Investing in People for the 21st Century: Education, Health, and Migration

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*The author is C.F. Curtiss Distinguished Professor of Agriculture and Life Sciences and Professor of Economics, Iowa State University. An earlier version of the paper was presented as the T.W. Schultz Lecture, South Dakota State University, Oct. 2009. The author owes a great debt to Schultz for stimulation his interested in the economics of human capital, which now covered more than forty years.
I. Introduction

T.W. Schultz became famous for developing a new concept called human capital, i.e., the idea that investing in people improves their health, skills and competencies, knowledge or information base, and geographical location relative to consumption and work opportunities. Because investing in people is costly, he argued that the investment decisions are deliberate in that the benefits are weighed against the costs. Moreover, it is not a story about how innate ability, e.g., IQ, predetermines your economic lot in life.

Furthermore, he argued that we can apply the principles of investment theory developed for decision making on physical capital to human capital investments. That is, when an individual decides to obtain an additional year of schooling, he or she bears the costs of foregone earnings and direct outlays for tuition, books, and supplies. And after completing the schooling, he or she expects to obtain high earnings for as long as he or she remains in the labor force. With a little work, the rate of return on this investment can be computed and compared to rates of returns on other available investments.\(^1\) Good investment decision making requires that the rate of return on education is greater than or equal to that on the best alternative uses of the funds (Schultz 1961a). This ambitious application of economic thinking to investments made in people shocked some economists, social scientists, and others when he presented it in his Presidential Address to the American Economics Association in St. Louis, MO, in December, 1960. For example, some people had difficulty in separating the direct consumption value and investment value of education (Schultz 1961b).

However, Schultz had been wrestling with the new idea of human capital for almost two decades. As a result of his post-World War II travels to Germany and Japan, he was able to see

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\(^1\) If the investment can be undertaken at different points in time, or in size of initial investment, or with complementary human capital, e.g., schooling and migration, the investment should be undertaken when the net present value is largest, provided it is positive.
firsthand a miraculous speed of recovery from immediate widespread devastation at the end of the war. In contrast, the United Kingdom took a long time to recover. He concluded that the rapid recovery was due to a healthy and highly educated population in Germany and Japan relative to the UK. Education makes people productive and good health care keeps the educated individual able to engage in productive work more intensely and longer. These insights were also useful new ideas about the primary source of economic growth of countries and regions.

Human Capital is now a well established part of economics. The widely used *Journal of Economic Literature* classification of topics in economics places human capital under the broad field of Labor and Demographic Economics. However, its fruits also spillover to the fields of Health, Education and Welfare; Economic Development, Technical Change and Growth; Agricultural, Natural Resource and Environmental Economics; and Urban, Rural and Regional Economics.

When Schultz was born (1902), the distribution of the U.S. labor force across employment sectors was 36% in agriculture, 28% in industry and 36% in services. In 1960 (the year that Schultz gave his investing in human capital address to the AEA) the shares had shifted dramatically—only 9% in agriculture, 34% industry and 57% in services. Hence, over this slightly more than half a century, the U.S. became a service economy by having a majority of employment in the services sector. Currently, the shares are 1.4% in agriculture, 15.5% in industry, and 83.1% in services. Rapidly growing service sectors have been in health and education and professional and business sectors. These structural changes suggest that the demand for the ability to do physical work has largely disappeared and the opportunity to perform services, some of which are quite highly skilled, has been growing rapidly.

Although the electronic digital computer was invented in the late 1930s, it used vacuum tubes for processing data and was very slow. Modern information technology built on the
invention of the transistor in 1947. A transistor is a semiconductor device that acts as an electrical switch and encodes information in a 0-1 form associated with the off and on positions of a switch. Integrated circuits, including memory chips, invented in 1958, consist of many transistors, and were first developed for data processing. The capacity of memory chips increased at a continuous compound rate of 35-45% for more than 40 years starting about 1970 (Jorgenson 2009), and over 1974-1996, prices of memory chips decreases by a factor of 27,270 times (or 41% per year compound). This resulted in a staggering rate of decline in the price of information technology used for storage of information and computing and provided the incentive for rapid diffusion of IT through new hardware and software (Jorgenson et al. 2011). Modern information technology and software have resulted in computerization of routine tasks and rapid displacement of labor in repetitive production and monitoring tasks, e.g., starting with bookkeeping and clerical work but later in the use of robotics in manufacturing of durable goods. Digital technical change has been a major force bringing rapid changes in the labor market.

Since 1979, the U.S. labor market has undergone major structural change. Accompanying these changes were shifts in the occupational composition of U.S. jobs with new job growth requiring generally in high skilled occupation but the destroyed jobs were in low-medium skilled occupations. Over the period 1979 to 2007, the constant dollar median usual weekly earning of full-time wage and salary for those with less than a high school diploma decreased by 28.2% for men and by 8.7% for women (Figure 1). Men who were high school graduates (but without any college) experienced a 16% decline, but for women, the weekly earnings rose a little—4%. Men who had some college or an associate degree also experienced a small decline—by 7%, but women’s weekly earnings rose 8.6%. Men who had a bachelor’s degree or higher education

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2 Over the forty year period starting in 1974, the decline in the price of memory chips is by a factor of about 8,900,000.

3 Over 1947-2010, information-technology using industries of the U.S. accounted for 55% of value added (Jorgenson et al. 2014).
experienced an 18% rise in earnings over this period, and women experienced a much larger rise by 33%. Hence, women at each education level have done better than men over this period of time. Men without a Bachelor’s degree lost weekly earnings in constant dollar while only women with less than a high school degree lost weekly earnings.

Job growth has favored high-skilled goods and services workers and to a lesser extent low-skilled service workers but low-medium-skilled goods-producing and monitoring jobs have been most adversely affected. For example over 2002-2014, the share of high-skilled jobs (managers, professionals) increased by seven percentage points and low-skilled jobs (e.g., local food and personal services) by three percentage points but the share of middle-skilled routine (e.g., manufacturing, operatives-assemblers, secretarial, clerical) jobs fell by nearly ten percentage points (OECD 2016). The main factors underlying these developments are technological change that automated medium-skill routine tasks, e.g., in manufacturing, farming, secretarial, administrative jobs, and offshoring of standardized goods and service facilitated by globalization and international trade. Hence, jobs created frequently require different skills, likely in a different industry and location, than those that were lost. Moreover, many of those losing jobs were males with many years of job experience and significant accumulated firm-(and industry-) specific human capital (Becker 1993; Laing 2011). With job losses and structural change in skills needed for new jobs, these workers lost significant human capital and earning power. This means immediate prospects of a significant wage decline in moving to a new job. Otherwise, these displaced workers need to be upskilled to be able to access new, available higher-skilled and wage

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4 There was about 0.5 percentage point decline in medium skilled workers in middle-skilled non-routine jobs.
5 However, in the Great Recession of 2007-09, geographical mobility was greatly reduced by a collapse in the price of houses in some areas, leaving many unemployed households with mortgages that were larger than the market value of their house.
6 Firm-specific on-the-job training increases labor productivity only in the firm where the training occurs. To reduce labor turn-over, it is optimal for the firm and worker to share the benefits and costs of this type of training. However, when the demand for labor is sufficiently large, firms may still layoff their workers with firm-specific training. This results in human capital loss to both the worker and the firm.
jobs. If the individual becomes part of the long-term unemployed or drops out of the labor force, society and families face major economic loses (OECD 2016).\(^7\)

With automation of work using computers and information technology, which displaced goods-producing workers doing repetitive activities, and of outsourcing manufacturing and more recently business service jobs to areas where labor is cheaper, the U.S. labor force is short on high skilled workers and over supplied with middle skilled workers. Furthermore, a large share of new entrants to the U.S. labor force do not have the education needed to compete well in this labor market of the 21\(^{st}\) Century. For example, in 2015, the U.S. ranks 10\(^{th}\) in the world for the share of the population 25-34 years of age with at least 2-years of college completed at 47\% (Figure 2).\(^8\)

Thirty-six percent of these adults have at least a 4-year college degree bachelor’s degree, but 10\% have less than a high school diploma (Ryan and Bauman 2016). A slightly different picture emerges when one looks at the education distribution of those who are in the labor force. Among U.S. adults 25 years of age and older who were in the labor force in 2016, 66\% had at least some college and 39\% had a four-year college degree or higher but 8\% had less that a high school diploma (U.S. Dept of Labor 2016).\(^9\)

U.S. public universities supply a large share of college-trained individuals. Although public universities struggled financially during the Great Recession of 2008-2009, they are now doing considerably better, but a decline in the price of oil, metals, and agricultural commodities over the past two years has inflicted a new source of hardship on some of them.

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\(^7\) On average, just over 3\% of U.S. workers age 20-64 years with tenure of one year or more are displaced from their job every year (1999-2013). One-half of these displaced workers get back to work within one year of job loss. See OECD (2016, p. 32 and 36).

\(^8\) Among the set of countries included in Figure 1, 30 years ago the U.S. ranked second in share of population with at least 2-years of college completed. Hence, over this period of time the U.S. has not been a leading investor in raising higher education completion levels.

\(^9\) Twenty-six percent had only a high school diploma and twenty-eight percent have some college or two-year college degree.
The purpose of my paper is to show that human capital theory and labor market adjustments have important implications for investing in people for the 21st century. Section two identifies major types of human capital, section three presents a model of the human capital investment decision, section four reviews globalization and changing world labor market, and section five takes up the issue of who pays for a college education and how much. The final section presents some conclusions.

II. Types of Human Capital

The field of human capital has taken on a strong acquisition of skills and information flavor. K-12 education is a time when students learn cognitive skills such as reading, writing, completing mathematical operations, and understanding biological processes. These are valuable skills if one takes a job or continues to higher levels of education. However, the list of human capital topics has been expanded to include pre-school activities, informal education or information acquisition, as in short courses and seminars, and informal study of written materials, shopping, and learning while working on the job (on-the-job training). For example, recent research by Heckman (2006) and Heckman et al. (2013) report that pre-school activities of disadvantaged children help children develop social skills, sometimes called “personality,” that have long term payoff: reduced male externalizing behavior (aggressive, antisocial, and rule-breaking behavior), increased learning in school, and likelihood of being employed as an adult. For girls there is also a significant reduction in drug use and an increase in months married by age 40.

Early discussions of investing in health focused upon public health investments (mandatory vaccinations for contagious diseases and treatment of water and waste materials) and the inputs of medical services and pharmaceuticals. However, economists were among the first to hypothesize that good health is a product of how we choose to live our daily lives, i.e, through
long-term choices made on diet, exercise, moderate alcohol consumption, and weight and stress management, sometimes referred to as healthy lifestyle choices. In addition, other factors for pregnant women are access to prenatal medical care, an improved diet rich in vitamins, folic acid, and calcium, and behavioral modification (no smoking, drinking alcohol or doing drugs). This set of events, which also has costs, has been shown to improve the health of newborn babies, including increasing birthweight (Rosenzweig and Schultz 1983). In addition, it is widely accepted that poorly developed organ systems that arise from a poor fetal environment are one of the main causes of early onset of chronic diseases of old age (Fogel 1994). Moreover, recent research by Behrman and Rosenzweig (2004) has shown that increasing birthweight increases adult schooling attainment and adult height for babies at most levels of birthweight, but does not affect adult bodymass index. However, mature height and school attainment impact adult earnings positively (Keng and Huffman 2007). Hence, a long-term payoff results from an investment in human capital as reflected in babies birthweight.

Human migration creates another type of human capital. It is costly for individuals and families to move from one place to another, or to migrate. It takes time to plan a move, to physically pack up and move one’s own and family possessions, and in a new location, to find employment, housing, grocery stores, schools, banks, churches, and friends. Huffman and Feridhanusetyawan (2007) have shown that migration of working-age males responds to wage opportunities and amenities at the origin and destination. In addition, they show that additional education of adult males increases the probability of interstate migration, holding constant their expected wage differential between a new destination and current location. Hence, an individual’s education makes a person more geographically mobile. However, it is widely recognized that human migration changes and frequently provides benefits through improved education, employment and/or consumption opportunities. For example, with the major shifts in the industrial
(and occupational) distribution of the U.S. labor force, rapid exit from farm to nonfarm jobs occurred in the 1950-1970s. More recently, as low-wage, goods-producing jobs have come under pressure from technical change and international competition, it has been difficult for the individuals who are displaced to make transitions to new jobs—say low-skilled service jobs or high-skilled managerial jobs.

Immigration or international migration to the U.S. has been a part of our history since at least the 16th century (Laing 2011, p. 717-753). In particular, the U.S. had relatively unrestricted immigration until 1924, when the National Origins Immigration Act was passed. It limited new immigrant numbers to the countries that had the largest share of the immigrants as determined in the most recent U.S. census of population. Hence, Western and Northern Europeans were favored. However, in 1965, this legislation was replaced by a family unification and refugee immigration policy. Potential immigrants who had family members who were U.S. citizens were given priority. This has had the effect of attracting a relatively large number of low-skilled individuals and parents of citizens. The Immigration Reform and Control Act of 1986 contained an amnesty provision that allowed illegal workers who could document their earlier U.S. work history to apply for a Green Card and later citizenship. The Illegal Immigration Reform and Immigrant Responsibility Act in 1996 established a means test for those seeking to bring family members from abroad. Since 1970, the largest group of U.S. immigrants has been from Mexico, Central America, and Asia. Legal and illegal farm workers from Mexico have been a major part of the workforce in U.S. fruit and vegetable production, especially the harvesting of fresh produce, which is very difficult to mechanize (Huffman 2014). Moreover, the recent Great Recession affected the availability immigrant farm workers for harvesting fresh produce (Pan et al. 2016).

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10 It also excluded welfare payments, including food stamps, for illegal aliens.
III. The Human Capital Investment Decision

Most human capital investment decisions take a similar structure—costs up front and expected payoff later. However, to be precise, let’s consider the decision of whether to invest in a four-year college degree rather than stopping with a high school diploma or completing secondary school. Let $Y'_t = $earnings of a high school graduate in year $t$ (in constant dollars), $Y''_t = $earnings while individual is enrolled in college, net of costs of completing a four-year or BA/BS college degree, and earnings after graduating from college (in constant dollars). See Figure 3. However, we simplify and assume that students while enrolled in a four-year college degree program are assumed to have zero earnings. Thus, while a student is enrolled in college, he or she foregoes the earnings of a high school graduate. This is one important part of the cost of obtaining a four-year degree, see Figure 3, area $C_1$.

Also, college students incurred the direct costs of attending college: expenditures for tuition, books, fees, and any net increase in housing, food, and clothing as a result of being a college student relative to being an earner with a high school diploma, see Figure 3, area $C_2$. These two types of costs are combined to obtain the total cost of obtaining a four-year college degree. In Figure 3, the earnings of a new college graduate are higher than for a high school graduate, and this difference is the net annual benefit of obtaining a college degree (Area B). Since a dollar next year (or 5 or 40 years from now) are worth less to most individuals than a dollar today, we must convert the education capital investment project into equivalent units by discounting. Let $r_t$ be the discount rate (in constant dollars) appropriate for this education capital investment decision, e.g., the real rate of interest that the individual or household would encounter if they were to obtain a college education loan, the real rate of return foregone on a passbook savings account or stocks or bonds if returns from these assets are used to self finance the investment. Consider the net present
value of investing at age 18 (NPV\textsuperscript{18}), the age at high school graduation, and assume retirement occurs at age 65:

\begin{equation}
(1) \quad \text{NPV}^{18} = \sum_{t=18}^{65} \frac{(Y_t^H - Y_t^I)}{(1 + r)^t} \sum_{t=22}^{65} \frac{(Y_t^H - Y_t^I)}{(1 + r)^t} = -C + B
\end{equation}

where the first term on the right of the above expression equals “-C” and the second term equals “B.” This investment in a four-year college degree is a worthy investment if NPV\textsuperscript{18} is greater than or equal to zero. If the investment in a four-year college degree were delayed by two years, the foregone earning (and tuition costs) would increase a little, but more significant is the loss of two years of benefits at the end of the work life. More generally, investing in a four-college degree at mid-life will not be a good investment because of shortening the benefits period and increase in foregone earnings cost while in college.

Huffman and Orazem (2007) present an agricultural household model where the marginal cost of human capital production is increasing each period but delaying results in one-period loss of benefits. The model concludes that large investments in human capital should occur early in the lifecycle. However, smaller increments in training may be a good investment later in an individual’s lifecycle but finite life is a drag on larger investments.

In many cases, it is useful to consider the internal rate of return on investing in a college degree: set the NPV\textsuperscript{18} = 0, and solve for the uniform discount rate \( r^* \), that makes NVP at age 18 equal to zero. A larger \( r^* \) implies a more attractive education investment project.

How has the payoff to a college relative to a high school degree varied over time? Figure 4 shows the ratio of the weekly wage rate for a four-year college graduate relative to a high school graduate over 1963-2008. The ratio was slightly less than 1.5 in 1963 and rose until 1971, reaching about 1.6. The ratio then declined to its starting value over 1978-1981. However, starting
in 1981, the ratio has trended strongly upward to about 1.95 in 2008. Later data show a slight increase over 2008-2012. This weekly wage ratio starting in 1980 shows a rapidly rising payoff to a college degree (Autor 2014).

Hence, with an increase since 1981 in the earnings of college graduates relative to high school graduates, the \( \text{NPV}^{18} \) and \( r^* \) have increased, implying that investing in a four-year college degree is an even better investment proposition than before. Autor (2014) documents that over 1981-2008, the net present value of a college vs a high school degree increased by a factor of 2.2 for men and by 2.7 for women.\(^{11}\) In addition, individuals who complete a four-year college degree tend to live and work longer than high school graduates, which further increases the \( \text{NPV}^{18} \) and \( r^* \).\(^{12}\)

Moreover, equation (1) and its internal rate of return alternative are powerful tools to be used in addressing any human capital investment decision. As indicated above, in almost all cases, the costs are upfront or at the beginning of the project and the benefits are in the future, generally ending at retirement (or at the end of life).

You might like some information about the relative attractiveness of various types of human capital investments. I have reviewed a wide variety of literature, and pulled together my assessment of the likely rate of return to human capital investments of various types (Heckman 2006; Welch 1999; Card 1999; Heckman et al. 1999; Psacharopoulos and Patrinos 2004; Dougherty 2005, Heckman et al. 2006, Heckman and Lafontaine 2006, Huffman and Evenson 2006; Henderson et al. 2011). In Table 1, I have grouped them into the following categories: (i) extremely high, (ii) high, (iii) medium to low, and (iv) other: highly variable. In the extremely high category, I include improved gestation environment of babies, pre-school programs of

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\(^{11}\) The calculations include the cost of tuition at public university, a work-life after college of 42 years and a real discount rate of 3%.

\(^{12}\) Petter et al (2016) report new results from a large study of twins showing that individuals with 13 or more years of schooling have about three years longer life expectancy at age 60 than those with only 10 years of schooling.
disadvantaged children and an elementary school diploma. In the high category, I include a high school diploma, four-year college degree, advanced degrees I (Master’s level) and advanced degrees II (PhD, MD, JD, DD). Investing in migration and information seem likely to have highly variable returns.

IV. Globalization and the Changing World Labor Market

The occupational distribution of the US labor force changed over 1950-2005, and so did wage rate growth. Table 2, adapted from Autor and Dorn (2013), shows (Panel A) the distribution in 1950, 1980, and 2005 by six major occupational groups arrayed by skill level as represented by the mean wage in 1980. Over this 55-year period, relatively steady growth in the share of employment occurred in occupations at the top of the skill distribution—managers/professionals/technicians/finance/public safety—and at the bottom of the skill distribution—local personal service occupations. However, steady decline (or no change) in the employment shares of the four intermediate skilled occupations have occurred. The decline is most pronounced for the later sub-period 1980-2005 when the employment-share in all four of the intermediate-skilled occupations showed a decline, e.g., 21.5 % per decade for machine operators/assemblers and 15.1 % for the production/craft occupation. At the highest and lowest skilled occupation groups, the employment-share increased by 11.9% per decade over this 35-year period.

Over 1950-1980, real wage rate growth occurred across all six occupation groups, ranging from 14-21%, being highest at the top and bottom of the skill distribution. However, over the second sub-period, 1980-2005, wage growth was most pronounced at the top and two bottom occupations in the skill distribution—services occupations and clerical/retail sales. The real wage actually declined by 1.2% per decade for workers in the production/craft occupational group.

Autor and Dorn (2013) argue that service occupations at the bottom of the occupational skill distribution comprise the new “manual labor.” This work requires physical dexterity and
flexible interpersonal communication skills. These occupations include food service workers, security guards, janitors, gardeners, cleaners, home health aides, child care workers, hairdressers and beauticians, and recreation occupations. They are non-routine-local jobs that are not subject to international competition and only slightly affected by new computer and information technologies.

At the top of the occupation distribution is high-education goods and service production occupations. In these jobs, new computer and information technologies have been complementary with high-educated labor where data analysis is key to good decision making, such as for professionals and managers. Losers during the past 25 years have been those who were employed in low-education, goods producing occupations such as production and craft occupations, operative and assembler occupations, transportation, construction, mechanical, mining, and farming occupations. Autor and Dorn (2013) argue that these are occupations where computerization of routine tasks has occurred, such as in repetitive production and monitoring activities, and bookkeeping and clerical work. Workers in production occupations have also faced growing international competition from low-wage production workers in developing countries. In some cases, assembling durable goods requires several cross-border transfers of parts or partially assembled durables, as is the case for automobile assembling in Mexico using US or Japanese technology.13

Globalization of the markets for many goods and financial assets has implications for the U.S. labor market of the future, which in turn has implications for future human capital investment opportunities. Manufactured goods are highly transportable and, hence, jobs in manufacturing are especially vulnerable to intercountry and international relocation with competition. But new

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13 Pierce and Schott (2016) liken the sharp drop in US manufacturing employment after 2000 to a change in US trade policy that eliminated potential tariff increases on Chinese imports. At the plant level, shifts toward less labor-intensive production and exposure to the policy via input-output linkages also contributed to the decline in manufacturing employment over this time period.
evidence suggests that both manufacturing jobs and some service jobs may be at risk to international competition.

Imports from low-income countries were the fastest growing components of U.S. trade from 1972 to 1997, increasing more rapidly than aggregate imports. As U.S. trade barriers have fallen in recent years, Bernard et al. (2006) show that low-wage countries like China and India have begun exporting to the U.S. many of the more labor-intensive products formerly produced domestically. After China joined the World Trade Organization in 2000, the U.S. conferred permanent normal trade relations on them. The policy change is notable for eliminating the possibility of future tariff increases and the uncertainty with which they were associated. With this reduction in uncertainty, China rapidly accelerated its exports of manufactured goods to the U.S. (Pierce and Schott 2016).

This so-called product cycling—where the U.S. firms and workers move out of labor-intensive products like t-shirts and sneakers as lower-cost developing counties move in—is a key feature of endowment-driven trade theory. Given the higher relative wages in the U.S., it is virtually impossible for U.S. firms to earn profits producing labor-intensive goods. As a result, industries like apparel, footwear, and leather goods more generally have all but disappeared, while more skill- and capital-intensive sectors, such as instruments and software creation, thrive here.

However, there are multiple margins of adjustment to low-wage country imports, e.g., exit and product upgrading. Labor-intensive plants are relatively more susceptible to low-wage country imports than are capital- and skill-intensive plants in the same industry. As a result, within-industry activity should shift toward relatively capital- and skill-intensive plants. It is important to focus on low-wage country import penetrations, e.g., import penetration from countries that have per capita GDP that is less than 5% of the U.S. level. This attention to where imports originate is motivated by the factor proportions framework (capital-labor, capital-skilled labor, and/or capital-
unskilled labor ratios) and allows for a cleaner test of the influence of comparative advantage than aggregate import penetration, which treats imports from high- and low-wage countries symmetrically (Finlay 1995).

Figure 5 displays the association between the U.S. low-wage-country import shares and the U.S. industry average annual wage for disaggregated U.S. industries. Low-wage U.S. manufacturing jobs can be classified as those that pay an annual wage of less than $40,000 (or roughly a wage of $20 per hour in 2006) and high-wage jobs pay $40,000 or more. The figure shows low-skill, low-wage, labor-intensive activities in the manufacturing sector face high levels of low-wage-country import competition as recently as 2006, e.g., apparel, leather and allied products, textile products, furniture and related products, and miscellaneous products (which include toys). In contrast, high-wage, high-skill industries face low competition from low-wage-countries as reflected in the low-wage-country import share, e.g., transportation equipment, chemicals, and petroleum and coal products. An outlier to this trend is the computer and electronic equipment industry, which has a high average wage and a relatively high low-wage-country import competition. This exception is most likely due to the increased fragmentation of consumer electronics production where the underlying components, like semiconductors, that are high-wage, high-skill activities produced in the U.S. and shipped to China for low-wage, labor-intensive assembly (Jensen and Kletzer 2008).

U.S. manufacturing plants seem to adjust to international competition from low-skilled, low-wage countries in three dimensions. At the industry level, exposure to low-wage country imports is negatively associated with plant survival and employment growth (Bernard et al. 2006). Within industries, the higher is the exposure of the industry to low-wage country imports, the larger is the relative performance difference between capital- and labor-intensive plants. Moreover, a positive association exists between exposure to low-wage country imports and
industry switching. Plants that switch industries shift into industries that have less exposure to low-wage country imports and greater capital- and skill-intensity than the industries they left behind. In manufacturing, it is the low-wage, labor-intensive industries like Apparel that are most vulnerable to low-wage import competition. The U.S. continues to have strong export presence in high-wage, skill-intensive manufacturing industries. These results support the view that U.S. manufacturing is moving away from comparative disadvantage activities and toward comparative advantage industries via exit, growth, and industry switching.

Some U.S. industries remain quite competitive, having large exports per worker. Figure 6 shows the association between U.S. exports per worker in manufacturing and U.S. industry average annual wage. It confirms the story from the import competition graph—low-wage, low-skilled U.S. industries export little per worker, e.g., apparel, textile products, leather and allied products, furniture and related products. However, it also shows that in high-wage, high-skilled U.S. industries, exports per worker are high, e.g., transportation equipment, computer and electronics, and petroleum and coal products. Summing up, lower-paying, labor-intensive U.S. industries face intense international competition from low-wage, labor-abundant countries, but that the U.S. continues to have a comparative advantage in high-wage, capital- and technology-intensive manufacturing, and workers are doing well there.

A new direction in potential international competition in services—both imports to the U.S and U.S. exports. Some services require face-to-face interactions, e.g., hair cuts, legal counseling and medical treatments, but others do not, e.g., accounting, architectural services, software publishing, securities and commodity trading, and R&D. Occupational groups with low employment shares in tradable activities require a physical presence to deliver them, e.g., education, health care practitioners, health care support workers, food preparers, janitorial workers.
While many services appear tradable, Jensen and Kletzer (2008) suggest that only about one-third of U.S. jobs in these activities will face meaningful competition from low-wage countries or risk being off-shored in the next decade. Tradable service jobs, such as those in engineering or research and development firms, are good jobs. Workers in tradable service activities have higher than average earning. Part of this premium is due to these workers having high educational attainment, but even controlling for differences in education and other personal characteristics, workers in tradable service activities have 10% higher earnings. Within the set of professional service industries, a worker in a tradable industry and a tradable occupation has earnings almost 20% higher than similar professional service workers in a nontradable industry and occupation.

High earnings in tradable service activities do not mean that these jobs will be “lost” to low-wage countries. High-wage, high-skilled activities are consistent with U.S. comparative advantage. The U.S. continues to export high-wage, high-skilled business services like computer software publishing, satellite telecommunications services, and integrated record production and distribution (Figure 7). Most issues about off-shoring focus on the jobs that might be lost but neglect to emphasize that the U.S. has comparative advantage in many service activities. Jensen and Kletzer (2008) suggest that increased exports of services are likely to benefit many U.S. firms and high skilled workers in the future. They suggest that at least two-thirds of tradable business service jobs are skilled enough to be consistent with U.S. comparative advantage. U.S. service workers and firms are likely to be beneficiaries of increased trade in services through increased export opportunities.

Jensen and Kletzer (2008) present evidence on the potential tradability of jobs by sector of the economy. They argue that good information on whether a good or service has the potential to be internationally tradable can be gleaned from evidence on intra-country tradability of a good or
service. For example, air craft manufacturing in the U.S. is concentrated in the Pacific Northwest and not evenly distributed across the U.S. In addition, movie and music recording production, securities and commodities trading, software and engineering services, and air-travel plan reservations—appear to be tradable within the U.S., and thus, are potentially tradable internationally. Services that require face-to-face interactions are far less likely to be domestically or internationally tradable. Figure 8 shows that the share of U.S. employment that is in non-tradable goods and services is 60%. Agriculture accounts for 1% of employment in tradeable goods compared to accounting for 1.4% of labor force. Likewise, manufacturing accounts for 12% of employment in tradable goods compared to roughly 15% of total employment. Professorial services accounts for the largest share of employment in tradable output—14%. Some big service sectors—education, healthcare, personal services and public administration—do have low shares of employment in tradable industries. Also, a relatively small share of employment is in tradable retail and wholesale trades. When workers in tradable occupations (e.g., computer programmers, the retail banking industry, or medical transcriptionist in the health care industry) in nontradable industries are included, the share of the U.S. workforce in tradable service activities is even higher (Jensen and Kletzer 2008).

It is important to emphasize that many impediments exist to trade in services, ranging from language and cultural differences to regulatory and technical barriers. These impediments are likely to protect U.S. firms and service workers from import competition but are also likely to impede U.S. firms and service workers from rapidly growing exports. These impediments reduce the gains to the United States from trade in services and increased living standards that could result. If harmonization of regulations and expanding mutual recognition of professional standards and accreditation could occur, the future potential of increased benefits of trade in services could develop over the next decade.
In summary over 1998-2004, all U.S. industries experienced a major downturn in employment—by 13% in nontradable agriculture, mining and manufacturing and 23% in tradable agriculture, mining and manufacturing. In contrast, service sector employment increased—by 10% in nontradable and 13% in tradable services. Thus, tradable manufacturing industries experienced large losses relative to nontradable manufacturing, but tradable service industries had employment growth similar to nontradable service industries in the U.S.

Currently, only trade-affected displaced workers are legally entitled to largely uncapped support, including training, and can receive generous help. However, this is a small minority among all displaced workers in the U.S. Most of these workers are from manufacturing (and a few from agriculture). However, if displaced workers qualify, they can receive not only training but also long periods of unemployment benefits. In addition, workers over age 50 can opt for a wage supplement which would cover 50% of the wage loss in a new job over a two-year period (OECD 2016).

V. Who Pays for College Education in the U.S.?

Who is paying for college education in the U.S.? Recent Sallie Mae, the nation’s leading provider of saving- and paid-for-college programs, and Gallop, conducted one of the first surveys of college students and parents of students 18-24 years of age (Sallie Mae 2016). The reference was the 2015-2016 academic school year, and they asked about the total cost of college tuition and related expenses (tuition, books, fees, room and board) and the method by which parents and students pay for college. The estimated average cost of a year at college was $23,289 for four-year state universities and $41,762 for four-year private colleges and universities (Figure 8). At four-year public universities, parents’ income and savings account for 32%, scholarships and grants for 29%, student borrowing for 17%, student income and savings for 12%, parent borrowing for 7% and money from other relatives and friends account for 4%. Hence, students attending 4-yr public
schools, the student and parents bore an average of $16,603 or 71 percent of the cost. For students attending 4-yr private schools, the student and parents bore an average of $24,580 or 59 percent of the cost.

In contrast, at four-year private universities, scholarships and grants account for 41% of the cost, parents’ income and savings for 26%, students’ borrowing for 11%, parent borrowing for 7% and money from other relatives and friends for 5%. The study shows that both parents and students shared the costs of a year of college, but also scholarships and grants have become more important over time.

Public universities receive a subsidy from state government appropriations to support undergraduate education and other teaching, research and outreach activities. Using a Delta Project Report (Desrochers and Hurlburt 2016), I estimate that the state government subsidies to public four-year universities for undergraduate education was $6,757 (2013 dollars) per full-time equivalent student in the 2013 academic year, or the average total cost of a year of college education at a four-year public institution was roughly $23,706 + $6,757 or $30,046. This is an average state government subsidy rate to public universities of roughly 22%.14 The size of this state government subsidy as a percent of total costs has been approximately unchanged since 2007.

VI. Land-Grant Universities

In the U.S., land-grant universities are special among public universities. They were established by the Morrill Act of 1862 for teaching of agricultural and mechanical arts to common people. The needs of farmers (and families) across the U.S. for new scientific knowledge to help them compete and prosper led to the Hatch Act of 1887, which provided federal funding for state agricultural experiment stations to undertake agriculture and home economics research. Although

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14 I use what is reported as “full educational costs,” which include direct instructional costs, plus spending for student services and the instructional share of central academic and administrative support. It does not, for example, include the implicit rental on capital in classrooms or laboratories and equipment used for teaching.
early financial support was mainly federal, state governments later assumed the majority funding role, which was natural given their emphasis on applied and basic research to assist local agriculture (and families). The establishment of a federal-state extension service was aided by the Smith-Lever Act of 1914. Hence, the primary structure of land-grant universities was established by the early 20th century (Goldin and Katz 1999, Huffman and Evenson 2006b).

In the first half of the 20th century, a growing supply of high school graduates from families with modest means were produced by the high school movement and some of them chose to attend college (Goldin and Katz 1997). During the post-World War II period, a major transformation of the land-grant system resulted in an expansion in scale (size) and scope (number of specialized departments and professional schools). Land-grant universities became major centers of complementary research and teaching activities, where faculty trained for research and advancing the state of knowledge also engaged in undergraduate and graduate education. Also, over 1948-1970, the mass exodus of people out of agriculture, most with high school diplomas, provided a growing demand for college education. Public universities responded by offering an increasingly diverse range of undergraduate majors and degrees. Through this era, undergraduate students were primarily in-state students, and they were seeking a college education so that many of them could continue to live and work in the state where their parents worked and paid taxes. Abundant evidence exists that state governments were willing to provide large subsidies to public institutions of higher education in these early years because it directly benefitted local agriculture, businesses, and natural resource development and the citizens of the state, include income tax collections.15

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15 Goldin and Katz (1999) emphasize that a large share of the early engineering graduates were employed by the government sector, and graduates of two- and four-year colleges were employed primarily by local school districts. Also, early graduates of colleges of agriculture, veterinary medicine, and the sciences were largely employed in local agriculture.
Jin and Huffman (2016) show that investments in U.S. public agricultural research and extension were a major factor explaining the increase in state agricultural productivity (and output) over 1970-2004, in the U.S. Moreover, they show that the real internal rate of return from within-state and spillovers effects of public agricultural research was 67% and for within-state extension was over 100%. However, the stock of public agricultural research peaked in 2005 and then stated a slow decline (Huffman 2016). With a total research lag of 33 years, it is impossible to quickly make up for past underfunding of public agricultural research.

Just and Huffman (2009) summarize other changes facing public universities. College students are now more mobile—looking across state borders for the best education deal. Even if they attend the local land-grant university, a large share of them expect to take jobs and live in other states. The USDA has dramatically reduced its block grant funding of agricultural research and extension, and scientists have been increasingly encouraged to seek competitive grant funding at the federal level (NIH, NSF, USDA, etc). This means that States can expect to capture a smaller share of the future benefits from the education of their graduates and discoveries of their scientists. Hence, state governments are reducing their appropriations for land-grant universities, and land-grant and other public universities are raising tuition rates at a relatively rapid rate in an attempt to cover a larger share of the cost of educating students.

Where are we headed? One consequence of budget realities is that public land-grant universities are transformed into mixed public-private universities. The components of the university that provide relatively largely within-State benefits, such as colleges of agriculture with their experiment stations and extension services and/or colleges of education may justify large state subsidies, including low tuition rates. Other units that provide training for degrees that are similar to that offered by non-land-grant public and private universities would charge higher
tuition rates—rates comparable to private universities with similar quality degree offerings. Research faculty would be asked to seek grant funds from outside of state sources.

Second, given that the benefits of college education and research discoveries undertaken in any given state extend increasingly beyond its boundaries, regional groups of states or perhaps the federal government, might take new responsibilities for raising resources and allocating them to instruction and research in public universities. This could be structured so that the cost burden of instruction and research are more closely tied to the area(s) receiving the benefits, including positive externalities. This is the principle of “fiscal equivalence” from public economics, which has been proposed by Mancur Olson (Olson 1969, 1986).

Third, land-grant and other public universities could continue on their path of slowly being converted into private universities, and eventually receiving insignificant state financial support. I have provided a short menu of options for land-grant universities in the future—some which seem better than others for the long term. However, the route that we travel will significantly impact investments in people in the 21st century.

**VII. Conclusions and Recommendations**

T.W. Schultz was an incredibly insightful man—judging ideas and people with unusual expertise. His idea of human capital, investing in people has steadily expanded to an increasing array of activities—ranging from modern economic growth and development to the economics of households and other non-market activities. However, the U.S. ranks tenth among OECD countries in the share of its population 25-34 years old that have completed at least two years of college education (Appendix figure). Over the past 30 years, it also ranks fourth among these countries having the smallest increase in the share of this age group obtaining at least a 2-year college degree. With 66% of U.S. labor force have at least a two-year college degree, and 83% of
the labor force employed in the service sector, many individuals in the U.S. are working in low-or medium-skilled services with less that a college degree, e.g., those in local service jobs.

Land-grant universities have a very special place in the training of undergraduate and graduate college students and in undertaking the work of advancing the frontiers of knowledge in many areas, including agriculture and life science, human sciences, and engineering. These are high-skilled, education-intensive activities and cannot be successfully undertaken by part-time faculty or faculty that spends all of their time teaching. At the start of the 20th century, major universities started to make discovery an important part of a university job for the first time. This feature distinguishes U.S. universities from those in many other parts of the world. New institutional funding mechanisms for instruction, research and extension are needed for U.S. land-grand universities.

With technological change eliminating routine jobs and globalization of standardized good production eliminating manufacturing jobs, the U.S. has faced reduced employment in low-middle-skilled, goods-producing industries and growth in high-skilled service occupations over the past two to three decades. Hence, the skilled of those losing these jobs do not match the skills needed for workers where rapid growth is occurring—a mismatch exists. so long term unemployment or exist from the labor force is likely. This frequently creates an unhealthy environment for many individuals—long-term malnutrition, drug use, family troubles, divorce, and suicide. The big challenge is how to save these individuals and redirect them into useful training programs that will enable re-entry into a productive life. Some type of carefully structured re-training and nutrition education programs with counseling might be successful.16 Otherwise, these displaced unemployed individuals need some type of extended unemployment benefits possibly with diet and family counseling.

16 There have been recent reports of unemployed individuals undertaking an intensive 13 week program in encoding and immediately being hired after completing the program.
Understanding where the future comparative advantage of the U.S. industries, occupations and workers lies is important in planning for future educational investments. For example, U.S. high school dropouts that are best prepared to work in low-skilled, low-wage U.S. manufacturing can expect a large amount of competition from large countries with many low-wage, unskilled workers. Job loss in these sectors and falling real wage rates are expected to continue. Young individuals should be advised to pursue college degrees and skills that are complementary with the new technologies and not subject to elimination by its application. Displaced workers need early re-employment support, which is possible only where there are vacant jobs that require skills that are similar to the lost jobs. They also need job-search assistance and low-cost job-search training.

Unfortunately, re-training programs for displaced workers have a bad reputation being a poor investment of resources (Heckman 2006; OECD 2016), but changes can be made to improve them. First, it is necessary to promote demand-driven training at the local level by matching worker’s pre-assessed skills and abilities closely with employers’ needs. Second, it is important to expand professional career guidance and stackable training (complimentary training) and skill credentials for displaced workers. Third, it is useful to expand profiling to dislocated workers to help pinpoint their future training needs early on and target training to those most in need. In addition, it is important that rigorous evaluation of training programs and training innovations and eventually expand successful element and eliminate ineffective interventions and training.

New computers and information technology are being included in new farm tractors and equipment and buildings. Auto steer (assist) technology is now available on tractors and combines, and they work well on long straight rows but still require manual turning at the ends of fields. This technology has displaced much of the farm labor previously allocated to routine field operating tasks, but supervision by alert operators is still required. Otherwise, large, expensive farm machinery are at risk of damage due to farmers’ inattention. Likewise, automatic feeding and
watering systems are available, especially in confined livestock and poultry production. They have also greatly reduced the use of routine labor.

Periodically, the issue arises as to whether low-skilled immigrant farm workers will be (or should be available) for harvesting fresh fruits and vegetables in the U.S. However, consumers are quite concerned about the quality of their produce when it is consumed fresh, and soft fruit, berries, and vegetables are easily damaged by mechanical harvesters, which degrade the appearance and reduce shelf-life and increases spoilage. In addition to these quality issues, mechanization of fresh fruit and vegetable harvesting is made more expensive by the fact that the size, shape, and row-spacing of trees and vines generally need a new configuration if mechanization were to have a chance. Hence, mechanization of fresh fruits and vegetable harvesting is a more complex and expensive issue than just finding a machine that will harvest the crop. As a result, low-wage countries such as Mexico and Chile have been exporting increasing quantities of fresh produce to the U.S. even with relatively large numbers of immigrant farm workers available.

Investing in people for the 21st century is a very important activity, with important decisions at many levels. The goal of U.S. higher education should be to significantly increase the share of high school graduates who obtain four-year college and advanced degrees that prepare them with skills to undertake non-routing jobs and be complementary with new information technology.
References


Figure 1. Change in Constant-dollar Median Usual Weekly Earnings, by Educational Attainment and Gender, 1979-2007

Note: Data relate to earnings of full-time wage and salary workers 25 years and older.
Figure 2. Population Completing Tertiary Education (≥ 2 years of college), Percentage by Age Group (2015) *

*Tertiary education is education beyond high school leading to a degree, which might be a 2-year vocational degree. Source: OECD
Figure 3. The Economics of Investing in a Four-year College Degree, Given a High School Diploma

Source: Adapted from Psacharopoulos (1981), p. 322
Source: March CPS data for earnings years 1963---2008. Log weekly wages for full-time, full-year workers are regressed in each year on four education dummies (high school dropout, some college, college graduate, greater than college), a quartic in experience, interactions of the education dummies and experience quartic, and two race categories (black, non-white other). The composition-adjusted mean log wage is the predicted log wage evaluated for whites at the relevant experience level (5, 15, 25, 35, 45 years) and relevant education level (high school dropout, high school graduate, some college, college graduate, greater than college). The mean log wage for college and high school is the weighted average of the relevant composition adjusted cells using a fixed set of weights equal to the average employment share of each group. The ratio of mean log wages for college and high school graduates for each year is plotted.
Figure 5  Low-Wage US Industries Face Low-wage–country Import Competition, Manufacturing (NAICS 31, 32, 33)

US industry average annual wage (dollars)

NAICS = North American Industry Classification System.

Sources: Jensen and Kletezer 2008.
Figure 6 Exports per Worker in Manufacturing Rise with Industry Wages, Manufacturing (NAICS 31, 32, 33)

NAICS = North American Industry Classification System

Sources: Jensen and Kletzer 2008.
Figure 7  Exports per worker in business services rise with industry wages, business services (NAICS 51, 54, 56)

NAICS = North American Industry Classification System

Note: The trend line is a polynomial regression ($y = 5E-09x^2 - 0.0002x + 1.3732$, $R^2 = 0.2946$) of the plotted data.

Sources: Authors' calculations; 2002 Economic Census.
Figure 8. Tradable and Nontradable Industries' Share of Total Employment (percent)

Figure 9. How Families Pay for College, Funding Source Shares by School Type: 2015-2016
**Table 1. Likely Inflation Adjusted Returns to Human Capital Investments**

1) **Extremely high (>25%)**
   - Improved pre-natal environment for babies
   - Pre-school programs for disadvantaged children (esp. development of social skills)
   - Elementary school diploma

2) **High (10-25%)**
   - Four-year college degree (BA/BS)
   - Advanced degree II (PhD, MD, JD, DD)
   - Advanced degrees I (Masters level)
   - High school diploma

3) **Medium to Low (0-9%)**
   - Some high school
   - Some college or 2-year college degree (AA)
   - General Equivalency Diploma (GED certificate)
   - Job training (O-J-T)
   - Job training (Job Training Partnership Act)

4) **Other: Highly variable**
   - Migration
   - Information, including Agricultural Extension which is actually quite high
Table 2. Levels and Changes in Employment Shares and Mean Real Log Hourly Wage Rates by Major Occupation Groups, 1950-2005: Occupations Ordered by Average Wage Level in 1980.

<table>
<thead>
<tr>
<th></th>
<th>Level</th>
<th>Percent growth</th>
<th></th>
<th></th>
</tr>
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<tbody>
<tr>
<td><strong>Panel A. Share of Employment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Managers/professionals/technicians/Finance/public security</td>
<td>22.3</td>
<td>31.6</td>
<td>40.9</td>
<td>41 (13.8)</td>
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<td>Production/craft</td>
<td>5.1</td>
<td>4.8</td>
<td>3.0</td>
<td>-5 (-1.8)</td>
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<td>Transportation/construction/Mechanics/mining/farm</td>
<td>29.2</td>
<td>21.6</td>
<td>18.2</td>
<td>-26 (-8.17)</td>
</tr>
<tr>
<td>Machine operators/assemblers</td>
<td>12.6</td>
<td>9.9</td>
<td>4.6</td>
<td>-21 (-7.0)</td>
</tr>
<tr>
<td>Clerical/retail sales</td>
<td>22.2</td>
<td>22.2</td>
<td>20.4</td>
<td>10 (3.4)</td>
</tr>
<tr>
<td>Service Occupations</td>
<td>10.7</td>
<td>9.9</td>
<td>12.9</td>
<td>-7 (-2.3)</td>
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<tr>
<td><strong>Panel B. Mean hourly wage ($2004)</strong></td>
<td></td>
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<tr>
<td>Managers/professionals/technicians/Finance/public security</td>
<td>11.21</td>
<td>16.95</td>
<td>23.10</td>
<td>61 (20.4)</td>
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<tr>
<td>Production/craft</td>
<td>9.39</td>
<td>15.64</td>
<td>15.18</td>
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<td>Transportation/construction/Mechanics/mining/farm</td>
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<td>Service Occupations</td>
<td>4.39</td>
<td>8.17</td>
<td>9.58</td>
<td>62 (20.7)</td>
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Source: Adapted from Autor and Dorn (2013)