10 percent altogether. During that time, imports and exports remained fairly stable and in balance, except for a few years after World War II. Starting in the 1970s, however, the share of imports and exports began rising and kept on rising, exceeding 30 percent of GDP for the first time in 2008. And beginning

FIGURE 1.5 Since the 1960s, imports and exports have tripled as a share of GDP, from 10 percent to 30 percent.



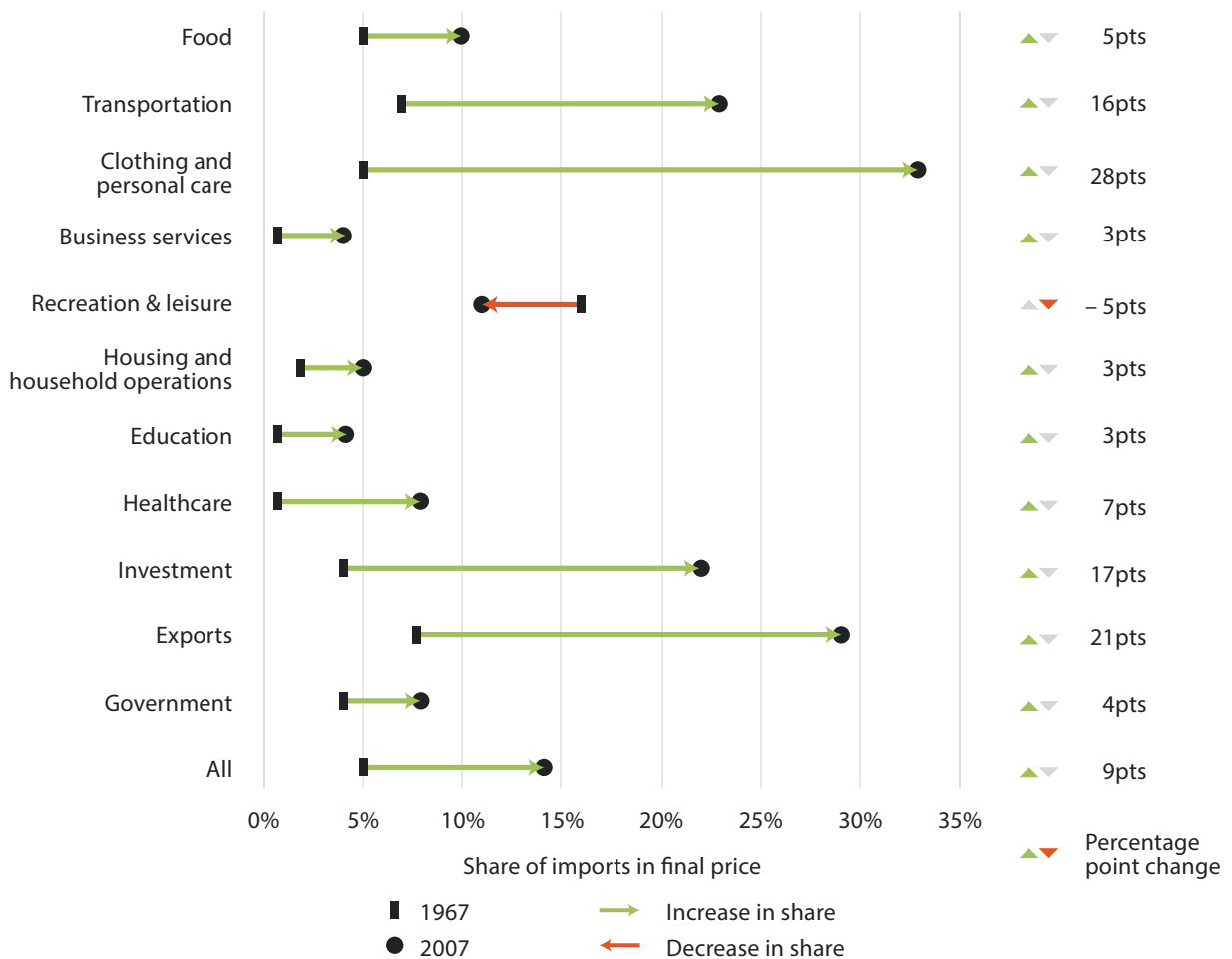
Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Department of Commerce, Bureau of Economic Analysis, 1929-2007.

in 1976, the trade balance turned negative, with imports exceeding exports; the trade balance stayed negative every year thereafter and rose to several percentage points of GDP by 2007.

The common-sense view is that the growth in the trade deficit leads to a loss of American jobs. For non-oil imports, it seems clear that American

workers could do the jobs embedded in imports. Trade economists don't share this common-sense view despite the fact that trade clearly negatively affects specific companies, workers, and communities. Instead economists argue that trade leads to lower prices and a more dynamic economy, and some have estimated the overall benefit of

FIGURE 1.6 Imports contributed 33 percent to the value of clothing in 2007, up from 5 percent in 1967.



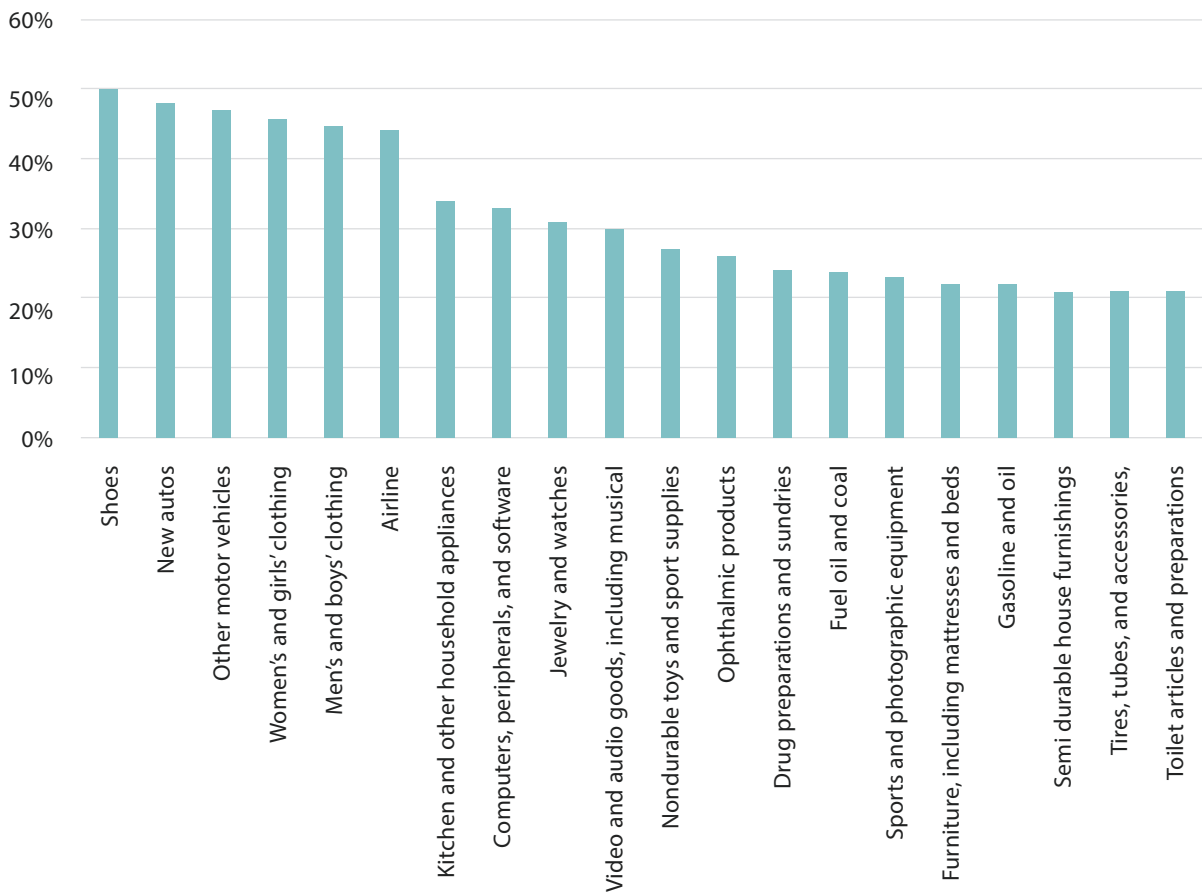
Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Department of Commerce, Bureau of Economic Analysis, 1967-2007.

trade at over a trillion dollars a year. Further, they argue that total employment is determined by factors that affect the macro economy with a minor trade effect. And in fact, if one compares shifting trade levels against ups and downs in unemployment, there really is no relationship.¹⁴

Thus, trade is a situation much like technological progress – a few people lose their jobs and

livelihood while the benefits are spread across the economy. In other words, the benefits outweigh the costs but the high costs of the few are very evident and troubling. But standing in the way of progress has never worked. The Luddites failed to stop the introduction of weaving machines. Or, consider the containerization that replaced the work of cranes and stevedores that loaded and unloaded relatively small freighters. Big strikes delayed the

FIGURE 1.7 Imports contribute 50 percent to the value of shoes, the most of any consumption good or service.



Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Department of Commerce, Bureau of Economic Analysis, 2007.

introduction of this new technology in New York, Los Angeles, and San Francisco. But the delay led to growth of ports in Newark, Long Beach, Oakland, and other ports. In the end, 90 percent of international bulk cargo travels in standardized metal boxes that are easily transported between trucks, rails, and jumbo-sized container ships. World trade has exploded as the cost of transportation has plummeted and the old working system on the docks has disappeared. The only good solution for the displaced workers is retraining and living vouchers.

In terms of the years studied in this paper, imports' share of GDP was 3 percent in 1947, 5 percent in 1967, and 17 percent in 2007. In terms of specific items, imports of capital goods, industrial supplies, food, transportation, and travel accounted for 7 percent of GDP in 2007 but this was offset by exports in these areas that also represented 7 percent of GDP, so there was no effect on our trade balance. Instead, our negative trade balance of 5 percent of GDP was half due to oil imports and half due to imports of motor vehicles and consumer goods.

In terms of our 11 final output categories, imports play the biggest share in the total value chain in clothing (outsourcing of textile mills), transportation (auto imports and oil), and investments. Imports play a relatively small role in office activities and personal services (business services to individuals, education, housing, healthcare, and government).

As Figure 1.7 shows, there are a limited number of specific consumer goods in which imports are responsible for a high share of the final value of that good. Shoes, clothing, motor vehicles, and

small gadgets (watches, video and audio equipment, and computers) are the products that have more than 30 percent of the final price coming from imports. But this list is fairly narrow because the total value of imports in all final sales is just less than 14 percent. Even though a recent ABC News report couldn't find many American-made furniture and furnishings to fill a home with, the value chain analysis shows that only 22 percent of the final price of these "foreign-made" products went to overseas companies. So while the import share has certainly risen, it is a mistake to think that it dominates the value chain of the American consumer marketplace. In *China, Inc.*, Ted Fishman posits that the Chinese are becoming the producers of everything. He misses, however, that all of these foreign goods are part of a complete production process in which the vast majority of value added goes to American firms and workers.

THE ROLE OF POSTSECONDARY WORKERS IN THE 11 PRODUCTION RECIPES OF FINAL OUTPUT

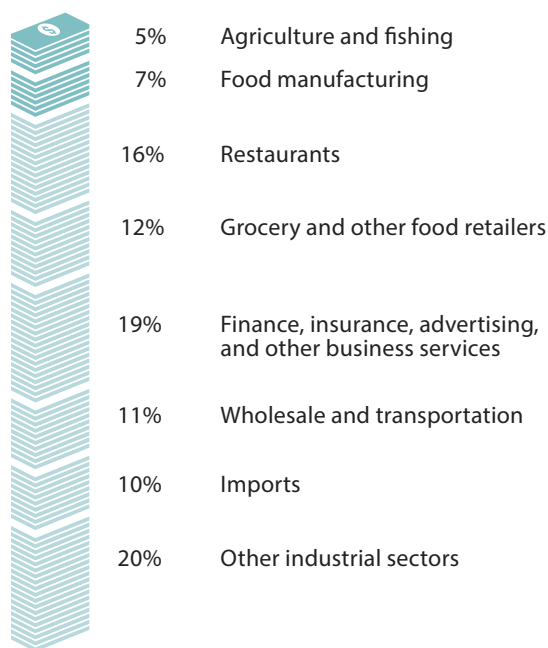
Most people don't realize that, on average, half the price they pay for a good or service goes to businesses totally unrelated to its production. Think, for example, of transportation companies that take the product to market, utility companies that provide power to the direct and indirect producers, bankers, insurance agents, etc.

Most of the upskilling in the American economy is accounted for by huge changes, not in what we consume, but in how we produce what we consume (“production recipes”).

Consider everything it took to make the \$1.3 trillion worth of food, beverages, and tobacco we bought in 2007 (Figure 2.1). Many presume, quite naturally, that farmers play a significant role in the production process or value chain of these items. But they are wrong: just 5 percent of spending on these items goes toward domestic farming (i.e., crop and animal production) and 4 percent to imported agricultural products. However, this does not mean that the production process is manufacturing-intensive (in value-added terms). In fact, food manufacturers – such as Del Monte, General Foods, and Coca-Cola – that turn raw food into products ready to be served and eaten, account for only 7 percent of the final price of food, beverages, and tobacco. So, where does most of the value come from? Restaurants (16 percent), grocery stores (12 percent), imports (4 percent for agricultural products and 6 percent for fuel and other imports

that are imbedded throughout the value chain) and transportation/wholesale (11 percent) contribute large shares to final value. In addition, business services such as finance, insurance, advertising, legal services, and accounting contribute 19 percent, making their contribution alone greater than the combined share of domestic agriculture, imported agricultural products, and food manufacturing.

FIGURE 2.1 Farming and fishing contributed only 5 percent of the total value of food.



Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts*, 1947-2007.

Educational investment has increased more than any other component of gross domestic product.

On the one hand, understanding our economy seems very easy in that it is about producing goods and services to support the needs of the population – basic and otherwise. The amount of output is dependent on the size and skills of the labor force, our ability to produce (technological level), and the size and effectiveness of our capital base (machinery, buildings, and transportation infrastructure). Other indirect factors like a good financial system (e.g., venture capital and borrowing for large investments) and smooth running legal and regulatory systems (e.g., intellectual property protection, quick resolution of disputes, and responsible regulations) permit change to occur with a minimum of impediments. In total these relationships are expressed in the iconic production equation common to basic economics:

$$\text{GDP} = \text{Personal Consumption} + \text{Investments} + \text{Government} + (\text{Exports} - \text{Imports})$$

(or shortened to $\text{GDP} = \text{C} + \text{I} + \text{G} + (\text{X} - \text{M})$ (where X represents exports and M represents imports).¹⁵

These monetary aggregates are the value of what we produce (the P in GDP stands for “product”).¹⁶ The value of imports needs to be subtracted because the costs of imports are included in the final sale prices of consumption, investment, government, and exports. By subtracting the import component from these production categories, Table 2.1 shows that, between 1947 and 2007, the share of personal consumption was down by nearly 5 percentage points while the share of government consumption was up by 2 percentage points.¹⁷ Since these two are combined in this report in the overall category of total consumption, this share is down by less than 3 percentage points of GDP.

TABLE 2.1 The personal consumption component of GDP declined by 4.7 percentage points between 1947 and 2007.

	1947	2007	Change (percentage)
Personal consumption	66.8%	62.1%	-4.7
Government	6.2%	8.4%	2.1
Total consumption	73.0%	70.5%	-2.5
Fixed investment, R&D	16.1%	15.9%	-0.2
Education	2.7%	6.7%	4.0
Total investment	18.8%	22.6%	3.8
Exports*	8.2%	6.9%	-1.3

*There is an anomaly in the export share in that the 1947 share is greater than the 2007 share. This seems to contradict the well-known finding that the importance of international trade has increased substantially over time. The cause of this anomaly is due to the Marshall Plan, which was created to help European countries recover from the devastation of World War II.¹⁸ Because the plan mainly worked by giving money to foreign countries to buy goods produced by American companies, these “purchases” were treated as exports as were the local purchases by the remaining U.S. forces based abroad.

Source: Georgetown University Center on Education and the Workforce analysis of data from U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts*, 1947-2007.

In one sense, farmers are unquestionably a fundamental component in the process of manufacturing food, and the view that the other components are nonessential seems plausible. However, this is clearly not reflected in food's market price. That's because the market does not differentiate between essential and nonessential components of production. Instead, market prices are determined by supply and demand. Thus, the cost of farm workers is relatively small because the skills necessary to tend crops are in large supply, i.e., they are easy to reproduce. By contrast, workers who work primarily with their minds are in relatively short supply, i.e., their skills are more difficult to reproduce, and require more education and training. As a result, they receive greater pay and constitute a larger share of the value chain in today's world.

The small share of food spending that farmers receive reflects an old economic puzzle: Why is water cheaper than diamonds? The puzzle arises from the intuition that water is essential for life, while diamonds are unnecessary, a luxury. The short (and incomplete) answer is that prices reflect relative scarcities among goods and services; in other words, diamonds are in short supply, while water is plentiful and thus extremely cheap to produce. If miners discovered a vast supply of diamonds overnight and they became as readily available as copper, the price of diamonds would fall dramatically.

Thus, our value-chain analysis does not reflect differences of necessity or intrinsic worth as the term "value" often does; it merely reflects the dollar value of all the contributions to a product. The fact that a product is necessary for survival does not guarantee high rewards in the marketplace when

production costs are low. One hundred years ago, the vast majority of the final price of food went to farmers; even in 1967, 14 percent of food value added went to farmers. With today's technology, farmers produce at least 20 times more per worker than a century ago and they now produce enough to export a significant portion of their output (and get paid to limit their production).

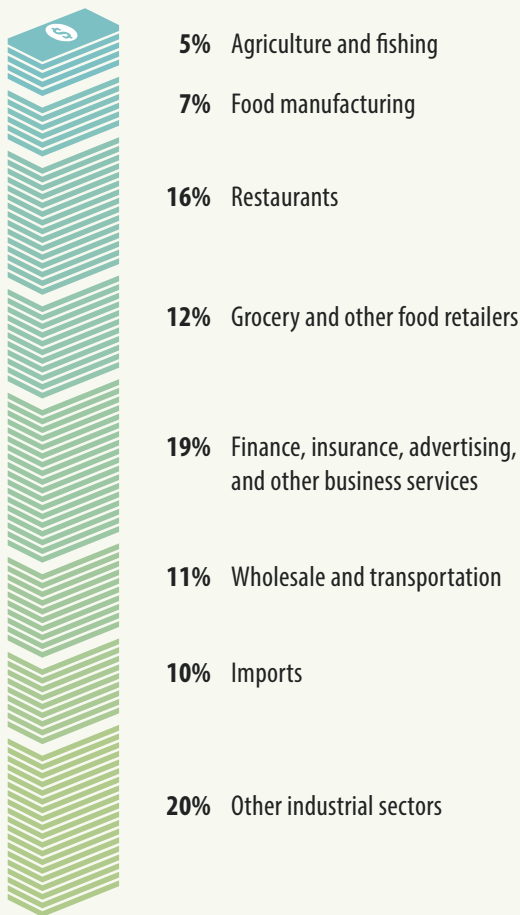
On the other side of this equation, today's consumers are getting a lot more for their money. They spend nearly half of their food dollars on eating out and expect an enormous variety of choices beyond meat and potatoes. At home or at a restaurant, chickens can be free range or factory-raised and fish are wild or farmed. Food choices are global. One in every 10 dollars spent on food goes to imports so we can get bananas in the winter and an apple from Israel, Washington State or Argentina.

To show the variation of production recipes, we present one page summaries of each of the final 11 output categories showing the direct and indirect contributions of different industries, occupations, and educational levels of the workers.

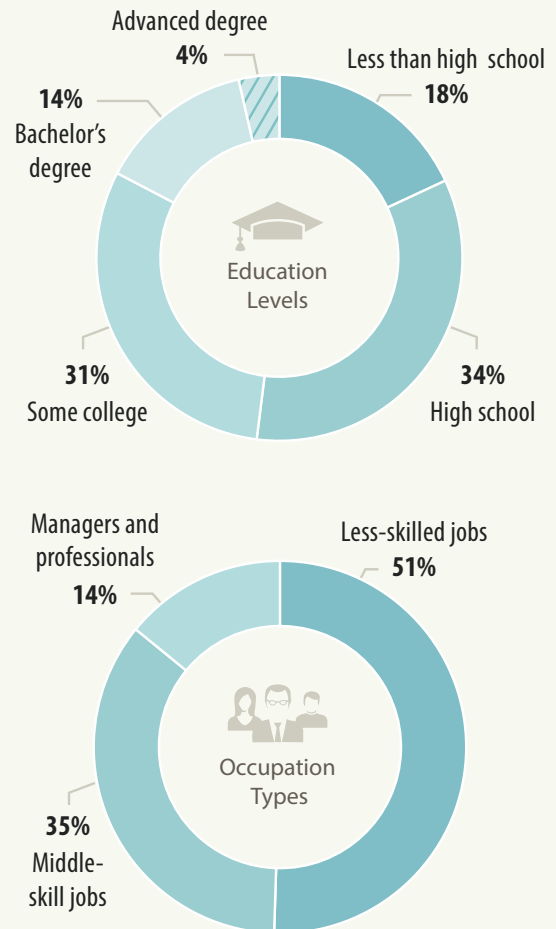
Food

FIGURE 2.2 Surprisingly, critical sectors in food production contribute little overall value to the commodities produced. For example, agriculture and fishing account for a mere 5 percent of the total value of food commodities, with food manufacturing comprising just 7 percent. Restaurants and grocery stores contribute 16 percent and 12 percent, respectively, while the largest value is generated by finance, insurance, advertising and other business services, at 19 percent, along with other industrial sectors, at 20 percent. This field is made up of a relatively high portion of workers with low education levels: 18 percent have less than a high school diploma. 34 percent have only a high school diploma, and 31 percent have some college. Only 14 percent have a Bachelor’s degree, and just 4 percent have an advanced degree. Workers in this field also tend to be concentrated in low-skilled positions, with 51 percent in less-skilled occupations, and only 14 percent classified as managers and professionals.

Key industrial sectors as of 2007



Aggregate worker profiles as of 2007



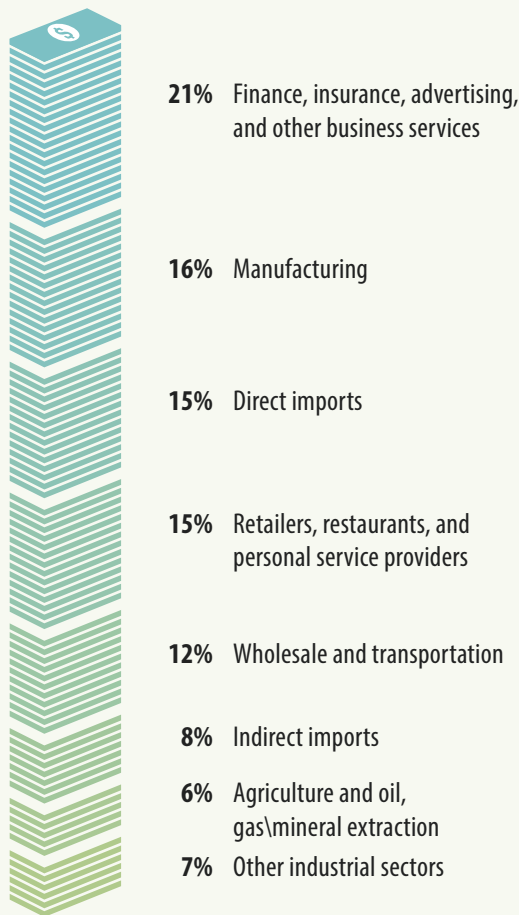
Source: Georgetown University Center on Education and the Workforce analysis of data from U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts, 1947-2007*.



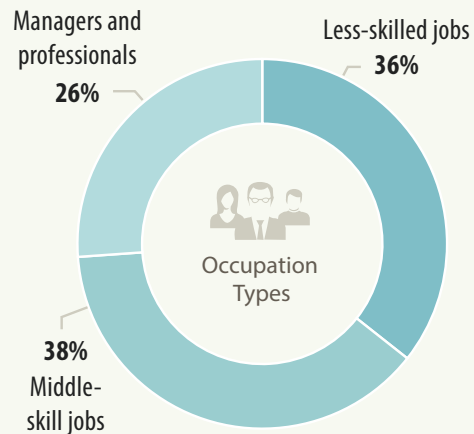
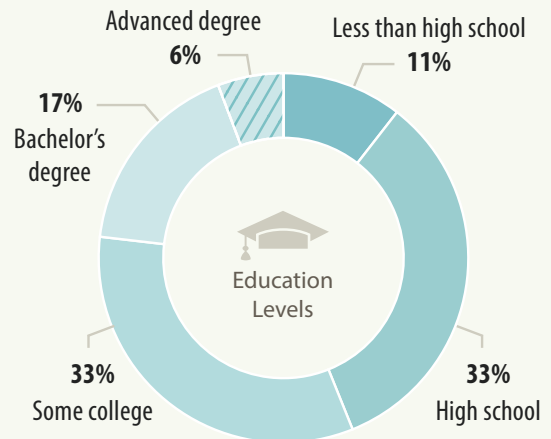
Transportation

FIGURE 2.3 A diverse group of industrial sectors drives value in transportation commodities: 21 percent is generated through finance, insurance, advertising and other business services; 15 percent through direct imports, with an additional 8 percent stemming from indirect imports; and 15 percent is generated through retailers, restaurants, and personal service providers. Sixteen percent of the value of transportation commodities is created by manufacturing, a relatively high portion relative to other commodities. The distribution of workers in this field is skewed toward those with lower levels of education: 11 percent have less than a high school diploma, and those with high school diplomas and some college each comprise 33 percent. In comparison, just 17 percent have a Bachelor’s degree and only 6 percent have an advanced degree. Occupation types reflect educational attainment, with 26 percent of workers in managerial and professional positions, 38 percent in middle-skill jobs, and 36 percent in less-skilled positions.

Key industrial sectors as of 2007



Aggregate worker profiles as of 2007

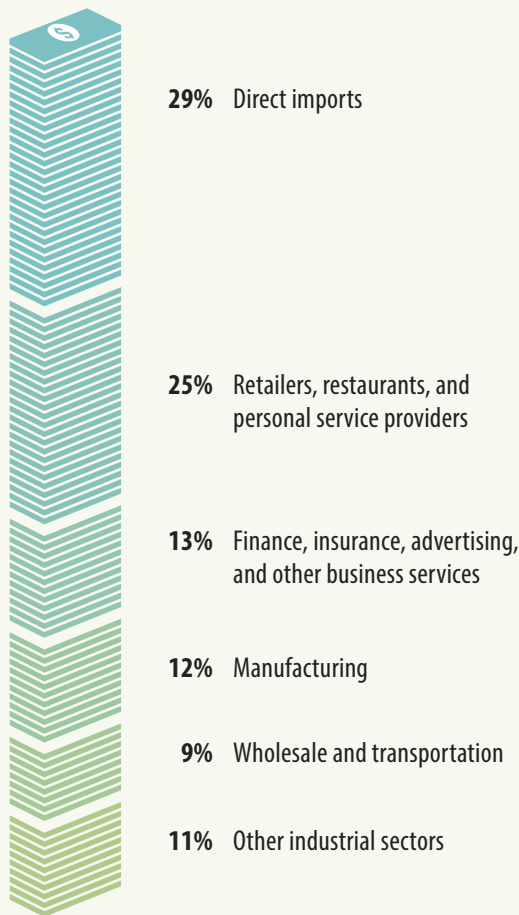


Source: Georgetown University Center on Education and the Workforce analysis of data from U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts, 1947-2007*.

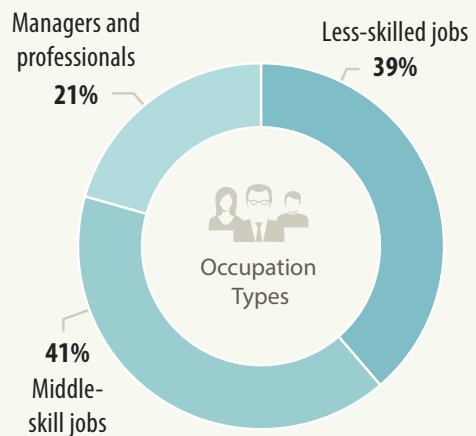
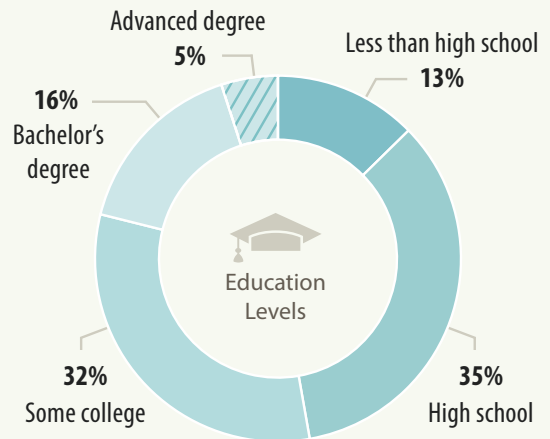
Clothing and personal care

FIGURE 2.4 In clothing and personal care commodities, the largest share of value is attributable to imports, at 29 percent – significantly higher than most other fields. Just 25 percent of the value added in personal care comes directly from restaurants, retailers and other personal service providers. However, only 12 percent of value in clothing and personal care is attributable to the U.S.-based manufacturing sector. The workforce in clothing producing sectors is relatively less-educated – 13 percent do not have a high school diploma, and 35 percent hold only a high school diploma. Only 16 percent have obtained a Bachelor’s degree and just 5 percent hold an advanced degree. The remaining 32 percent of positions require some college. Similarly, a small portion – 21 percent – of all positions in this field are considered managerial or professional occupations, while 41 percent are middle-skill level positions and the remaining 39 percent are classified as less-skilled jobs.

Key industrial sectors as of 2007



Aggregate worker profiles as of 2007



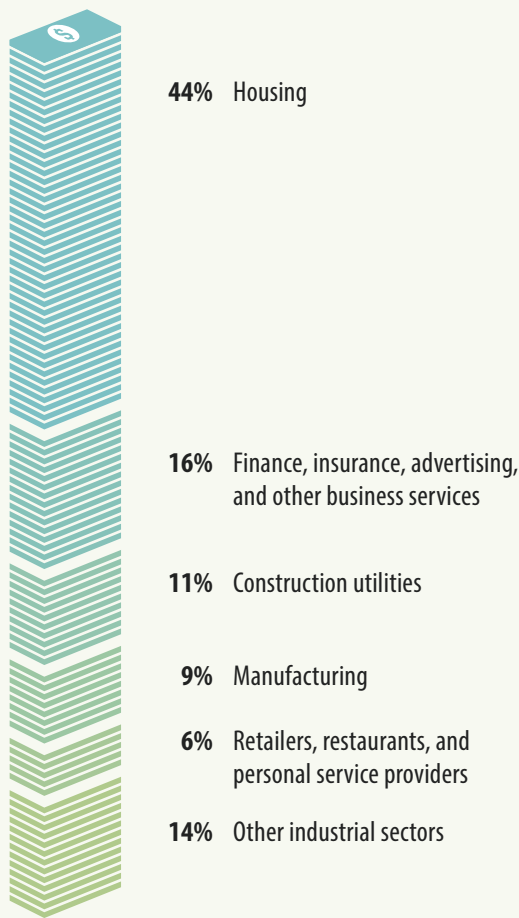
Source: Georgetown University Center on Education and the Workforce analysis of data from U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts, 1947-2007*.



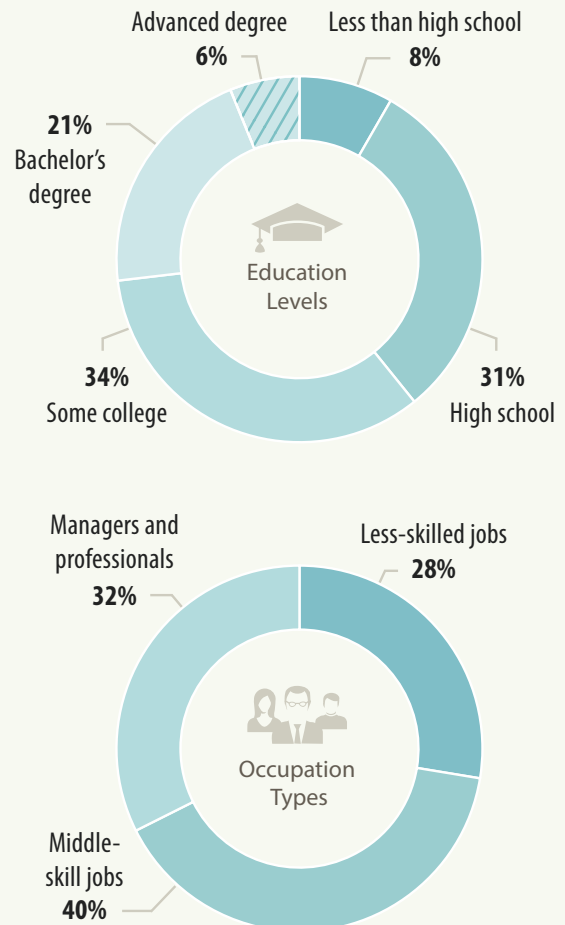
Housing and household operations

FIGURE 2.5 Forty-four percent of the value in housing and household operations is generated by housing, while the remaining value is created throughout other industrial sectors. Thirty-nine percent of workers in housing and household operations have a high school diploma or less, 34 percent have completed some college or an Associate’s degree, and just 27 percent hold a Bachelor’s degree or higher. Skill levels are also relatively evenly split, with 40 percent of jobs categorized as middle-skill level, 32 percent as managerial or professional, and just 28 percent classified as less-skilled workers.

Key industrial sectors as of 2007



Aggregate worker profiles as of 2007

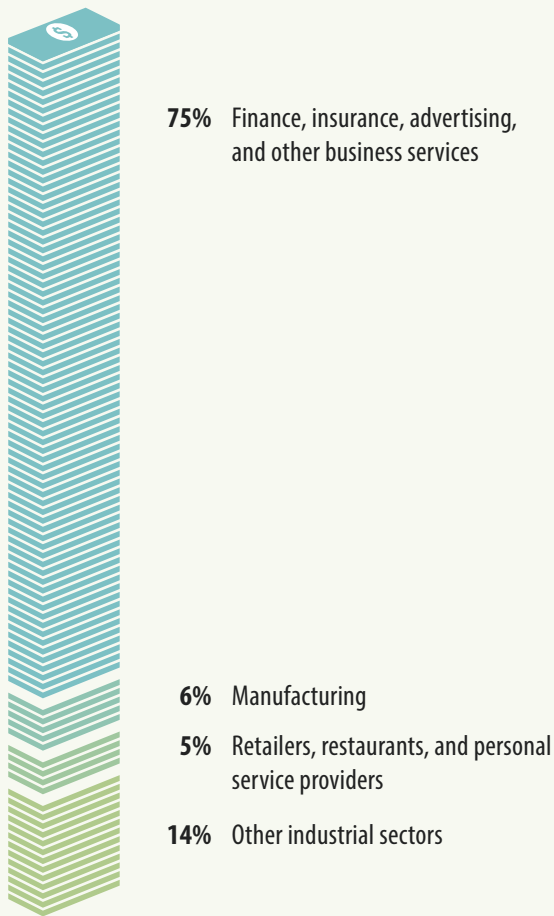


Source: Georgetown University Center on Education and the Workforce analysis of data from U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts, 1947-2007*.

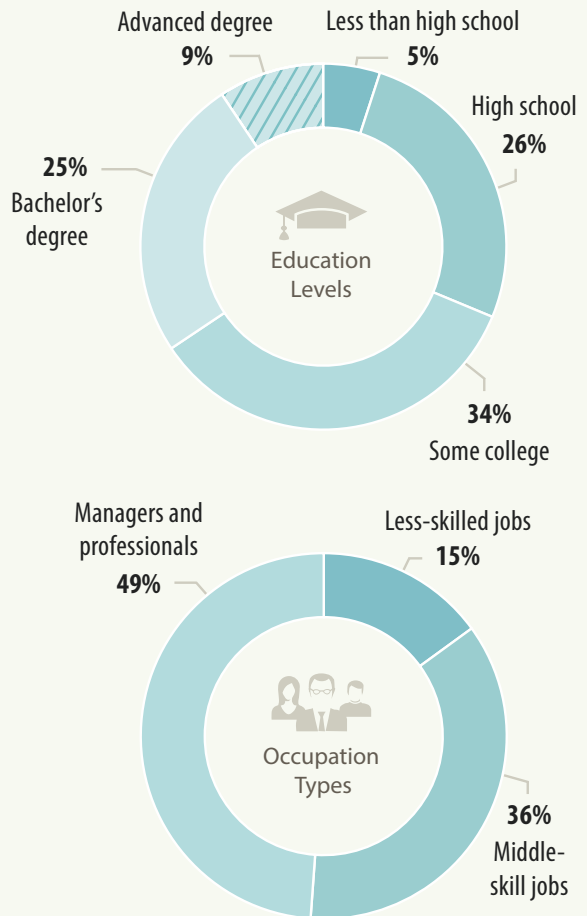
Business services

FIGURE 2.6 A considerable 75 percent of the value added in business services comes from finance, insurance, advertising and other business services – surprisingly, manufacturing and retailers, restaurants and personal service providers account for 5 percent and 6 percent, respectively. This field is split relatively evenly across education levels: 5 percent of workers have less than a high school diploma, and 26 percent have only a high school diploma. Thirty-four percent have some college or an Associate’s degree, and 25 percent hold a Bachelor’s degree, while 9 percent have an advanced degree. Despite this, the available jobs in this field are concentrated among managerial or professional skill levels, with these positions making up 49 percent of available jobs. Thirty-six percent are considered middle-skill level, and just 15 percent are less-skilled jobs.

Key industrial sectors as of 2007



Aggregate worker profiles as of 2007

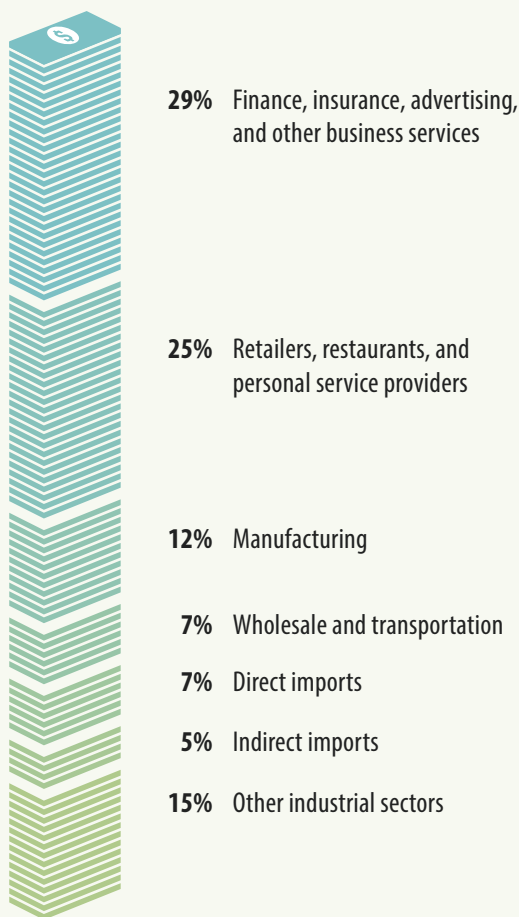


Source: Georgetown University Center on Education and the Workforce analysis of data from U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts, 1947-2007*.

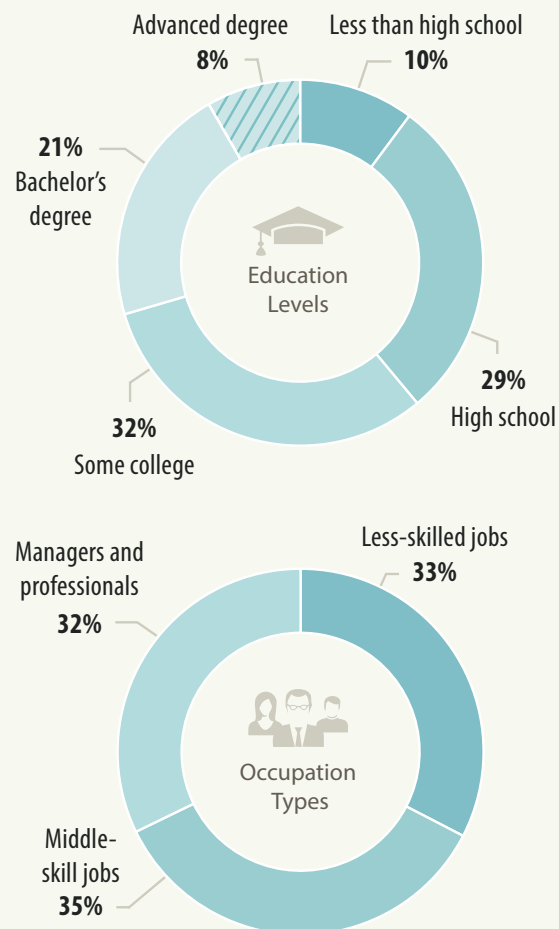
Recreation and leisure

FIGURE 2.7 Retailers, restaurants and other personal service providers contributed 25 percent of the value generated in the production of recreation and leisure commodities, with 29 percent of that value associated with finance, insurance, advertising and other business services. Surprisingly, 12 percent of the total value of these commodities is generated by manufacturing. Thirty-nine percent of those employed in this field hold a high school diploma or less, while 32 percent have some college, just 21 percent have a Bachelor's degree, and 8 percent hold an advanced degree. Most jobs in this field are classified as middle-skill level, at 35 percent; the remaining jobs are split evenly, with 33 percent described as less-skilled positions, and 32 percent considered managerial or professional positions.

Key industrial sectors as of 2007



Aggregate worker profiles as of 2007

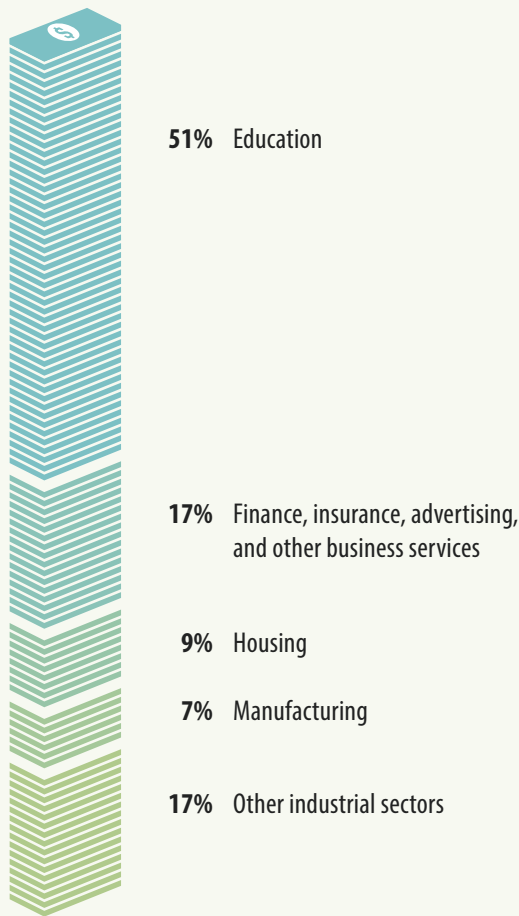


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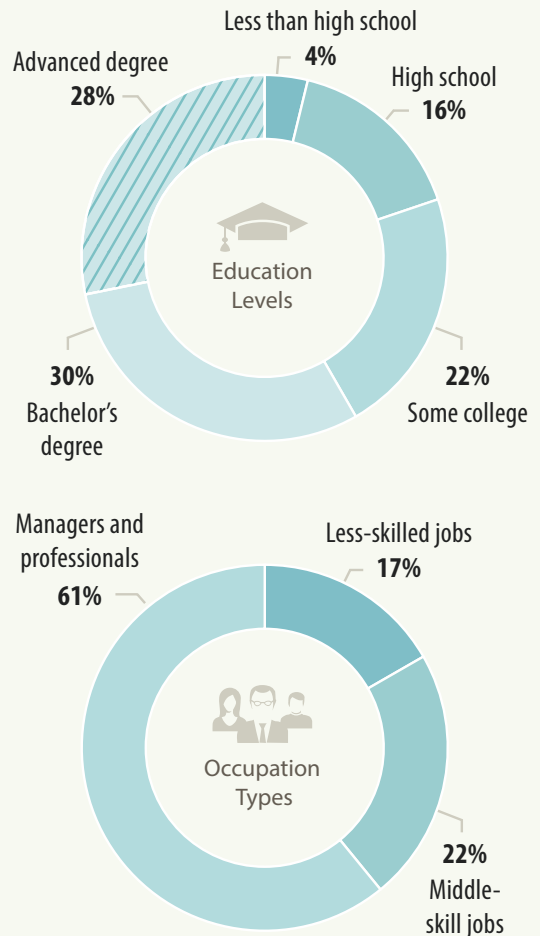
Education

FIGURE 2.8 The substantial portion of the value added in education is generated by outside industries – 17 percent comes from finance, insurance, advertising and other business services, 9 percent is generated by housing, and 7 percent comes from manufacturing. Producing education commodities requires a highly educated workforce, with 30 percent of those in this field holding a Bachelor’s degree and 28 percent holding an advanced degree. These patterns are similar for occupational classifications, with 61 percent of employees performing managerial or professional roles, and only 22 percent in middle-skilled jobs.

Key industrial sectors as of 2007



Aggregate worker profiles as of 2007



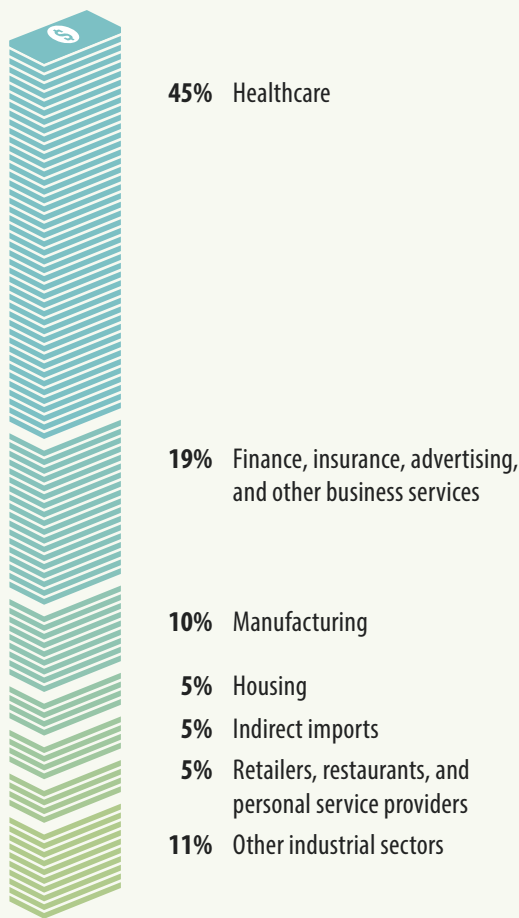
Source: Georgetown University Center on Education and the Workforce analysis of data from U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts, 1947-2007*.



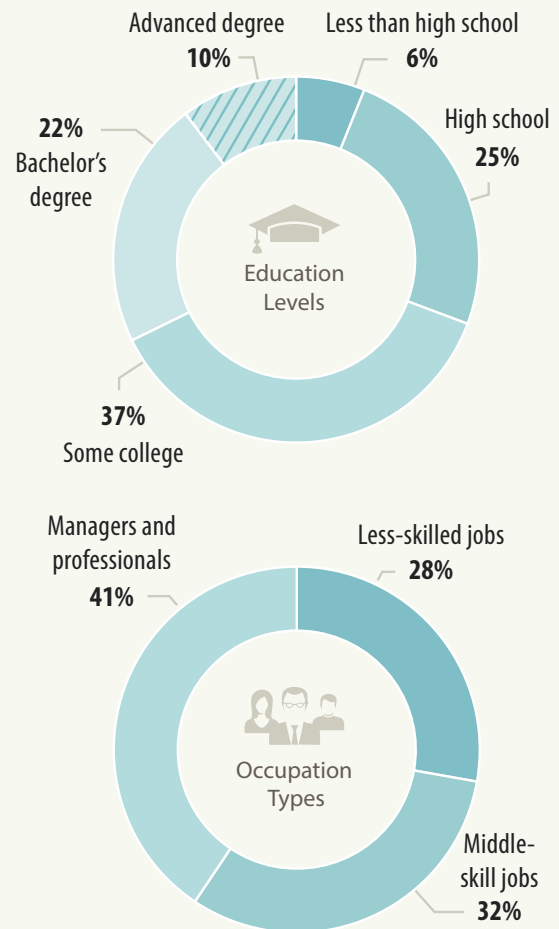
Healthcare

FIGURE 2.9 In the production of healthcare commodities, 45 percent of the total value in this field is generated by healthcare industries themselves, making this the largest contribution of any industrial sector. Finance, insurance, advertising and business services comprise 19 percent of the value added in healthcare. Thirty-one percent of workers in this field have a high school diploma or less, with 22 percent of workers holding a Bachelor’s degree and 10 percent holding an advanced degree. The remaining 37 percent of workers have some college experience. Healthcare positions are heavily concentrated in managerial and professional positions, which comprise 41 percent of all jobs in this field. Only 28 percent are considered less-skilled positions.

Key industrial sectors as of 2007



Aggregate worker profiles as of 2007

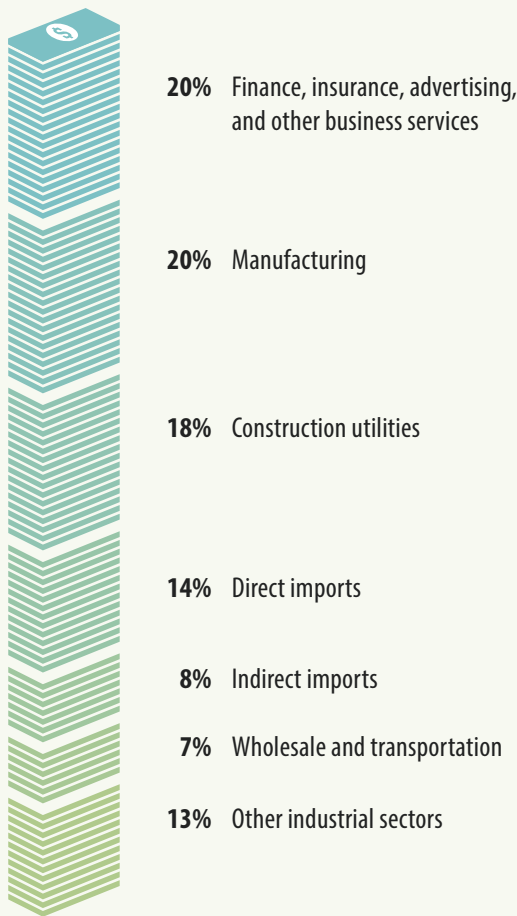


Source: Georgetown University Center on Education and the Workforce analysis of data from U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts, 1947-2007*.

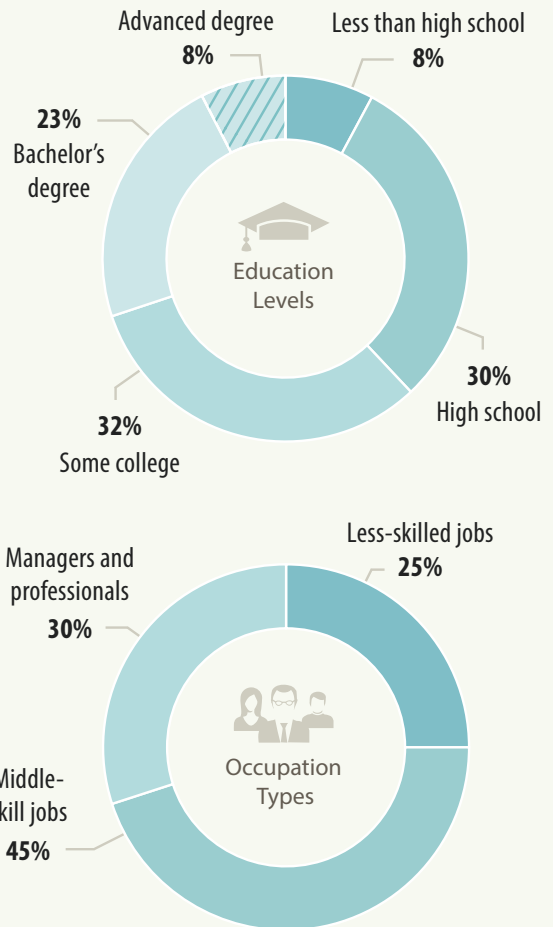
Investment

FIGURE 2.10 Twenty percent of the value in investment commodities is generated by finance, insurance, advertising, and other business services, with an equal portion generated by manufacturing. Eighteen percent is contributed through construction utilities, and 22 percent is generated through a combination of indirect and direct imports. Thirty percent of those employed in these industries have a high school diploma, 8 percent have less. Thirty-two percent have at least some college, while 23 percent have a Bachelor’s degree and 8 percent have an advanced degree. Forty-five percent of positions are classified as middle-skill level, 25 percent are considered less-skilled, and the remaining 30 percent of positions are designated managerial or professional positions.

Key industrial sectors as of 2007



Aggregate worker profiles as of 2007



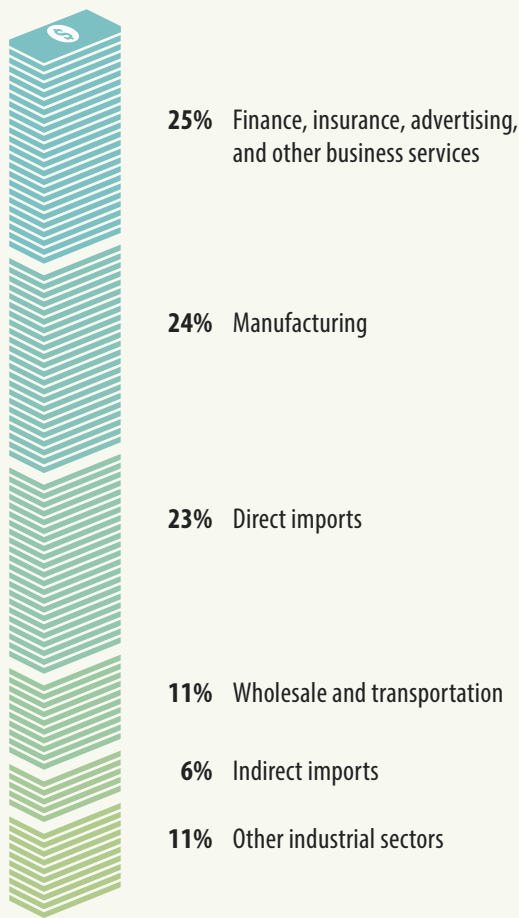
Source: Georgetown University Center on Education and the Workforce analysis of data from U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts, 1947-2007*.



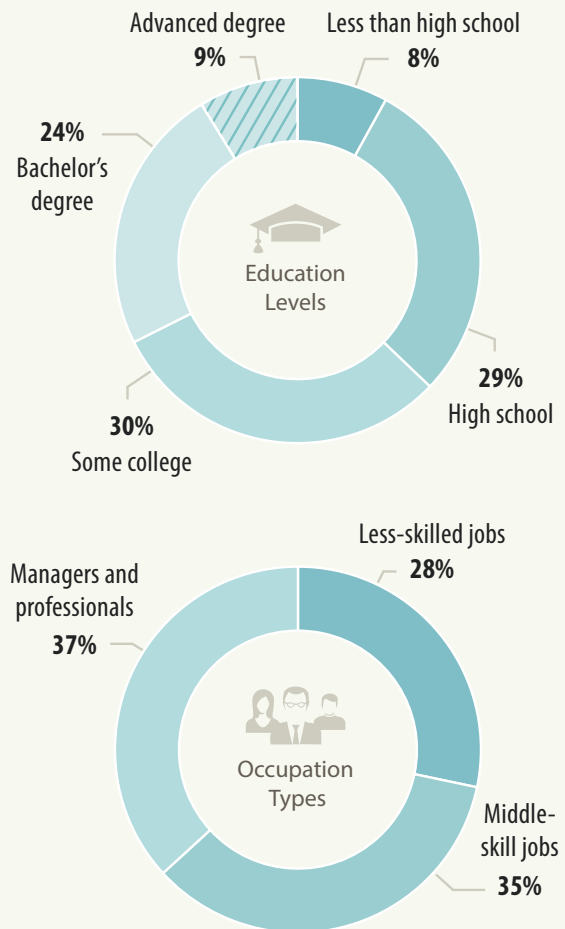
Exports

FIGURE 2.11 Export commodities’ value comprises a variety of industrial sectors, with 25 percent generated in finance, insurance, advertising, and other business services, and 24 percent generated through manufacturing. Interestingly, direct and indirect imports comprise 23 percent and 6 percent, respectively, of the value of export commodities. Twenty-nine percent of workers involved in the production of these commodities have a high school diploma, and 8 percent have less than a high school diploma. On the other end of the education spectrum, 9 percent of workers in this field have an advanced degree, and 24 percent have a Bachelor’s degree, with the remaining 30 percent having some college experience. In terms of occupation types, export commodities are relatively evenly split, with 37 percent of workers in managerial and professional positions, 35 percent in middle-skill jobs, and 28 percent in less-skilled jobs.

Key industrial sectors as of 2007



Aggregate worker profiles as of 2007

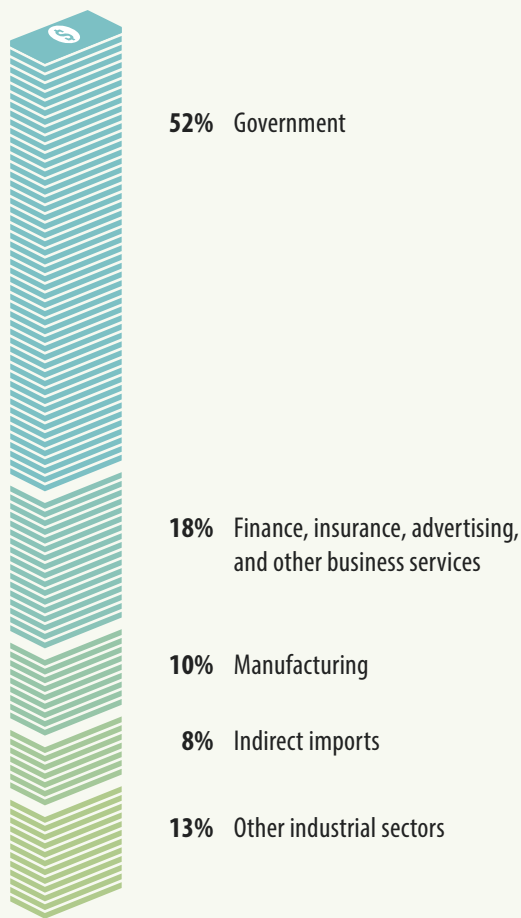


Source: Georgetown University Center on Education and the Workforce analysis of data from U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts, 1947-2007*.

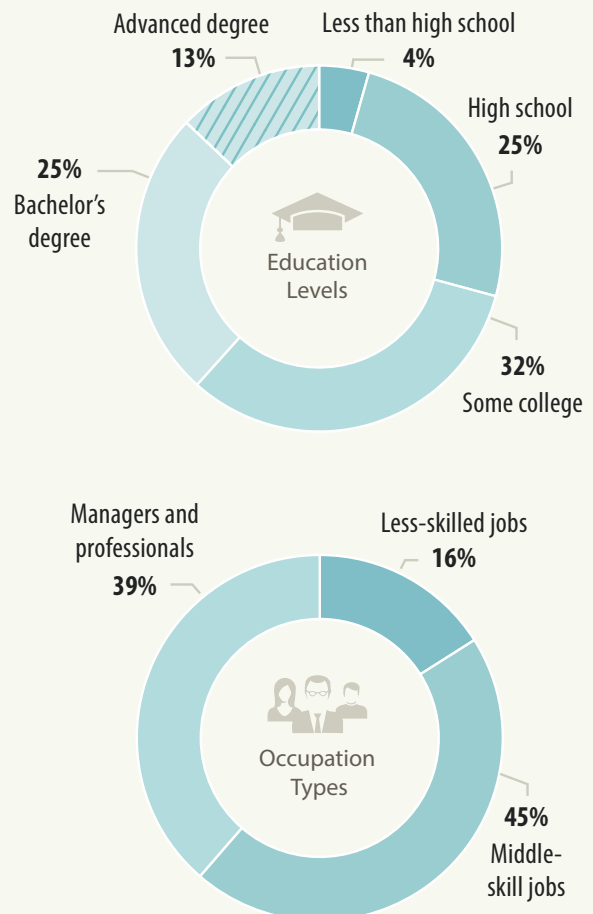
Government

FIGURE 2.12 Fifty-two percent of the value of government commodities is generated by the government itself, with an additional 18 percent contributed by finance, insurance, advertising and other business services. The demand for highly educated workers in this field is high, with 13 percent of the population holding an advanced degree, 25 percent holding a Bachelor’s degree, and 32 percent having at least some college. The occupations in this field are relatively high skilled, with 39 percent classified as managerial or professional positions, and 45 percent considered middle-skill jobs.

Key industrial sectors as of 2007



Aggregate worker profiles as of 2007



Source: Georgetown University Center on Education and the Workforce analysis of data from U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts, 1947-2007*.

OCCUPATIONS

Over the past 60 years, the share of high-skill jobs in the economy has increased, while the share of low-skill jobs has declined sharply.

So far, we have analyzed the U.S. economy through the lenses of output categories and industries. Those analyses provided a look within each industry and output category to see the education level of its workers. This section analyzes the economy through another lens – an occupational lens. Instead of looking *within* each industry or output sector, it looks *across* all sectors to get a detailed look at the occupational categories that span the entire U.S. economy. By focusing more directly on workers than industries, this occupational analysis reveals the transformation that’s been taking place in the education levels of America’s workers.

In general, there are more similarities in skill requirements within occupations or related occupational clusters than there are within industries. The healthcare industry, for instance, includes a wide array of occupations with different skill sets: from doctors to secretaries to accountants. Consider the example of a unit clerk in a hospital. Though part of the healthcare industry, he or she would likely have the credentials and skills to become a clerical worker in a transportation company. However, if the unit clerk tried to shift within the hospital to compete for an entry-level nursing job, it would require new or pre-existing training. This dynamic – when workers within occupations have more similarities than workers within industries – shows why the occupational analysis is vital.

Three Major Occupational Tiers¹⁹

Elite managerial and professional jobs:

- Managers (with the exception of retail and food service managers) and self-employed professionals
- Lawyers and judges
- Doctors, dentists, and other health diagnostic professionals
- Other medical professionals (e.g., nurses)
- Accountants and other related business professions
- Sales representatives (but not sales clerks) and financial and insurance professionals
- Teachers at all levels (includes clergy)
- Professional artists, performers, and writers (which historically have been classified as professionals in government tabulations)

Middle-skill jobs:

- Supervisors including self-employed non-professionals and managers in retail and food stores
- Farm owners and managers
- Healthcare and other technicians and technologists
- Skilled blue-collar workers in construction, repair, and machinery operation
- Firefighters, police, and other protective service workers (but not guards)
- Clerical and administrative workers

Low-skill jobs:

- Factory operatives
- Service workers including guards
- Sales clerks
- Farm and nonfarm laborers

In the approach used here,²⁰ three major occupational tiers are defined (see Three Major Occupational Tiers):

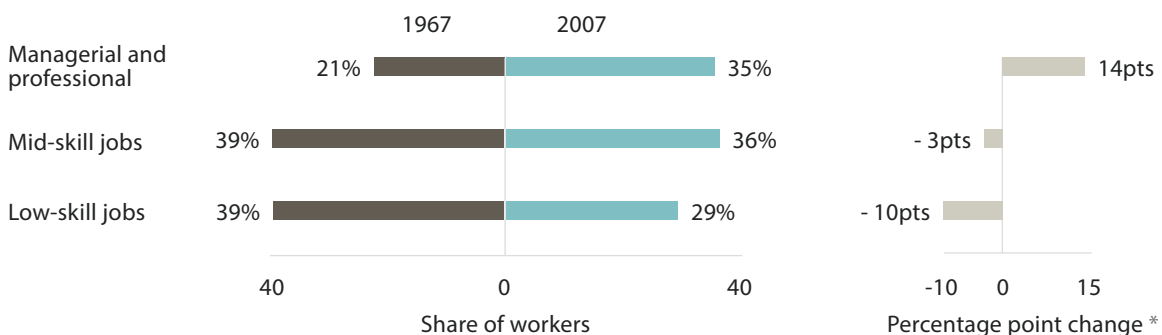
- Elite managerial and professional jobs;
- Middle-skill jobs; and
- Low-skill jobs.

Specific occupations are assigned to these tiers based on the education and pay of the incumbents, with education being weighted twice as heavily as pay. Because women make less than men at every education level, occupations that are predominantly male or predominantly female are assigned on the basis of their relative standing within that gender. In general, top-tier jobs are the ones in which workers are highly paid, have high levels of responsibility and/or autonomy, and have high levels of education. At the other end of the spectrum, the lower tier is composed of manual, service, and sales workers who are at the bottom of the earnings hierarchy and supervised by others to perform a relatively narrow range of tasks.

There has been a massive decline in low-skill jobs that require a high school education or less and a substantial growth in elite managerial and professional jobs that require college degrees.

- The share of managerial and professional workers increased from 21 percent of the total workforce in 1967 to 35 percent in 2007 as seen in Figure 3.1.
- The share of low-skill workers in the overall workforce declined substantially, dropping from 39 percent to 29 percent between 1967 and 2007.
- Middle-skill jobs also declined during this period, though only modestly. Their share in the total labor force fell from 39 percent to 36 percent.²¹ The reduction in the number of blue-collar supervisors, skilled blue-collar workers, and clerical workers meant that there were slightly fewer high school graduates in middle-skill jobs and more in low-skill jobs.

FIGURE 3.1 High-skill jobs are increasing, middle-skill jobs are changing, and low-skill jobs are declining dramatically.



Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Census Bureau, 1967-2007. * Values may not sum to total due to rounding.

Though there is significant occupational diversity within the high-, middle-, and low-skill tiers, the three groups draw from very different occupational clusters.

- Among managers and professionals in 2007, 57 percent worked in public or private administration or as business professionals (e.g., accountants, analysts and sales representatives in business-to-business transactions); 32 percent were in teaching and the arts, and 11 percent were medical practitioners or healthcare professionals.
- Middle-skill jobs are roughly divided in thirds. The major middle-skill jobs in 2007 were clerical workers (31 percent but down considerably from 1967), supervisors (31 percent including non-professional self-employed),

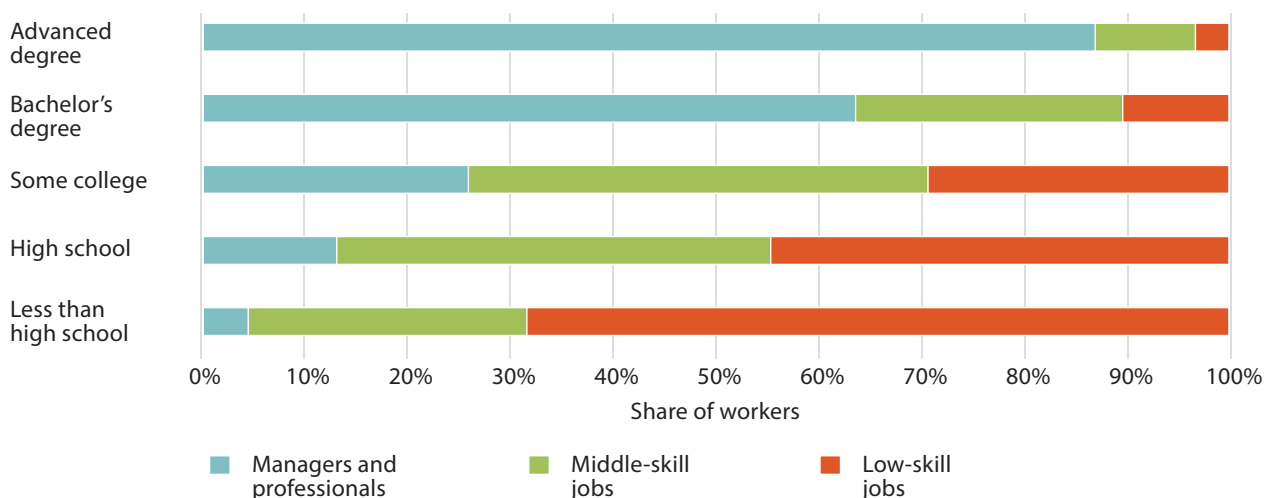
skilled blue-collar workers (21 percent and down from 1967), technicians (9 percent) and police and firefighters (8 percent).

- As for the low-skill tier in 2007, 57 percent were manual workers in manufacturing, construction, mining, and farms, and 43 percent were low-skill retail and service workers.

The chances of becoming a manager or a relatively autonomous professional increase dramatically as students move up the education ladder.

- While just 4 percent of high school dropouts were managers and professionals, this share rises to 64 percent among those with a Bachelor's degree and an astonishing 87 percent for those with a graduate degree (Figure 3.2).

FIGURE 3.2 Nearly nine out of 10 graduate degree-holders work as managers or professionals, while seven out of 10 high school dropouts work in low-skill occupations.



Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Census Bureau, *Current Population Survey*, 2007.

- Low-skill, low-wage jobs are concentrated among the least educated. Sixty-eight percent of those without a high school diploma are in low-skill, low-wage occupations while just 10 percent and 3 percent, respectively, of those with a Bachelor’s or graduate degree are in low-skill, low-wage jobs.
- Middle-skill jobs, by contrast, do not follow a consistent pattern. Instead, workers with either a high school diploma or an AA/ some college had a roughly equal chance at middle-skill jobs (42 percent and 45 percent, respectively) while high school dropouts had lower concentrations in middle-skill jobs.

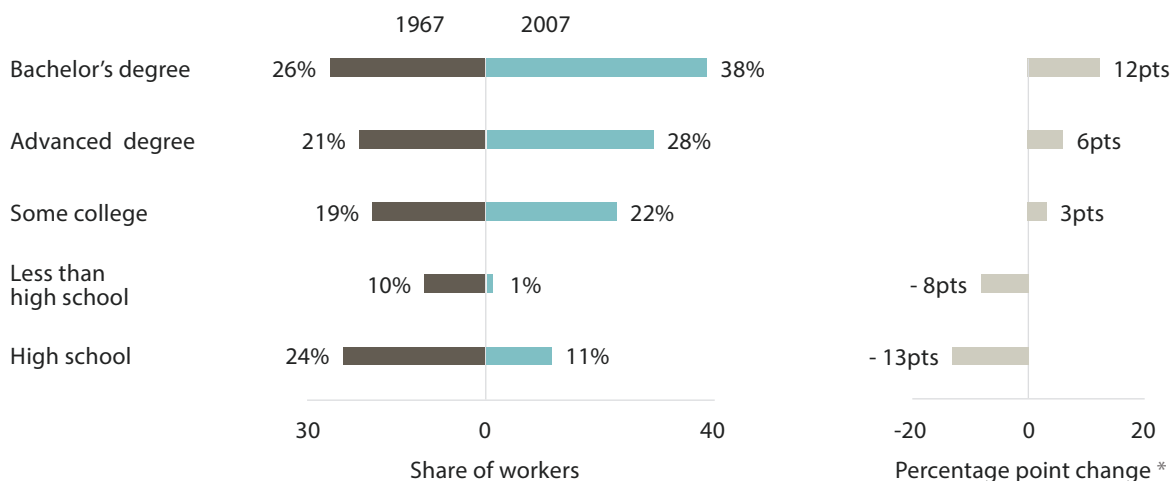
The consequences of occupational upgrading (more managers and professionals) and educational upgrading (more workers with BA and

graduate degrees) altered the composition of top managerial and professional jobs (Figure 3.3). In 1967, fewer than half of such workers had a BA or graduate degree and 34 percent had at most a high school diploma. By 2007, the share of those with a Bachelor’s degree or higher rose to 66 percent (just under two out of three) while the share with at most a high school diploma fell to 12 percent.

Managerial and professional occupations have grown in every output category since 1967; the lowest increase was in food (2 percentage points) and the highest were in exports (20 percentage points) and business services (18 percentage points).

As Figure 3.4 shows, the share of managerial and professional jobs in the value chain of each output category varied widely in 1967: from a

FIGURE 3.3 Among managers and professionals, the share of those with Bachelor’s and graduate degrees rose to 66 percent.



Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Census Bureau, *Current Population Survey*, 1967-2007. * Values may not sum to total due to rounding.

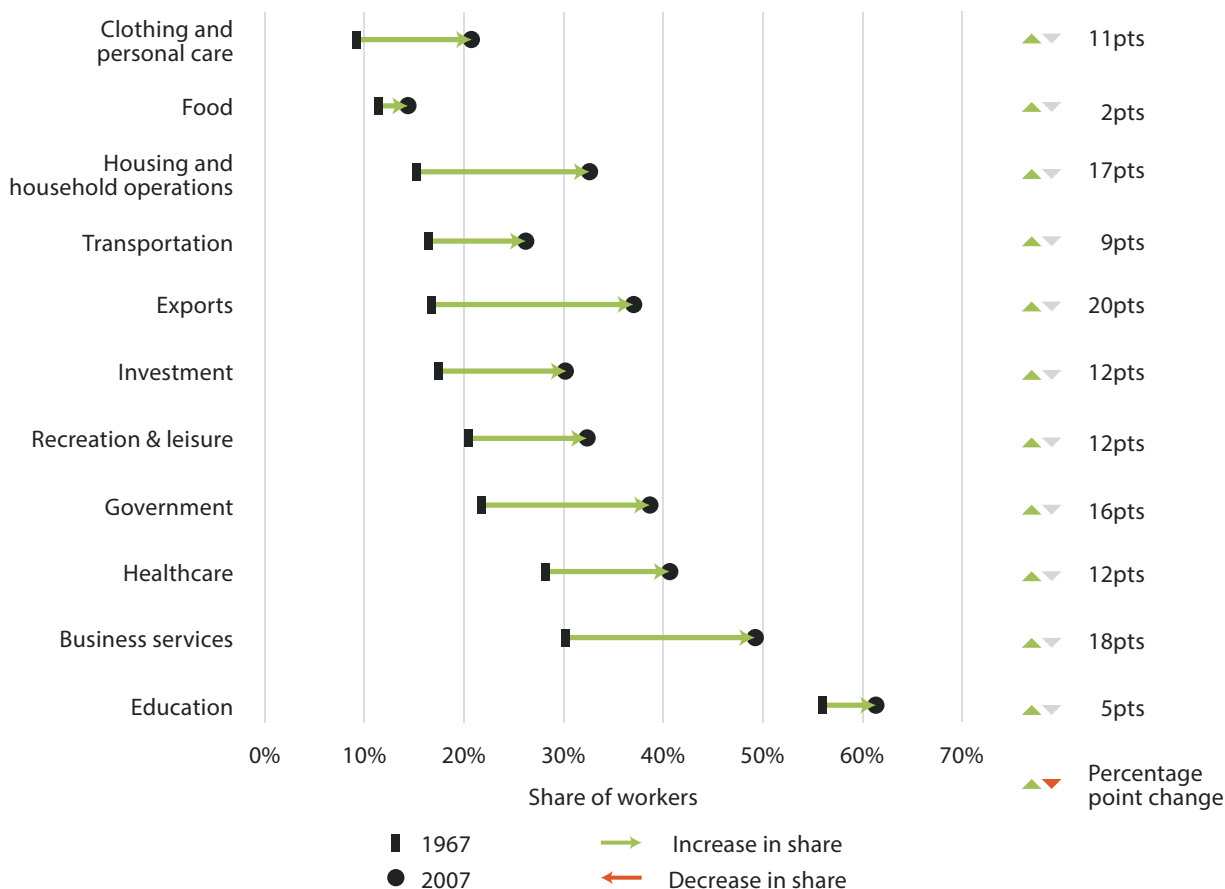
low of under 10 percent for clothing and personal care to a high of 56 percent for education.

By 2007, the share of managerial and professional workers had increased significantly in most output categories (Figure 3.4). The exceptions were education (which had so many managers and professionals in 1967 that there was little

room for growth) and food (which remains a low-skill, labor-intensive sector and is now dominated by fast food and retail workers).

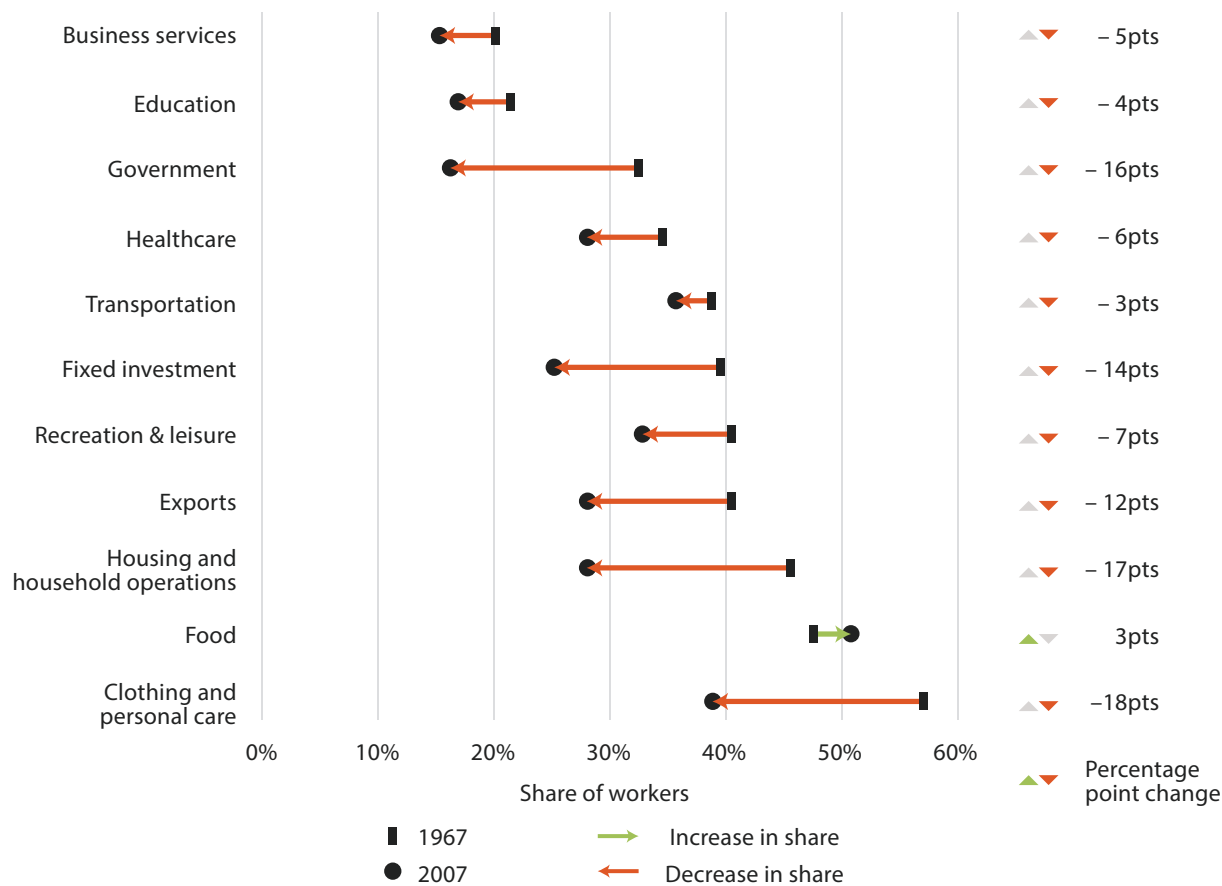
The largest increases in high-skill jobs occurred in exports, business services to individuals, housing, and government. The rising share in exports was due to the increase in finance and

FIGURE 3.4 The share of managerial and professional employment in the value chain of exports increased across the board, with exports increasing managerial and professional employment by the largest margin.



Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts* and U.S. Census Bureau, *Current Population Survey*, 1967-2007.

FIGURE 3.5 With the exception of food, the share of low-skill employment declined in every final output category between 1967 and 2007; in clothing and personal care the share declined the most, from 57 percent to 39 percent.



Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts* and U.S. Census Bureau, *Current Population Survey*, 1967-2007.

related business-to-business services provided to foreign companies. The other three big gainers in the managerial and professional workforce (business services to individuals, housing, and government) are office-based activities that have been impacted by the rising use of computers and the decline in middle-skill clerical jobs.

The shift in the distribution of outputs alone would have increased the share of managerial and professional workers by 2 percentage points between 1967 and 2007. But the gain in managerial and professional jobs during that time was nearly 14 percentage points overall. That indicates that change in the occupational recipes within economic

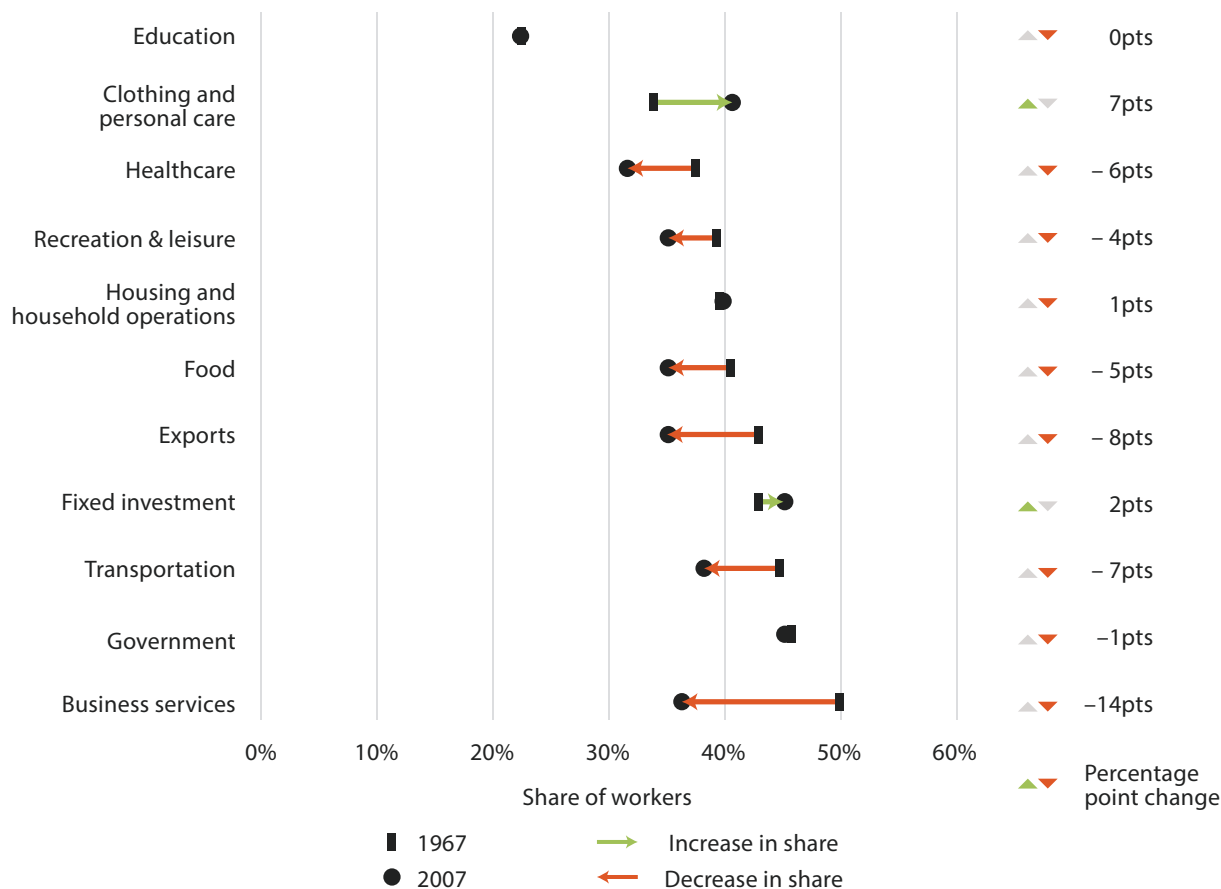
sectors was responsible for the bulk of the large increase in elite managerial-professional jobs.

Low-skill jobs declined in every output category except food. And the only output categories that didn't have a large decline in the share of low-skill workers were ones where the use of low-skill labor was very low in 1967 (education

and business services) or where low-skill labor is cheap and automation or offshoring is difficult (food, transportation, and recreation and leisure).

The trend in low-skill jobs has generally been the reverse of the patterns for high-skill managerial and professional jobs. For instance, low-skill employment has plummeted in housing, government,

FIGURE 3.6 Between 1967 and 2007, the overall share of middle-skill jobs decreased slightly. Across all final output categories, seven had decreases and four did not.



Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts* and U.S. Census Bureau, *Current Population Survey*, 1967-2007.

investment, and exports – four of the five sectors where low-skill jobs fell the fastest between 1967 and 2007 (Figure 3.5). Conversely, those were four of the five sectors where high-skill employment rose quickest during the same period. However, the losses in the share of low-skill jobs were neither as large nor as consistent as the gains for high-skill jobs in other sectors. The exception, however, was the shift in the food sector to more eating out which meant that the low-skill share in this output category actually increased slightly to over 50 percent.

Middle-skill jobs have been affected by countervailing forces of upskilling and deskilling as well as industry growth and decline that in combination reduce their share of jobs marginally while shifting away from manufacturing toward service jobs with higher postsecondary educational requirements.

The change within middle-skill jobs varied considerably (Figure 3.6). In 1967, middle-skill jobs were most common in business services (a whopping 50 percent), government (46 percent), and transportation (45 percent). By contrast, they didn't play a big part in education (just 23 percent) and clothing and personal care (34 percent) in 1967.

As noted above, the share of clerical jobs has fallen and therefore this has accounted for much of the decline in the share of middle-skill jobs in business services. The declines in healthcare, transportation, and exports need to be interpreted cautiously because these have had big shifts to top-level jobs and declines in both low- and middle-skill jobs. In healthcare, the decline in middle-skill jobs reflects the growing importance of nurses and other professionals with Bachelor's

and graduate degrees, while in transportation and exports, the decline reflects the rising importance of finance, insurance, and managerial employees.

Overall, only two-thirds of the small decline in middle-skill jobs was due to changes in production recipes, with the other one-third due to changes in the distribution of economic output categories. This contrasts with the experience of the low-skill and high-skill tiers, in which the changes were larger and were overwhelmingly due to changes in production recipes.

FUNCTIONAL SUPER SECTORS

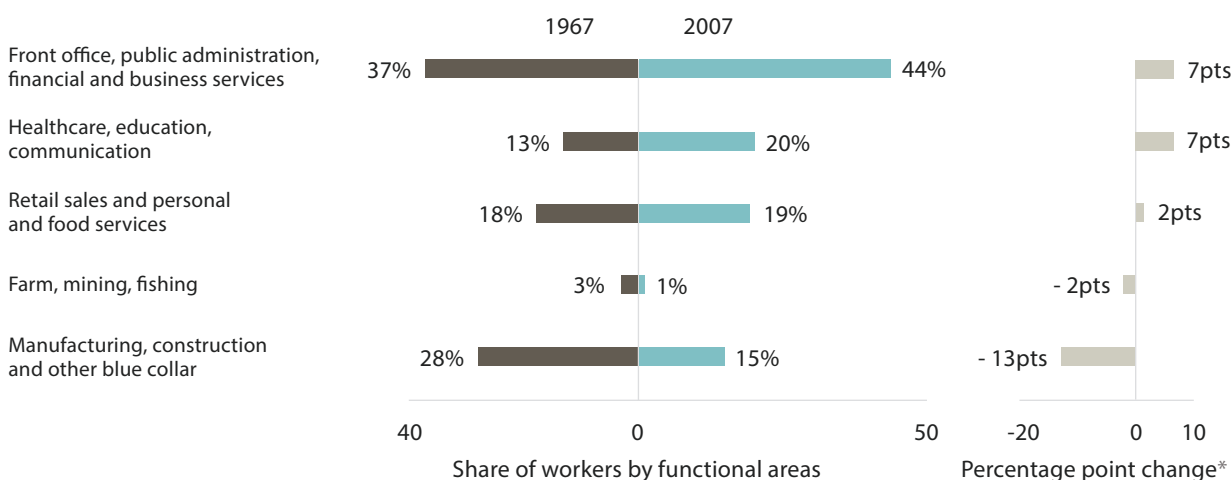
Identifying what workers actually do on the job reveals the dominant role of white-collar office work in the U.S. economy.

This section takes the occupational analysis of Part 3 one step further to do a “functional analysis” – a close look at what workers actually do on the job. That’s key because although Americans know we’ve been shifting from a manufacturing to a services economy, they’re unclear on what services have been expanding or where they’re being delivered. By conducting this functional analysis, we can see plainly that fast-food restaurants are *not* the dominant workplace of the post-industrial era.

Look around any central city today, and you will see one large office building after another. Go to the inner suburbs and you will see even more office buildings. And finally, at the airports of many cities (which are often further out of town), there is usually another cluster of office buildings. Yet, when people talk about the economy, they talk about “manufacturing” and “services,” but not offices.

The reason for this analysis gap is because our data are organized by industrial employment at the company level. This means that office employment in manufacturing, healthcare, or any other industry is hidden in the main activity of

FIGURE 4.1. Between 1967 and 2007, the share of manual labor workers declined from 28 percent to 15 percent, while the share of high-skill services workers increased from 13 percent to 20 percent.



Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts* and U.S. Census Bureau, *Current Population Survey*, 1967-2007. *Values may not sum to total due to rounding.

the company. We tend to identify industries with their final product or service – housing, health-care, transportation, etc. – not with a functional analysis of what people actually do at work.

To bridge this analysis gap, we created a methodology in 1998 to group similar activities across industries in five functional categories:²²

- Office work
- High-skill services
- Low-skill services
- Manual labor in industry
- Primary production (farming, mining, fishing)

Office work and high-skill services can be considered a “functional super-sector” for college degree-holders.

By splitting activities within employers this way, there is much more accuracy in assessing what workers actually do and the skills they’re required to have than there is when one follows the classic categorization based on industries. In both 1967 and 2007, the two functional categories that were most college-education intensive were office work (management, administrative, finance, and related) and high-skill services (healthcare, education, and communications).

As Figure 4.1 shows, employment in offices was already the largest sector of employment in 1967 at around 37 percent of all employment. The share in office employment grew steadily through 1990 and reached 44 percent of employment by 2007. The second biggest employment share in 1967

Defining Functional Activities

Office work

- Managers in any field
- Clerical and administrative workers in any field
- Business professionals in any field (e.g., sales representatives, accountants)
- All workers in finance, insurance, real estate, and business services
- All workers in public administration

High-skill services

- All non-office workers in healthcare
- All non-office workers in education
- All non-office workers in communications
- Police and firefighters

Low-skill services and retail sales

- All non-office workers in retail
- All non-office workers in personal and food services

Manual labor in industry

- All non-office workers in manufacturing
- All non-office workers in construction, utilities, and transportation

Primary production

- All non-office workers in farming, mining, and fishing (excludes farm managers)

was found in direct labor in manufacturing and related activities (manual labor in industry) with nearly 28 percent of employment. By 2007, there was a sharp 13 percentage point drop in this share of workers, declining to 15 percent. There was also a 2 percentage-point drop in primary production

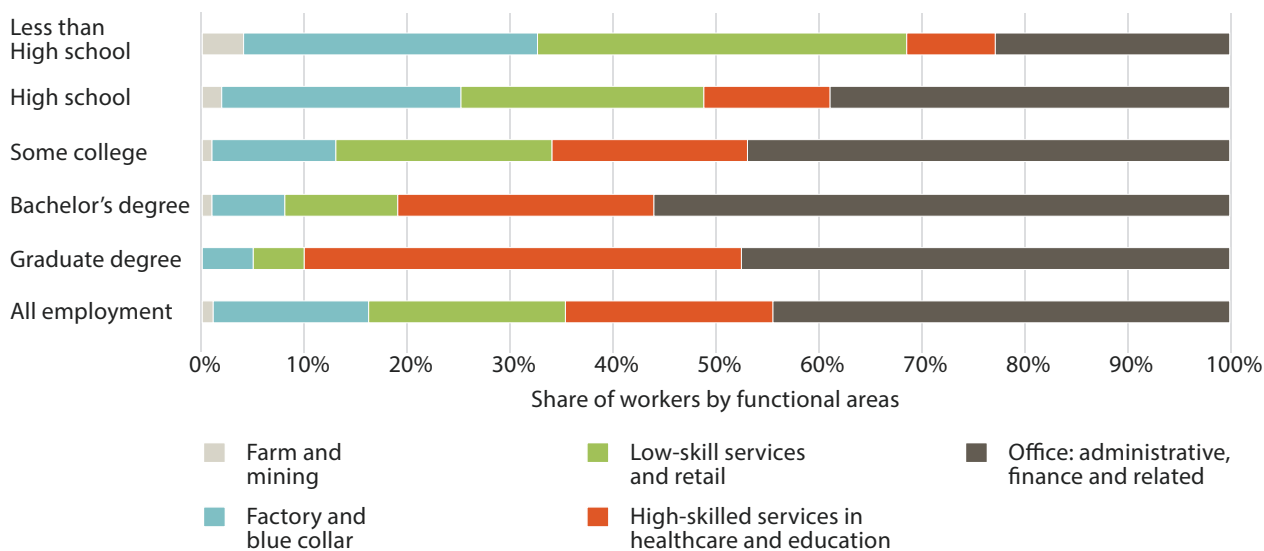
workers. These drops were countered by a small rise in low-skill services workers (up less than 2 points to 19 percent) and a larger rise of nearly seven percentage points among high-skill services workers (to 20 percent). Overall the high-end service economy went from employing slightly over 50 percent in 1967 to 64 percent in 2007.

While the share of workers is an important indicator, the share of earnings is in some ways a better indicator of importance to the economy. Because office workers earned 21 percent more than the typical earners in the economy, the high-end service sector accounted for 74 percent of all earnings in 2007. The other three functional areas of the economy represented just slightly more than one-quarter of all earnings: 1 percent for farming

and related primary production (few workers and lower than average pay); and under 12 percent for retail sales and food and personal services (typical pay 40 percent below the economy-wide median). The biggest change was that in the position of blue-collar workers in manufacturing, construction, and other industries. Not only did their numbers fall by nearly half, but their relative pay also changed from 7 percent above the average economy-wide level to 9 percent below. This meant that their share in 2007 was just 14 percent of all earnings (down from 30 percent in 1967).

Workers of different educational levels are distributed very differently across functions. As Figure 4.2 shows, those who haven't finished high school are mainly in manual labor (29 percent) and

FIGURE 4.2 Those with a Bachelor's or graduate degree are predominantly employed in the high-end service sector.



Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts* and U.S. Census Bureau, *Current Population Survey*, 2007.

low-skilled services (36 percent), leaving only 32 percent in high-skilled services and office work. As people get more education, they shift from the three lower skilled functions (agriculture, manual labor, and low-skilled services) to the high-skilled service economy (offices and high-skilled services). This movement means that the office/high-skill service employment increases to 51 percent of those with a high school diploma, to 66 percent for those with some college or a two-year degree, to 81 percent for those with a BA degree, and finally to 91 percent for those with a graduate degree.

Consequently, the dominance of the office/high-skilled services is characterized by the following five factors. The sector:

- Employed 81 percent of workers with a Bachelor's degree and 91 percent with a graduate degree in 2007;
- Included 64 percent of all U.S. jobs in 2007, and paid out 74 percent of total earnings;
- Paid a wage premium of 15 percent over the average U.S. wage in 1967, which increased to 20 percent in 2007; (conversely, manual laborers earned 7 percent above the average in 1967, but saw this advantage evaporate by 2007 when they made 9 percent below average;)
- Showed a huge divide between the occupational composition of the office and high-skill super sector and the rest of the economy; (in this combined high-end service sector, 51 percent are in managerial and professional jobs, 38 percent in middle-skill jobs, and 11 percent in low-skill jobs;) in the rest of the economy the comparable figures are 7 percent managers and professions, 33 percent middle-skill jobs, and 60 percent in low-skilled jobs; and
- Increased from 50 percent of the jobs in 1967 to 64 percent of the jobs in 2007, while extractive and production jobs declined from 32 percent of the jobs in 1967 to 16 percent in 2007.

The prevalence of these functions varies considerably across the 11 final output categories.

Perhaps the easiest way to show these differences is to go through each of the functions and present where they played the biggest role (i.e., share of employment within an output category) in 1967 and how the role expanded, contracted, or stayed about the same through 2007. We are also able to estimate whether the change in the overall size in a function's employment share is driven mainly by shifts across final output categories (i.e., change between categories) or by changes in the production recipes of each category (i.e., changes within categories).

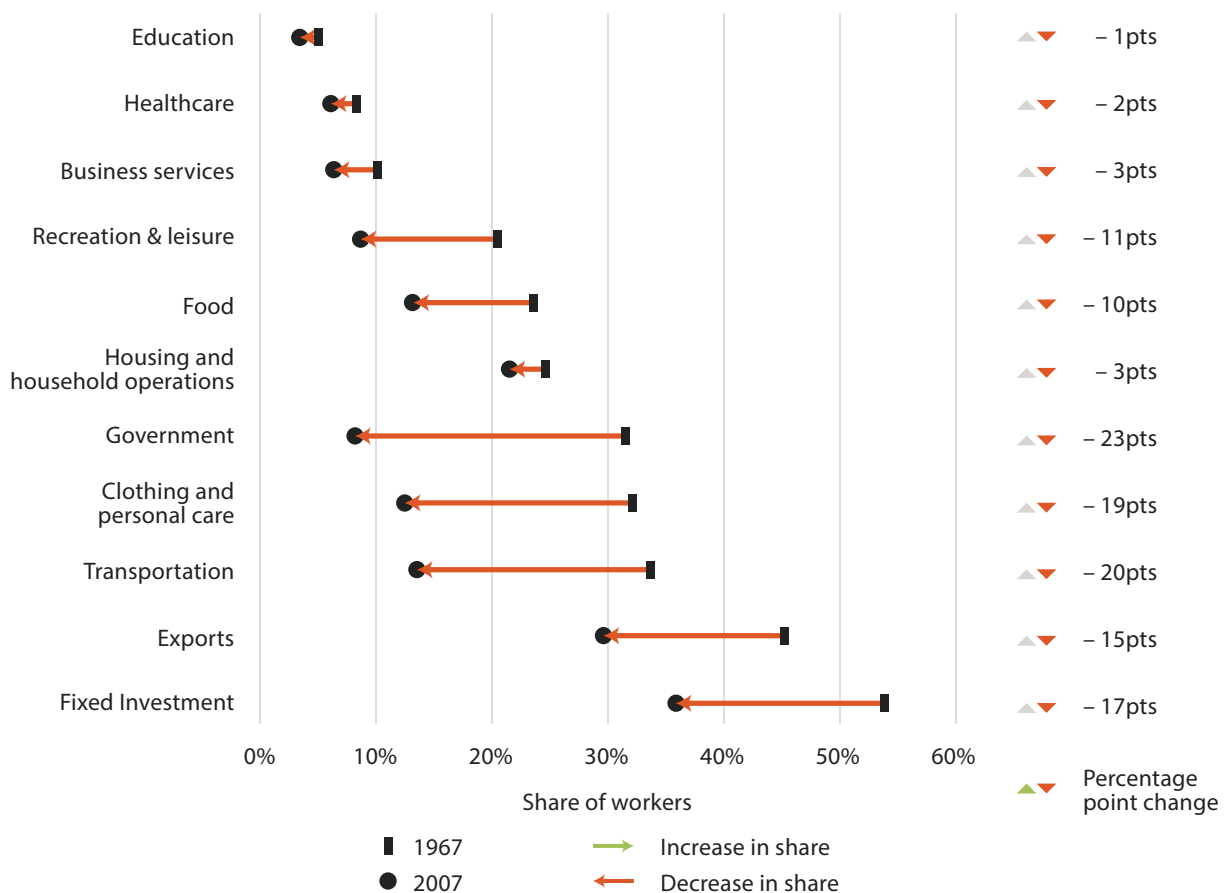
Primary production (farming, mining, and fishing) continued to decline as a share of total consumption as well as a share of total economic value in extractive industries and exports.

This is by far the smallest functional area and only played a significant role in 1967 in the output categories of food (13 percent of the direct and indirect workers in this area) and exports (9 percent). Because the food output share in the economy declined and the "primary production" function was most concentrated in food, this shift away from food production led to some of the decline in primary production workers. But

the decline of farming within food and export production was quite large, meaning that changes within recipes were responsible for 85 percent of the decline in primary production's share of employment. Manual labor (manufacturing, construction, and other blue-collar) was the second biggest of the five functional categories in 1967 but fell to the fourth-largest category by 2007.

While this was the second biggest function in 1967, it played varying roles in the production processes of our 11 output categories. For example, over half the employment in fixed investment was composed of these manual labor jobs versus just 5 percent of employment in education. Manual labor also played a large role in exports, transportation, and clothing in 1967 – large armament

FIGURE 4.3 Manual labor's share of employment declined from 32 percent to 9 percent between 1967 and 2007, the largest decline among final output categories.



Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts* and U.S. Census Bureau, *Current Population Survey*, 1967-2007.

purchases during the Vietnam War also drove high manual labor employment in government. On the other side of the ledger, manufacturing and other blue-collar workers were fairly scarce in the health-care and business services to individuals sectors.

By 2007, as Figure 4.3 shows, the drop in manual labor as an ingredient in output categories was dramatic: down by 17 percentage points in fixed investment, 15 points in exports, 20 points in transportation, and 23 points in government (this was despite the fact that we still have a large amount of military spending). There were also smaller drops in several categories, most of which had small shares in 1967, and more sizeable drops in food (10 percentage points) and recreation and leisure (11 points). These reductions were mainly driven by technological improvements and secondarily by rising imports.

As in primary production (farming, mining, and fishing), about 85 percent of the large decline in employment in this functional area was driven by changes within categories (production recipes) and only 15 percent was due to changes in distribution across categories (the distribution of final output).

Low-skill services and retail sales remained relatively stable between 1967 and 2007.

Employment in this functional area tends to play either a major role in the direct and indirect employment chain of an output category (e.g., transportation and food) or a minor one (e.g., education and government). Today, it arguably plays a middling role in just one category, housing, with 18 percent of employment. The role of retail workers

in sales to consumers is what drives this functional category. As Figure 4.4 shows, the low-skill services/retail sales function in 1967 was responsible for at least 29 percent of employment in food, recreation and leisure, housing, and clothing and personal care (which includes salons and related personal services).

By and large, the 1967 patterns were reproduced in 2007 with some prominent exceptions. First, the share of low-skill/retail sales employment in food rose from 29 percent to 48 percent, thanks to the increase in eating out. Second, there was a big jump in the share of low-skill/retail sales in the transportation sector's value chain; since auto imports and increased mechanization among domestic auto producers reduced the contribution of domestic manual labor in the transportation sector, it meant that a greater share of the United States-based contribution to transportation came from sales, service, and repair.²³ And third, the rise of clothing imports drove up the share of low-skill services/retail sales to 43 percent of employment in the clothing sector.

The relatively stable employment of the low-skill services/retail sales function reflects economic trends between 1967 and 2007 that offset one another. For example, because so many low-skill service and retail sales jobs are in declining output sectors like transportation and food – and so few are in expanding sectors like healthcare – one might assume that low-skill services/retail sales would be in serious decline. But because changing production recipes in transportation and especially food tilted strongly toward the low-skill services function, the net result of all these competing changes was a small increase in its overall employment share over the time period. Once again, changes in production recipes were decisive.

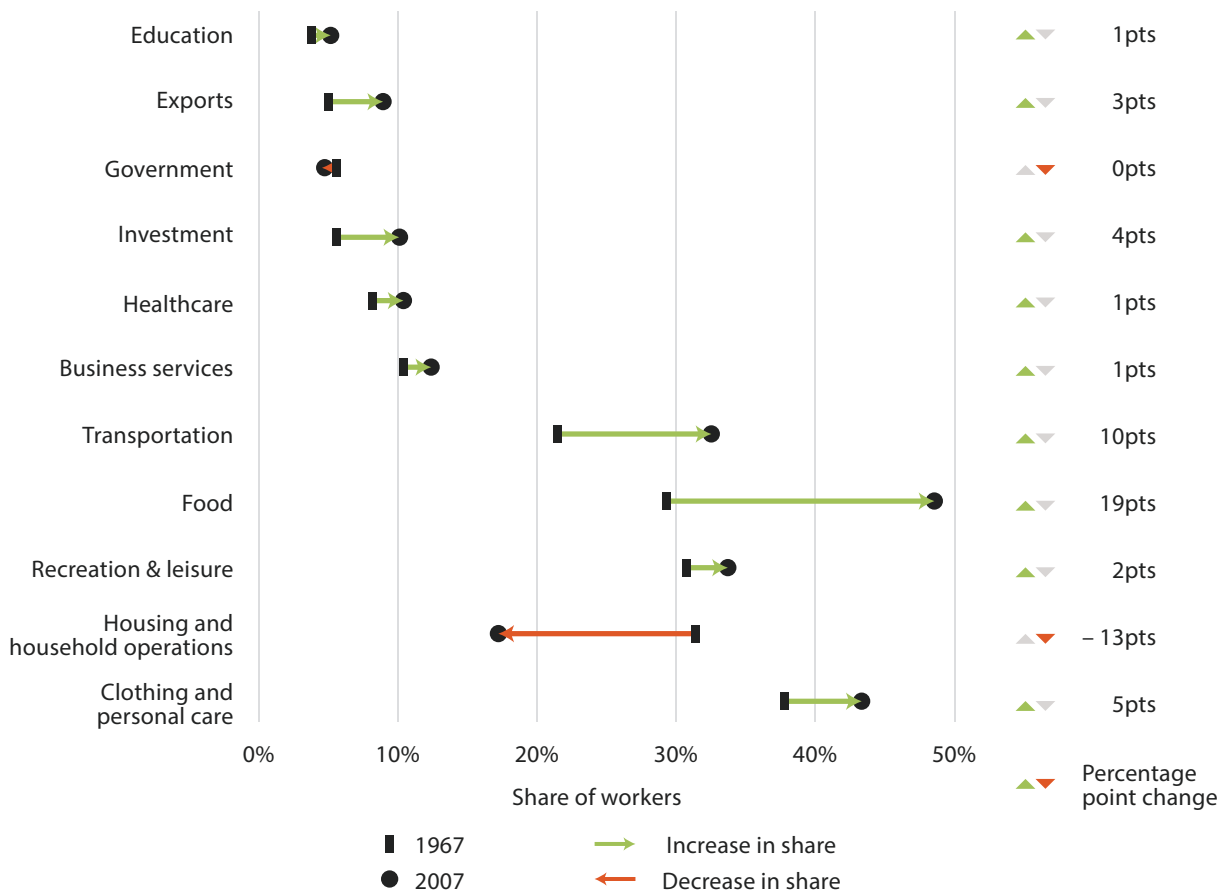
High-skill services grew between 1967 and 2007 as consumption shifted toward education and healthcare.

Employment in high-skill services is dominated by college-educated workers in education and healthcare, with only small shares of employment in the other nine output categories. This

occurred in both 1967 and 2007 and therefore there are no interesting shifts in contribution of high skills within our 11 final output categories.

In terms of production recipes, approximately 70 percent of direct and indirect workers necessary to produce educational services were

FIGURE 4.4 Low-skill services/retail sales' share of employment in food increased from 29 percent to 48 percent between 1967 and 2007, the largest increase among final output categories.

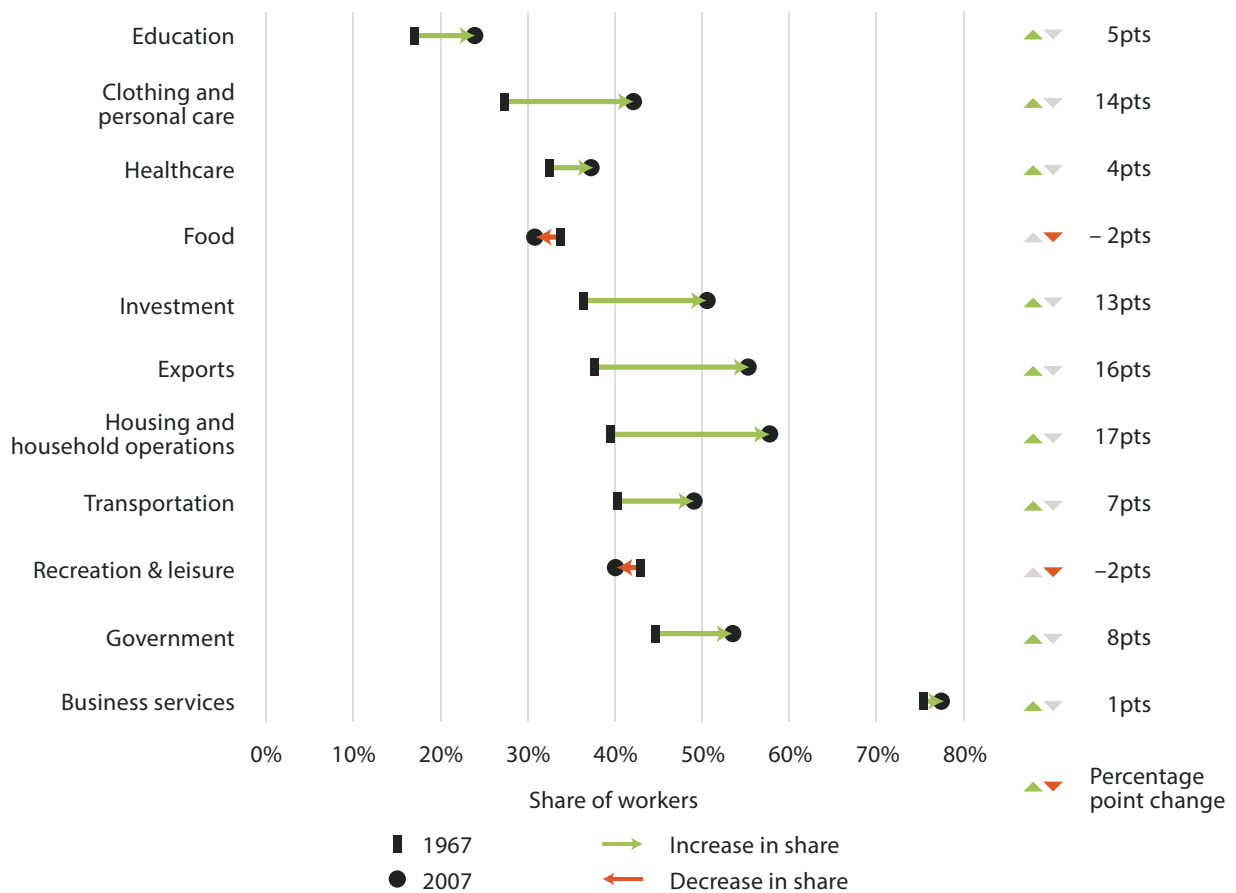


Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts* and U.S. Census Bureau, *Current Population Survey*, 1967-2007.

high-skill service workers. For healthcare, this high-skill service share was only 50 percent in both 1967 and 2007. While still a high number, healthcare requires more varied imports (e.g., drugs, more machines, and insurance companies) than the provision of educational services.

In healthcare, workers in medical establishments provide only half of the total output. Workers who make drugs and medical instruments comprise the other half, and are less likely to work in high-skill services.

FIGURE 4.5 Office work’s share of employment in housing and household operations increased from 40 percent to 57 percent between 1967 and 2007, the largest increase among final output categories.



Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts* and U.S. Census Bureau, *Current Population Survey*, 1967-2007.

Office employment grew between 1967 and 2007 because of economy-wide changes in production recipes that favored white-collar and professional functions.

Even in 1967, the office sector had the most workers within six of our 11 output categories. Business services to individuals stands out in that over three-quarters of employment in that sector was based in offices. Not surprisingly, government, with its heavy component of administration, was next with 45 percent of the sector's employees working in offices. Finally, transportation, housing, and exports rely heavily on office workers in finance, insurance, and real estate to produce their final outputs.

At the other end of spectrum, education stood out in 1967 as the output sector with the lowest concentration of office workers. Clothing and food are labor-intensive sectors with a big retail component and also had relatively few office workers.

By 2007, most output categories experienced large gains in the share of office workers (Figure 4.5). Five output categories had over 48 percent of their workforces based in offices: business services, housing, government, fixed investment, and transportation. While the share of office workers in education rose by 5 percentage points, it remained the final output category with by far the lowest concentration of office workers. Finally, food and healthcare were the only other categories not to have at least 40 percent of their workers in the office functional category. There is no systematic relationship between growing/declining output sectors and the share of office

employment, so all of the substantial growth in the share of office workers was due to changes in production recipes within output categories.

Changes in production recipes drove most of the change in functional employment.

The vast majority of the shifts in functional employment were due to changes in production recipes within the final output sectors. The one exception to this pattern was the high-skill services function, whose increased share of employment (up 7 percentage points) was driven by the increased size of the healthcare and education sectors, not by changes in production recipes.

With respect to manual labor (manufacturing, construction, and utilities), which declined steeply between 1967 and 2007, its share within all 11 output categories declined over the time period. For those five of 11 output categories that started with over 30 percent of the labor force being manual laborers, the average decline was 19 percentage points.

Office work, the neglected economic powerhouse, started out with the highest share of overall U.S. employment and had a 7 percentage point increase in share. This increase was driven completely by increasing concentrations within output categories; and in four sectors (housing, exports, clothing, and investment, the increase was approximately 15 percentage points.

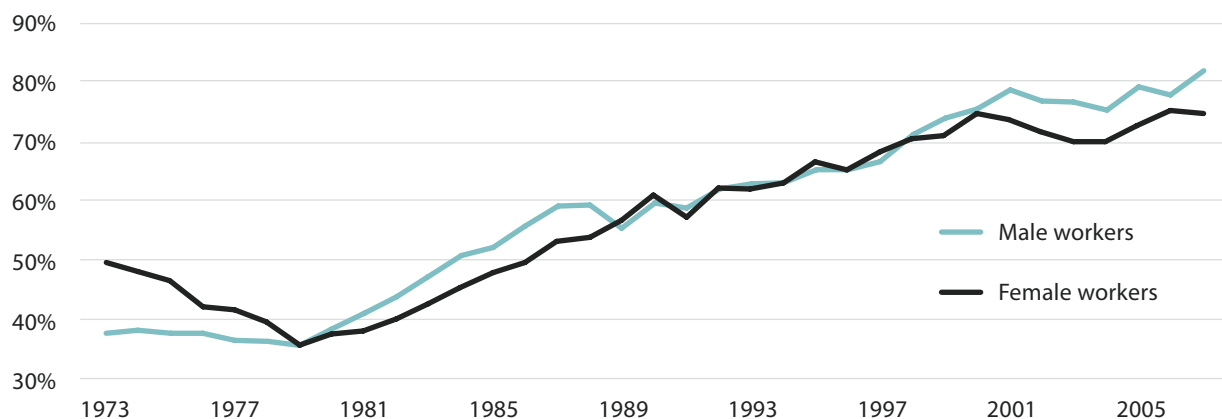
EDUCATION AND INEQUALITY

An undersupply of educated workers has been a key driver of the growing economic inequality.

Historically, the education wage premium has risen and fallen depending on the complex interaction between supply and demand.²⁴ In *The Race Between Education and Technology*, Harvard economists Claudia Goldin and Lawrence Katz present a detailed historical account of the demand for highly skilled college-educated workers. Not surprisingly, in all periods, those with a Bachelor's degree earn considerable more than those with just a high school diploma. But the level of the difference varies substantially, and Goldin and Katz report that it was very large at the beginning of the century, fell during the Great Depression and World War II, and then rose again – not to the heights of the beginning of the century but to reasonably high levels – by the 1960s.

The best data to compute the BA premium only began being collected in 1973, and Figure 5.1 shows a clear upward trend from 1973 to 2007.²⁵ In 1973, the male BA wage premium was already low at 38 percent while the female premium was at 50 percent. However, by 1979, the premium was 36 percent for both male and female workers. From 1973 through 1979 were the years of “stagflation” and the entry of large numbers of baby boomers into the labor market. These circumstances led another Harvard economics professor to publish a book in 1976 arguing that Americans were “overeducated.”²⁶ This turned out to be a poor predictor for the future as the wage premium exploded after 1980 and climbed steadily to 82 percent for men and 75 percent for women by 2007.

FIGURE 5.1 Between 1973 and 2007, the college wage premium for men grew from less than 40 percent to above 70 percent.



Source: Georgetown University Center on Education and the Workforce analysis of data from the Economic Policy Institute, based on hourly earnings from *Current Population Surveys*.

Our commitment to postsecondary education has grown.

The commitment of the United States to mass education has a long history. We were the first country to institute free and compulsory public elementary education in the late 19th century. Before that, it was common for churches to operate schools and for schools to require students to pay fees. Other countries prior to the 20th century relied mainly on religious institutions and had widely varying levels of school attendance among the young.

We expanded this commitment to mass attendance to high schools around the turn of the 20th century. While relatively few students completed high school, more and more children between 14 and 16 attended school. Throughout the 20th century, the percentage of high school graduates expanded steadily. However, even with this steady improvement, just 30 percent of the workforce had a high school diploma in 1940 and a mere 12 percent had a Bachelor's degree.

After World War II, America's commitment to education increased as there was a push for all young people to finish high school and for a high proportion to pursue postsecondary education. We implemented the G.I. Bill for returning veterans and poured resources into educating the baby boomers.

These commitments made the United States the undisputed leader in educational attainment and gave us a significantly higher rate of college completion than any other nation. In the 1960s, when our share of the workforce with a college degree was significantly larger than most other

industrialized countries, we continued to expand access to college, and eventually between 50 and 60 percent of America's youth attended postsecondary institutions (approximately 35 percent would get a degree). It should be noted that not all of this gain took place at four-year, Bachelor's degree-granting institutions: in 1965, the fall enrollment in two-year community colleges was 1 million; by 1980, enrollment had reached 4.3 million.

From 1980 to about 2005, there was hardly any change in the share of American 18-year-olds enrolling in postsecondary institutions. Since 2005, the share of college-going has increased slightly, driven in part by the increased transition from high school to college of Hispanic youths. Yet our competitors throughout the industrialized world have increased the college-going of their young tremendously since 1980. Led by Finland, Canada, and South Korea, many countries have surpassed the United States in terms of shares of 25-34 year olds with a two- or four-year degree. Our fall to the middle of the pack of industrialized countries has prompted President Barack Obama and others to call for new initiatives to dramatically increase college-going among young people.

On average, real earnings are up for men with Bachelor's degrees and graduate degrees and women's earnings are up at every education level.

As Figure 5.2 shows, earnings increase steadily with more education. In 1967, when less than one in four had any postsecondary education, the median earnings of those with a high school diploma were above the median for all workers by 2 percent. But by 2007, the minority

of workers had at most a high school diploma, leading to the median of high school workers being 18 percent below the overall median.

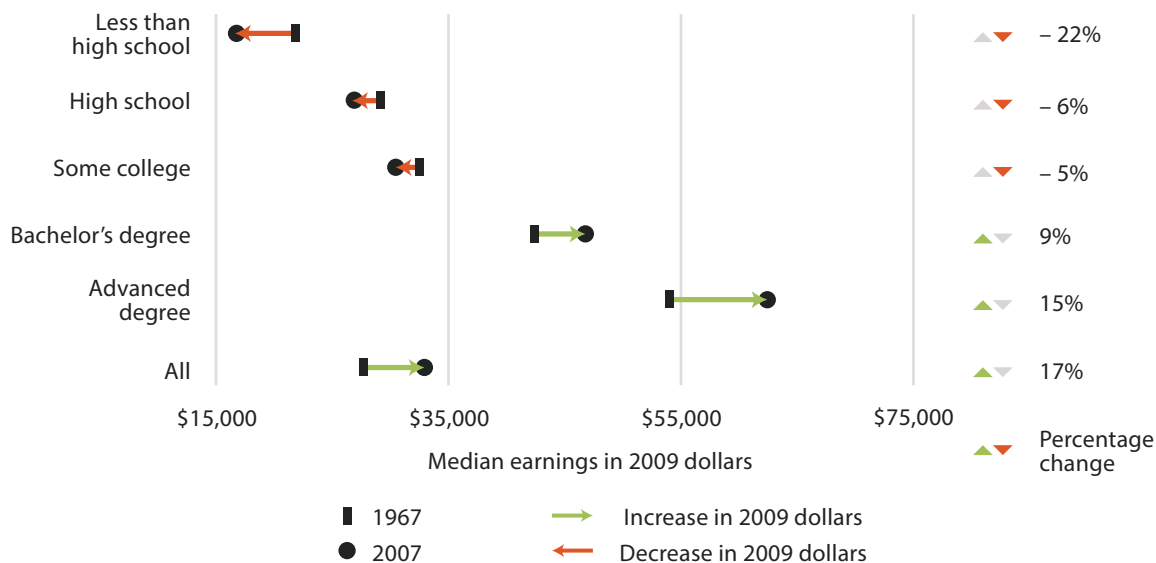
Overall median earnings (in 2011 dollars) grew by 17 percent from 1967 to 2007. But huge educational upgrading meant that a much higher proportion of workers had a postsecondary education. This change in composition alone should have led to a median earnings level of \$35,000. The fact that the real median in 2007 was lower than this amount is driven by the very uneven growth/decline of earnings by education level. As can be seen, the first three steps of the education ladder have lower real median earnings in 2007 than they had in 1967. It is only those in 2007 with a Bachelor's or graduate

degree who had earnings above their 1967 level – by 9 percent and 17 percent, respectively.²⁷

The shift in earnings is also heavily affected by the changing gender composition of the workforce: 64 percent of workers were men in 1967 while this figure dropped to 53 percent in 2007. Since women earn considerably less than men, this shift in gender composition tended to drive earnings down. However, as women's participation in the workforce grew, their relative earnings rose: in 1967, median women's earnings were 55 percent lower than the men's level; by 2007, this gender gap had fallen to 35 percent.²⁸

This meant that women's earnings over these two periods grew by 60 percent while men's earnings

FIGURE 5.2 From 1967 to 2007, real earnings rose for those with Bachelor's and graduate degrees but fell for all workers with less education.



Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts* and U.S. Census Bureau, *Current Population Survey*, 1967-2007.

grew by just 8 percent. Further, women at all education levels earned more in 2007 than comparably educated women made in 1967. By contrast, men's real earnings were down by 28 percent, 19 percent, and 9 percent, respectively, for the three lowest levels of education (high school dropout, high school graduate, and some college). Men with a Bachelor's degree could only eke out a 5 percent gain, and it was only men with a graduate degree who saw their earnings rise by a healthy amount (33 percent).²⁹

Across occupations and education levels, college graduates in high-skill occupations have seen the largest growth in earnings.

Educational preparation represents our major transmission belt into employment for different

occupations that require different levels of generalized and specialized skills. As shown earlier, the distribution of our three occupation tiers was very similar in both 1967 and 2007. That said, earnings within the same occupation tier vary considerably by educational attainment.

Earnings for managerial and professional occupations have broken away from the larger pack of college-educated workers.

As more and more people earned Bachelor's and graduate degrees the share of top tier managerial and professional jobs held by these most educated people rose from 48 percent in 1967 to 66 percent in 2007. At the other end of the ladder, the share

FIGURE 5.3 Between 1967 and 2007, the earnings of managers and professionals with graduate degrees increased by 33 percent.



Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Department of Commerce, Bureau of Economic Analysis, *Input-Output Accounts* and U.S. Census Bureau, *Current Population Survey*, 1967-2007.

of those with at most a high school diploma in these jobs fell from 34 percent to 11 percent.

Figure 5.3 shows the earnings by education levels in 1967 and 2007 by those in managerial and professional jobs. At the beginning of this period, the earnings of those with a high school diploma through a four-year degree were different (the more educated earned more) but the gradient was not that steep.

By 2007, however, the earnings of those in the three lowest educational levels were lower than they had been in 1967.³⁰ Given that the majority of those with a Bachelor’s degree, and the vast majority of

those with a graduate degree, are employed in managerial and professional jobs, their substantial earnings gains in these jobs explains why they’re “moving away from the pack” and is the most significant driver of the increasing college wage premium. This can be tied to our earlier analysis of functions because virtually all managers and professionals are employed in the new high-skill service economy in offices, healthcare, education, and communication. In other words, changes in the pay in these sectors gave rise to increasing inequality by educational attainment.

FIGURE 5.4 Between 1967 and 2007, the earnings of high school dropouts who work in middle-skill jobs declined by 22 percent, while the earnings of graduate degree-holders who work in middle-skill jobs increased by 20 percent.



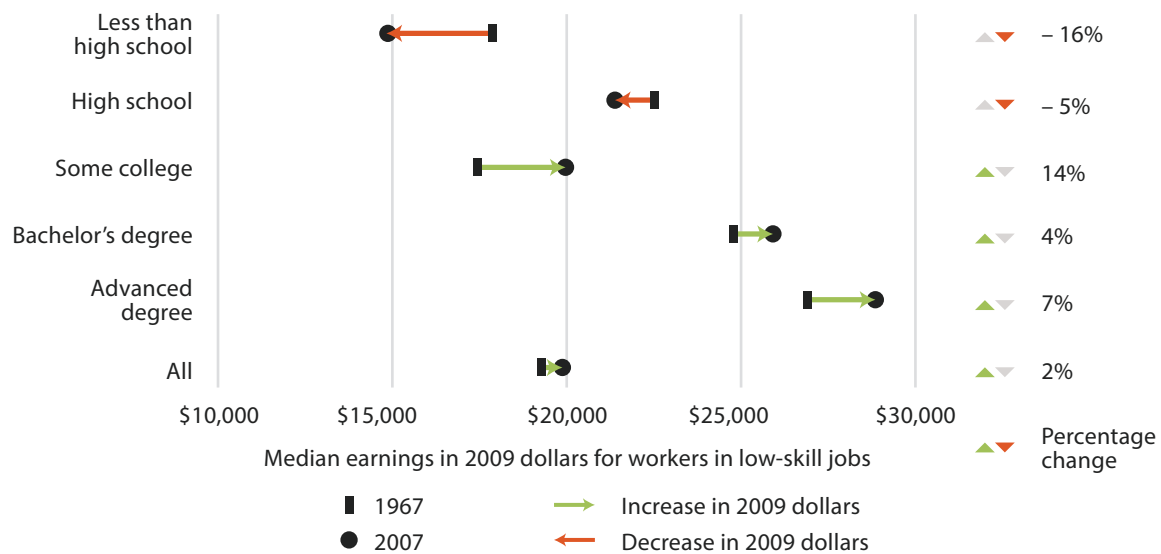
Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Census Bureau, *Current Population Survey*, 1967-2007.

Among middle-skill occupations, advanced degree-holders, wages grew the most, while high school dropouts' wages declined the most.

As Figure 5.4 shows, there is a huge gap in the pay of middle-skill jobs between the bottom three levels and those with a Bachelor's degree or more. This gap was big in 1967 and grew bigger by 2007. In 1967, there was actually a minimal wage gap in middle-skill jobs among high school dropouts, workers with a high school diploma but no college, and those with some college but no Bachelor's degree. Going forward to 2007, pay among high school dropouts fell by a significant 22 percent, while pay among those with a high school diploma was flat, and those with some college grew by an anemic 4 percent.

The relatively high pay of the few Bachelor's and graduate degree-holders in these jobs indicates that they often bring their advanced skills with them. In 2007, a Bachelor's degree-holder in a middle-skill job earned as much as someone with some college in a high-skill job. Similarly, a person with a graduate degree in a middle-skill job earned as much as a Bachelor's degree-holder in a high-skill job. For those who think that these high-quality jobs pay the highest wages, with skill having nothing to do with it, the ability of highly educated workers in the second tier to earn as much as slightly less-educated workers in the top tier should make them think twice. That it happens indicates that there is a lot of heterogeneity in job titles and that those highly educated workers can find niches where their higher skills are used and rewarded, even in middle-tier jobs.

FIGURE 5.5 Between 1967 and 2007, the earnings of high school dropouts in low-skill jobs declined by 16 percent.



Source: Georgetown University Center on Education and the Workforce analysis of data from the U.S. Census Bureau, *Current Population Survey*, 1967-2007.

Low-skill jobs don't pay well even when occupied by higher-educated incumbents.

Figure 5.5 shows that low-skill jobs have an earnings ceiling that is very low no matter what the level of education. Although those with a Bachelor's or graduate degree do earn more than those with the other levels of education, the absolute level is so low that it suggests strongly that the relatively few people with levels of education that are in these jobs do not bring their added skills to the table.

Despite predictions of decline, the U.S. economy can grow stronger and more equitable by ramping up postsecondary education.

As America continues to drag itself slowly out of recession, doubts have emerged about our economic future. In a constantly changing world that's more globally integrated than ever, fears are rampant that our economy – with its huge service sector and relatively small manufacturing base – is fundamentally out of balance and cannot produce the kind of jobs Americans need.

This report shows that view is mistaken. It confuses current problems – cyclical unemployment, high income inequality – with structural economic shifts that have profoundly and irreversibly transformed how everything in our economy is produced. Where we work, how we work, what we consume, and how we consume it have all been radically altered by the relentless march of technological change and educational upgrading. These shifts reflect our ability to produce more commodities with fewer but more highly skilled workers and to produce a wider range of commodities that more consumers can purchase.

The result of these shifts has been profound. A new post-industrial service and office economy has developed on the basis of changing patterns of consumption and production that rely on postsecondary education to produce growth in the scale and scope of value added. The consumption basket is very different today in terms of types of products (the shift from the necessities of food and clothing to healthcare, recreation, and business services to individuals) and in terms of the nature of the specific product itself (more variation, quality, style, and consumer involvement at mass production prices). But even more importantly, there has been a change in how the new enhanced consumer goods are produced (expanding networks and changes in production recipes). All of these transitions have been fed by the widespread introduction by firms and individuals of computers and IT processes. Finally, a big chunk of this innovation is hidden from consumers because it is based on business-to-business transactions.

Over the space of a mere 40 years, the rapid educational upgrading of the workforce has been accompanied by a surge in high-skill jobs, a shift away from manual labor in industry toward high-skill services and the now dominant office function of our economy and a sharp decline in manufacturing employment, with concomitant increases in business services, health, and personal services.

These changes in America's job structure, with their sharply increased demands for skill, have two basic sources. The first is dramatic changes in what we consume, changes that favor the use of more highly skilled labor. In 1947, the basic necessities of food, drink, and clothing, a part of the economy where skill

levels are generally low, accounted for 46 percent of consumer spending. By 2007, the lower cost of producing these goods and the rise in living standards caused spending on these basic necessities to drop 28 percentage points to just 18 percent of consumer spending. Spending on transportation, another low-skill sector went down a percentage point and a half over the time period. In contrast, healthcare, produced by relatively high-skill labor, constituted only 5 percent of spending in 1947, but now accounts for 20 percent of consumer spending. In addition, spending on business services to individuals, a high-skill sector went up by 4 percentage points.

These changes in the mix of economic activity explain some of the shift in our job structure toward higher-skill occupations, industries and functions. However, they account at most for only 20 percent of the upskilling of our economy from 1967 to 2007. That means that 80 percent of this upskilling is accounted for by huge changes not in what we produce, but in *how* we produce it – what we call the production recipes of different types of goods and services. These changes are somewhat hidden because they are driven by business-to-business intermediate sales and by structural changes within firms as more of total employment is concentrated in front-office functions and not in direct production labor. Our analysis of the extended value chain of production has allowed us to uncover this hidden economic world and bring it to light.

In the aggregate, our findings indicate that there is an intimate fit between the rise of our new service economy and the huge increases in educational attainment of our workforce. Today's educated workers are needed to run our increasingly skill-driven

economy; they are not having their human capital wasted in dead-end jobs. Far from it – they are being rewarded greatly for their human capital, as today's high education wage premiums attest.

Today's approximately 80 percent premium for a college education (over high school) is artificially high because we are under-producing college talent. Because we are under-producing college talent employers are bidding up the cost of college labor artificially, contributing significantly to the growing wage inequality between college haves and college have-nots. We find that if we could increase the supply of college talent by 20 million people we could still provide upper middle-class wages for college graduates and distribute the economic benefits of college degrees more evenly to both employers and workers. In our analysis we find that if this increase in college access and success could add almost \$500 billion a year in economic growth and retain a wage premium of college-educated workers over high school of about 46 percent a year.

- This 46 percent wage premium over high school was the college wage premium for a Bachelor's degree over a high school diploma from 1950 to 1970 in the United States.
- A 46 percent premium represents a 10 percent rate of return for each of the four years of college attendance (compounded), still high enough to make borrowing money to attend college a good investment.
- This level of wage premium is consistent with the premium level in many other industrialized countries, including Australia, Finland, France, Germany, and the United Kingdom.

This more even distribution in the college wage premium can be obtained if we increase the supply of college-educated workers by around 20 million over the next 15 years (right now, we are on track to add only about 8 million). Such an increase in the college-educated workforce would raise total output by \$500 billion a year by 2025 (about 3.5 percent of GDP). And this change would take a big bite out of inequality, rolling back about three-quarters of the increase in inequality we've seen since 1979.

No doubt there are other reforms and policies that should be considered to increase our growth rate and bring down today's troubling inequality. But we do think improving the educational levels of our workforce and the environment within which they work is a great place to start. And whatever other policies are needed, we feel sure that they will benefit by starting from an accurate picture of what today's new service economy is and how it really works.

Of course, some may argue that our picture of today's economy is not accurate – that it is far too optimistic about the state of our economy and its long-run potential. This is hardly unprecedented. Looking at economic history, one finds many cases of people worrying about our economic future. Sylvia Nasar in the *Grand Pursuit: The Story of Economic Genius* writes about the long history of economists predicting a rather bleak future ahead.³¹ In our own recent history, there have been multiple predictions of extended economic malaise ahead: in the 1950s there was the fear that automation would lead to high levels of “structural unemployment.” Pessimism rose at the end of the 1970s with “stagflation” followed by a double

dip recession in 1979 and 1981 that led to a brief period when the unemployment rate topped 10 percent. Despite strong economic growth during the rest of the 1980s, worries arose about a “day of reckoning” and a Japanese onslaught that would displace America as the world's strongest economy. The prominent MIT economist, Lester Thurow, went one better in arguing that a combined Europe would lead to the United States being the third-most dominant economic power after Europe and Japan by the first decade of the 21st century.³²

One of the reasons for these concerns is that the economy is chaotic and diverse: 120 million households, 140 million workers, and tens of millions of companies each pursuing their own interests. In many ways, it is a wonder that this process is as smooth as it is and that it frequently leads to positive outcomes for the large majority of the population. Since the economy is always changing, there can be a disconnect between people's past experiences and what is happening now.

As the old relationships tend to decline, it is natural to think that this current disruption will have permanent negative consequences. The Physiocrats, writing in the mid-1700s, provided the most detailed elaboration of how the old is what matters. They argued that only agriculture created value and that manufacturing was “barren” and only manipulated things without adding value. In retrospect, this position seems quaint, as manufacturing has been the driving force of economic growth over the past 200 years.

Are some now making the same mistake when they imply that only manufacturing matters, that

services provide mostly low-skill, dead-end jobs and that our current economic trajectory is taking us toward a bleak future? We think so, but this pessimistic take has been supported recently by three lines of argument, the first two of which are, interestingly, diametrically opposed to one another.

- The rise of advanced technologies like robotics will reduce the need for skilled labor and produce a shortage of good jobs.
- The growth potential of our economy is limited because today's technologies will not yield the growth dividends seen in the past.
- Today's economy is putting more and more college-educated, skilled workers into jobs for which they are overqualified.

All these objections are inaccurate assessments of today's economy and its future potential. Let's start by addressing the question of an economic transformation driven by more capable robots. Kevin Drum, in a widely read *Mother Jones* article and web posting, predicts that "[s]mart machines won't kill us – but, they will take our jobs, and sooner than you think."³³ While this repeats the age-old theme that automation kills jobs, it is based on a much more advanced perspective on how much machines can do. Or as Drum says: "The Luddites weren't wrong. They were just 200 years too early."

Drum predicts that machines will be smarter than humans within a couple of decades; they will be able to do most things better than ever before and even fix global warming. By 2040, our "robot paradise" will be here but it will not be a real paradise because no one will have a job.

But Drum hasn't followed his own logic far enough. If robots can do everything – create themselves, produce and upgrade themselves, repair any problems themselves, diagnose and treat diseases, etc. – then why do we need to work? Since the robots don't need to be paid, this cornucopia of capabilities should cost nothing as we have entered the world of "true communism" – to each according to her needs and from each according to her ability with everyone free to read poetry in the morning, fish in the afternoon, attend parties at night or do whatever mix of activities they choose. It sounds like the retirement life of multimillionaires, only that deteriorating health won't be a problem for most people – robots would have found the cure for cancer and most other diseases.

But this utopia, if it ever arrives, is highly unlikely to be here by 2040. From 1950 to 2012, real GDP per person grew by 340 percent or slightly less than 2 percent a year. Although he doesn't think in these terms, Drum is actually predicting that real growth will increase astronomically (by perhaps as much as 10 percent per year) as smart machines are able to increase output with very few human requirements.

This is not remotely realistic. One way to see the limited effects of robots is see how greater technological capacity would change how things are produced in each of our major industries.

The second line of argument about our bleak economic future is diametrically opposed to the premises of the first. According to this view – laid out in Robert Gordon's essay "Is U.S. Economic Growth Over?" – slow economic growth began in the 2000s, was made worse by the financial crisis and is

never going away because of faltering innovation. Gordon posits that economic growth should not be taken as a given and that strong growth only occurs in waves associated with new innovations that set off “industrial revolutions.” Gordon believes that the most recent industrial revolution – computerization – has already run its course (contra Drum) and lacks further ability to drive economic growth.

He begins his argument with a wild extrapolation: he shows that economic growth was very low from 1300 to 1750 and predicts we eventually will return to this level. He shows that the rate of economic growth (of per capita GDP) grew steadily in the 19th and 20th centuries and then accelerated more, reaching a peak in the 30-year golden age following the end of World War II. Starting in the 1970s, growth rates declined but end up at levels that are still high when considered against pre-World War II rates of growth. But Gordon decides that the recent decline from peak growth will continue unabated until it approaches zero.

Gordon backs up this extrapolation by talking about six headwinds to growth: demographics (baby boom retirements), little increase in educational attainment, high levels of inequality, globalization, rising energy and environmental costs, and high levels of household and government debt. He singles out inequality as a special problem, not because it necessarily interferes with growth *per se* but rather because it reduces the incomes received by most of the population from economic growth.

Gordon has company in Tyler Cowen’s *The Great Stagnation*, which makes similar arguments. In both cases, there is no real analysis of how these factors

decrease growth and it is just posited that these factors will obviously have negative consequences. Moreover, it is posited there is essentially nothing that can be done about these “headwinds.”

We disagree with this approach. It cannot be assumed that all these headwinds will collectively have the effect of stopping growth. After all, any historical period has had economic problems that were barriers to growth. Why should we assume that today’s headwinds are uniquely able to *stop* growth when that has not happened in the past?

It also cannot be assumed that there is nothing we can do about these headwinds or that they will all remain as troublesome as they are today. Take slow growth in educational attainment. This slow growth is not inevitable but can rather be affected by policy. Either that or we have to believe that the low rates of college completion among Latinos and African Americans – which Gordon cites – are somehow innate to these race-ethnic groups. Similarly, inequality can potentially be mitigated by policy (one way, in fact, is by increasing educational attainment, as we argue in this report). Globalization may not always have the wage-depressing effects it has now in advanced countries as wages in developing countries (e.g., China) continue to rise. The household debt problem is likely to diminish over time as the economy recovers. And the government debt problem, as we have seen recently, is not a crisis but rather a difficult but manageable problem that does not need to be solved by growth-reducing austerity. And so on. The assertion that these headwinds add up to an insurmountable barrier to growth is just that: an assertion, not a convincing argument.

This brings us to the final argument: that today's economy is putting more college-educated, high-skill workers into jobs for which they are overqualified. This widely held view has led to a recent vogue for newspaper stories about college graduates only being able to get work for which they are obviously overqualified. A recent *New York Times* story, for example, refers to: the chemistry major tending bar; the classics major answering phones; the Italian studies major sweeping aisles at Wal-Mart; and so on.³⁴

The implication is that many people are wasting their time getting a college degree because fewer and fewer of these highly educated people are in jobs that use their skills and, accordingly, are earning only modest wages.

This view received some academic support from a study conducted by Richard Vedder and several colleagues. They argued that 48 percent of Bachelor's degree-holders weren't in Bachelor's-appropriate jobs.³⁵ This is odd because the Bachelor's premium over less-educated workers is still very high and presumably pay in non-Bachelor's-appropriate jobs is relatively low – so how can we have so many low-paid Bachelor's degree-holders but still have such a relatively high median level of Bachelor's earnings?

Of course, we can't, and it turns out Vedder's methodology is based on a backward looking view of what skills are needed to perform each job. For example, in Vedder's analysis, the large number of sales representatives in manufacturing is presented as an occupation in which only a high school diploma is needed. Yet, 60 percent of the incumbents in this job have either a Bachelor's or

graduate degrees *and* the earnings of Bachelor's degree-holders in this occupation are 60 percent higher than the overall Bachelor's median. Only 19 percent of incumbents have at most a high school diploma and those few with just a high school diploma in these jobs earn approximately half of what their Bachelor's counterparts earn.³⁶

So America is neither losing all its good jobs to robots nor running out of growth potential nor wasting our college graduates in low-skill jobs. In fact, we have a bright future ahead of us *if* we adjust to the demands of our evolving high-skill service economy. The choice is ours.

APPENDIX A

SOURCES AND METHODS

Input-Output Analysis: A Primer

The findings in this report are based on the analysis of two key data sources:

- The input-output (I-O) tables compiled by the U.S. Bureau of Economic Analysis that measure the value of all goods and services in the United States; and
- The comprehensive survey of U.S. workers contained in the Current Population Survey, which is conducted by the Census Bureau for the Bureau of Labor Statistics.

The creation of the I-O tables is an arduous task that requires a team of dozens of economists who pore over data collected from surveys of all the major firms in every U.S. industry. While the origin of this detailed economic accounting can be tracked to Quesnay's *Tableau Economique* produced in the 16th century,³⁷ Nobel Prize winner Wassily Leontieff developed modern I-O analysis in the 1920s. This report also follows in the footsteps of a similar study released in 1988 by the Congressional Office of Technological Assessment.³⁸ (The I-O analysis in this report begins in 1967, the first year that the necessary data are available, and ends in 2007 because utilizing data from the years of the Great Recession would distort long-term comparisons.)

Conceptually, input-output analysis is a full accounting of what an economy produces and what industries are necessary to produce each type of good or service.

What is produced is fairly straightforward and is called Gross Domestic Product (GDP). This report divides U.S. GDP into 11 final output categories. The first eight categories are the consumption categories, which include all the goods and services immediately consumed by private or public buyers. The eight categories are: food and drink, clothes and personal care products, transportation, housing, medical care, recreation and leisure, business services to individuals (which are mainly finance, insurance, and real estate services purchased by consumers), and government administration and services (not including public education). The next two of the 11 final output categories are education and fixed investment, which are treated as a joint investment grouping because these are goods and services that are made to last a long time and aid in future production.

The last of the 11 final output categories is exports, which are produced by American workers but consumed by non-Americans. So when we focus on production, we will show the qualities of the workers that are part of the export production recipe. Imports, by contrast, are consumed in America but produced by foreign workers on whom we have no information.

A good example of how input-output analysis works can be found in the Office of Technology Assessment's (OTA) 1988 report, in which there is a detailed analysis of the value of a frozen pizza. (All prices in the following example are hypothetical.) Of the \$7 purchase price, the supermarket has laid out \$5 to pay the manufacturer for the product, transport it to the market, cover electricity and rent, plus pay a small amount for advertising, financial services, and other overhead. The \$2 kept by the store represents the "value added" by the store and goes for paying employees, depreciation, the interest on loans, profits to the company, and indirect taxes. This last component – indirect taxes – is an odd one, as it is neither sales taxes nor corporate profit taxes; it is mainly property taxes and import duties, which aren't assigned to be being produced by businesses and hence are treated as a separate entity of value added.

If we go back one step to the food manufacturer that made the frozen pizza, the \$2 that it received had to buy raw materials from many producers plus assorted business expenses to promote its product and keep its company going. So of the \$2 it received, its share (or value added) was probably only \$1. And going back to each of the firms that were suppliers to the pizza manufacturer, their payments supported both its value added plus purchases from other firms.

The tale of frozen pizza is even more complicated because the maker of the packages and suppliers of the energy that power the machines also have suppliers that they rely on. And even those suppliers have suppliers. So, in our analysis, we actually go back 15 iterations to break down the value added of each contributor.

This report is based on the make, use, and bridge tables of the 1967 benchmark files and of the 2007 annual files. The 2007 benchmark files were only released in December 2013 and hence were not available when we began the report. Nonetheless, the differences between the annual and benchmark 2007 files is not large enough to change the results reported here in a meaningful manner.

The I-O data are based on detailed industries and commodities. In order to make the analysis easier to follow, industries are combined into 10 categories, and commodities into eight categories. Many public expenditures are taken out of the government "industry": 1) In typical GDP accounting, fixed investment is limited to private investment; this report treats government fixed investment as part of a combined private and public fixed investment; 2) public spending on providing healthcare services (e.g., public hospitals and clinics) are combined with private spending on healthcare; and 3) most education spending is done by governments with some spending on private schools and on school supplies and books. All these expenditures are combined into one education category, which we treat as a type of total investment.

We make a few tweaks to the make-and-use table to produce the value added of commodities. About 7 percent of value added by industries consists of "taxes on production and imports less subsidies." The distribution of these taxes is very uneven across industries as nearly 30 percent of this total is accounted

for by wholesale and retail trade. In order to get a more accurate view of the production value added by workers, we excluded this row. Otherwise we use the standard approach to derive the direct and indirect value added for each commodity (see discussion in the methodology chapter of the OTA study that inspired this study).

As a result, the first table that we create is the production recipe for each commodity in dollar terms by each industry that is part of the value chain to produce that type of final output. We summarize this table by aggregating industries and commodities: our second table is the 11 types of final output by 10 industries.

Next, we create a cross walk from the detailed industries from the industry categories in the make-and-use tables with industry codes from the *Current Population Survey* (CPS) We combine three years of the March Supplement (Annual Social and Economic Supplement) to create a large number of cases and allocate CPS industrial employment in proportion to the division of industrial value added across each of the detailed commodities. It should be noted that the number of workers per dollar of value added is not the same across industries for two very important reasons – some industries pay their workers more (e.g., retail compared to banking) and, since depreciation is part of value added, some industries are very capital intensive while others are not (e.g., chemical manufacturing compared to barber shops). Ultimately this difference does not create many distortions because we are allocating with ratios across commodities and not ratios within commodities.

Once we align employment by industry with commodities, it is easy to use the other variables on a person's CPS record to get the divisions by occupation, sex, race/ethnicity, earnings level, and educational attainment. Thus, there are many tables showing the characteristics of the workforce of each of the 11 major final output categories.

ENDNOTES

1. When college-level skill is oversupplied, employers pay less for college talent. In the 1970s, for example, when the baby boom flooded the labor market with college talent the college-wage premium dropped precipitously from 59 percent in 1970 to 48 percent in 1980 (Goldin and Katz, *The Race*, 2008).
2. This report's I-O analysis concludes in 2007 in order to avoid the distortions caused by the Great Recession.
3. See Appendix A for the methodology used to determine this figure.
4. The shift from simple efficiency to a more complex palate of competitive requirements began with a growing concern for quality in the 1970s. Since then it has been part of a revolution in modern management, organizational development, and skill requirements at work. Broad recognition of the growing importance of an expanded set of performance standards has a long history in private sector strategic management as initially chronicled by the *Harvard Business Review*. It was often billed as a movement toward Total Quality Management (TQM) in response to performance failures in private business, especially manufacturing, in the 1970s and '80s. In essence, the core of the new idea was to unbundle the economic value produced by an institution; to develop metrics to measure the component elements of economic and noneconomic value; and then align different kinds of value with strategies and diverse institutional cultures and human capital necessary to produce and maximize them with the greatest efficiency. The diversity in the kinds of value pursued often led to collaborative networks to tap institutional and workforce strengths outside the culture and core competencies beyond the traditional reach of individual institutions, to share risk in market cycles, or to enter on new markets.

The capstone in the evolution of the TQM "movement" was the Malcolm Baldrige National Quality Award passed by Congress and signed by President Bill Clinton in 1987. The Baldrige Award was the culmination of a general consensus in the business community that U.S. companies were falling behind in the increasingly global competition for performance beyond the traditional metrics of cost per unit of output. Defect rates in American versus German and Japanese companies were the initial evidence, especially in the manufacturing of computer chips and autos. Ultimately, the quality movement in manufacturing led to the pursuit of the Six Sigma standard (no more than 3.4 defects per 1 million manufactured parts) pioneered by Motorola and General Electric. The basic ideas that began with the quality movement in manufacturing in the 1970s have long since been adopted by private service companies and more recently in government, symbolically marked by the National Partnership for Reinventing Government led by Vice President Al Gore between 1993 and 2001.

In the 21st century the quality framework has moved into healthcare and education with varying degrees of success. In healthcare, the Affordable Care Act is our most ambitious effort yet to unbundle and measure valued outcomes and drive them strategically. In K-12 education, the attempt to measure outcomes and tie them to strategies to improve quality is ongoing. In higher education, the movement toward accountability for access,

choice, completion, cost, and employability is nascent as is our ability to unbundle and measure the value of socialization, learning for its own sake, and career development as critical components in the higher education value proposition.

5. The U.S. Department of Labor provides data on knowledge, skills, abilities, work values, work interests, and personality traits for more than 1,100 occupations. These examples are drawn from our ongoing work with the O*Net database. For a more detailed description see Carnevale, "All One System," 2007.
6. "Skill-biased technical change" has become the consensus explanation for the increasing value of postsecondary skill in the labor force. For an historical review Goldin and Katz, *The Race*, 2008; Levy and Murnane, *The New Division of Labor*, 2004.
7. Linden, Kraemer, and Dendrick, *The Case of Apple's iPod*, 2007.
8. Carnevale and Strohl, *Separate and Unequal*, 2013.
9. Marshall, Humphrey, and Bottomore, *Citizenship and Social Class*, 1950.
10. Ibid.
11. By and large, these changes were fairly steady over the entire period judging from the intermediate data from 1967.
12. Spending on housing is different from the other sectors in that there are very few workers producing this activity. Most of the costs are related to home ownership (taxes and imputed rents).
13. In our data, exports represent goods and services produced in the United States that are paid for by foreign customers. Conversely, imports represent goods and services produced outside the United States that are consumed here. So, imports are included in the final sales price of goods and services but are not included in GDP because they are not produced by American workers.

The existence of international trade contributes to an important difference between production and consumption. The level of consumption is determined by the prices in the marketplace. But the cost of those products includes embedded imports. By contrast, exports and investment outputs are not consumed in this period and are therefore not treated as part of consumption.

14. The Bank of International Settlements (BIS) in Switzerland handles all of the transactions among countries. For the United States, dollars flow out whenever we make purchases of goods and services (imports), invests in other countries (either by companies building facilities abroad or individuals buying foreign stock), or makes interest payments on debt held by foreign governments, companies, and individuals. By contrast, foreign currencies flow into the United States for goods and services (our exports), investments (foreign plants, buying U.S. stocks, foreign banks and countries purchasing U.S. Treasury bonds, paying interest on U.S. loans to foreigners, and repatriated

profits from foreign subsidiaries of U.S. companies). The flows of dollars and foreign currencies across borders (called “balance of payments”) must be equal each year (with small deviations made up by special loans from the BIS called “special drawing rights”). So, our trade deficit has been offset by a surplus in the international flows of investments, interest payments, and repatriated profits.

15. All sales of companies are approximate double GDP because business purchases from other businesses result in a lot of double counting. Therefore GDP is the sum of all value add – the difference between total final sales minus purchases from other companies. The primary components of value added are labor compensation (salaries and benefits), depreciation of fixed assets, taxes on production and imports, and “operating surplus” (profits and interest payments).
16. Because of the circular flow relationships, the value of what we produce leads to different “incomes” such that the value of Gross Domestic Incomes (GDI) equals GDP. GDI is composed of the elements of value added where depreciation is treated as consumption of fixed capital. Most studies on income shares, however, are based on National Income which is GDI minus depreciation.
17. These shares are slightly different than the shares computed from the National Income and Product Accounts (NIPA) tables on GDP because the import components are individually subtracted from consumption, investment, government, and exports. In the GDP accounts, the C+I+G+X components include imports while GDP is derived from a single subtraction of the value of all imports. Because imports as a share of each of the components of final sales differs, all computation is the U.S. production share of each component out of total production.
18. In the decade of the 1950s, the export share was 3 percentage points lower than the 1947 level.
19. See Appendix A for a discussion about how our groupings align with the official government categories.
20. Our approach differs from others in that we use a combination of educational attainment and earnings weighted more heavily to education. David Autor, in a series of papers with a number of co-authors, has found a shrinking middle in terms of occupation growth (faster growth among low- and high-skill jobs). Autor and Dorn, “The Growth of Low Skill Service Jobs,” 2007 and Autor, Katz, and Kearney, “The Polarization of the U.S. Labor Market,” 2006. Although Autor describes jobs by “skill” levels, all of his rankings are based only on earnings. This alternative decision rule has very big consequences in determining trends because of the case of manual workers, predominantly men in manufacturing. These workers had mid-level earnings in the 1906s and 1970s and low levels of education. In Autor’s approach, these workers counted as middle-skill workers whereas in our approach they fall into the low-skill level. Since the share of these manual workers declined significantly over the past four decades, that decline has had a profound effect on the distribution of middle- and low-skill jobs. In Autor’s approach, this leads to a declining middle; in our approach, it leads to a declining share of low-skill workers.
21. It should be noted that with few exceptions there wasn’t much change from 1967 to 2007 in this three-way occupational division within functional categories. In both periods, the office and high-skill service sectors had high concentrations of managerial and professional jobs while the agriculture, manual blue-collar, service, and retail sectors

had high concentrations of low-skilled workers. The two prominent exceptions were the rising share in managerial and professional jobs within the office sector (from 35 percent in 1967 to 49 percent in 2007) and the decline of low-skill workers in the combined manufacturing, transportation, construction, and utility sector (from 66 percent in 1967 to 50 percent in 2007). Both these changes were driven by technological advances: in offices, the increased use of computers replaced clerical workers, while in blue-collar production, more mechanization (e.g., robots in factories) led to fewer production workers.

22. Carnevale and Rose, *Education for What?*, 1998.
23. Auto repair is included in the low-skill service function even though many of the workers in this field are highly skilled manual workers.
24. We would have liked to track the wage ratio of high school-only workers against Associate's degree-holders as well as the wage ratio of Associate's degree-holders against Bachelor's degree-holders, but information on those getting an Associate's degree (as distinct from some college without a degree) only became available in the *Current Population Survey* in 1992, by which time most of the increase in earnings inequality had occurred. In previous surveys, the highest educational attainment was presented in terms of highest grade completed: the common practice was to use 12 years completed as having a high school diploma, 16 years completed as having a Bachelor's degree, and 13 to 15 years completed as some college and no four-year degree. There was no attempt to say that 14 years completed was an Associate's degree.
25. Richard Freeman, *The Overeducated American*, 1976.
26. The Outgoing Rotation Group of the *Current Population Survey* asks respondents what they earned last week, thus minimizing recall problems.
27. The mathematics of changing composition create the odd finding that overall median earnings grew faster than any of the education levels grew. In fact, if you just looked at the change for each level, it would imply that the median should be constant or perhaps even fall. But this does not occur because of the massive shift from education levels with low relative earnings in 1967 to a much greater concentration at relatively higher earnings levels in 2007.
28. The often-cited figure that women make 78 percent of what men do is based only on the group of workers that are full-time (35 hours or higher) and full-year (work at least 50 weeks). Since a much higher share of women work at some level less than full-time and/or full-year, this approach focuses on the higher earning workers of both sexes. (See Rose and Hartmann, "Still a Man's Labor Market," 2004 for a discussion of different ways to look at the gender gap, especially those that focus on multiple-year comparisons.)
29. The rise in the earnings of male graduate degree-holders was driven less by earning gains within the same occupations than by a shift of men with graduate degrees from working in the education profession, a low-paying field, to business, a high-paying field.

30. There are two views about the rising share of managerial and professional jobs held by those with a Bachelor's or graduate degree. First, some theorists believe in a "job competition" model in which employers choose the most educated people for high-level jobs on the assumption that more talented people went to college and therefore picking college-educated workers maximizes their chance of getting the best employees. The second view is that various specific skills, some job-related (e.g., engineering, nursing) and some conceptual (e.g., task completion, ability to learn and work with others, problem solving) are gained during the college experience. We fall into the second school and think that the earnings differences within occupations by education levels is so large and has changed enough over time as to indicate that more educated workers have more skills that translate into higher productivity.
31. Nasar, *Grand Pursuit*, 2012.
32. Ibid.
33. Drum, "Welcome, Robot Overlords," 2013.
34. Rampell, "Many With New College Degree Find Job Market Humbling," 2011.
35. In Carnevale and Rose, *Match or Mismatch?* (unpublished), the authors estimate that only 23 percent of workers with a Bachelor's degree are in jobs that don't utilize their skills and don't pay high wages.
36. It seems to us that the labor market is screaming that this has become a Bachelor's job. In our work on education mismatch, we find only 23 percent of Bachelor's degree-holders in jobs in which they are overqualified, and in these jobs, they earn 40 percent less than the wages of typical Bachelor's degree-holders.
37. Quesnay, *Tableau Economique*, 1972.
38. Our study owes a great deal to a similar effort led by Henry C. Kelly for the Office of Technology Assessment (OTA) of the U.S. Congress in 1988. We borrow not only their use of the input-output method, but we also borrow some of their narrative framework and phrasing. The OTA work originated the terminology that divided final economic output into categories that they termed "amenities" and then analyzed final output as "recipes of consumption" and "recipes of production." For their full report, see Office of Technology Assessment, *Technology and the American Economic Transition*, 1988.

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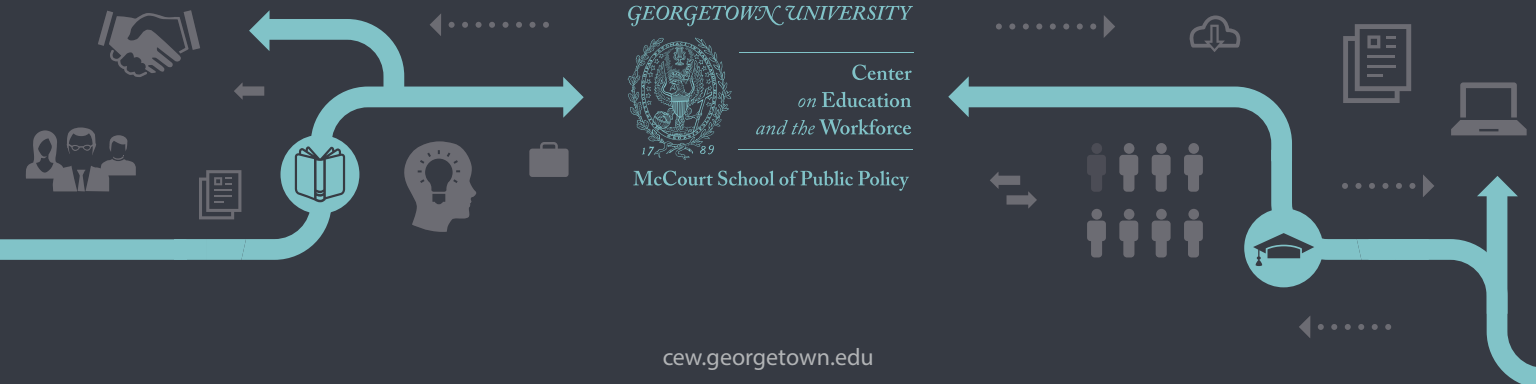
The Economy Goes to College comprises a full report and an executive summary. Both can be accessed online at cew.georgetown.edu/economygoestocollege

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