The Democratization of Unemployment

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by

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Abstract

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Workers with more education have historically experienced lower unemployment rates than workers with less education. An analysis of recent data, however, indicates that the difference in unemployment rates by educational attainment appears to be shrinking. During the early 1980's recession, workers with less than a high school education experienced a sharp increase in unemployment with the increase in unemployment increasingly smaller the more schooling received. Although the percentage point increases in unemployment rates were not as large, the 1990's recession exhibited a similar trend by educational attainment. The recession in 2001, however, revealed a noticeably different pattern. Each education group experienced roughly the same percentage point increase in unemployment. Workers with some college education as well as those with a Bachelor's degree experienced a greater percentage point increase change in unemployment relative to those with less education, suggesting that increases in unemployment may now be shared more "democratically" across educational attainment groups. This change in the profile of unemployment has been driven by changes in the industrial and occupational composition of the economy, the peculiar nature of recent economic shocks as well as the educational composition of the workforce in general. Data suggest that this trend may continue in future recessions.

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To Claire, for without your support this work would not have been possible.

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Chapter 1 – Introduction and Purpose

"Don't be a fool, stay in school." Conventional wisdom has long held that the more education you have, the better off you will be in the labor market. More education generally equates with higher income, but it presumably also acts as insulation from the cold winds of economic recession that result in job loss and financial insecurity. Therefore, when defining policies for how to improve labor market outcomes, education is commonly seen as the cornerstone of such improvement. Moreover, as education presumably becomes ever more important for labor market success, one would think that labor market outcomes would be increasingly correlated with educational attainment.

Historical relationship between education and unemployment

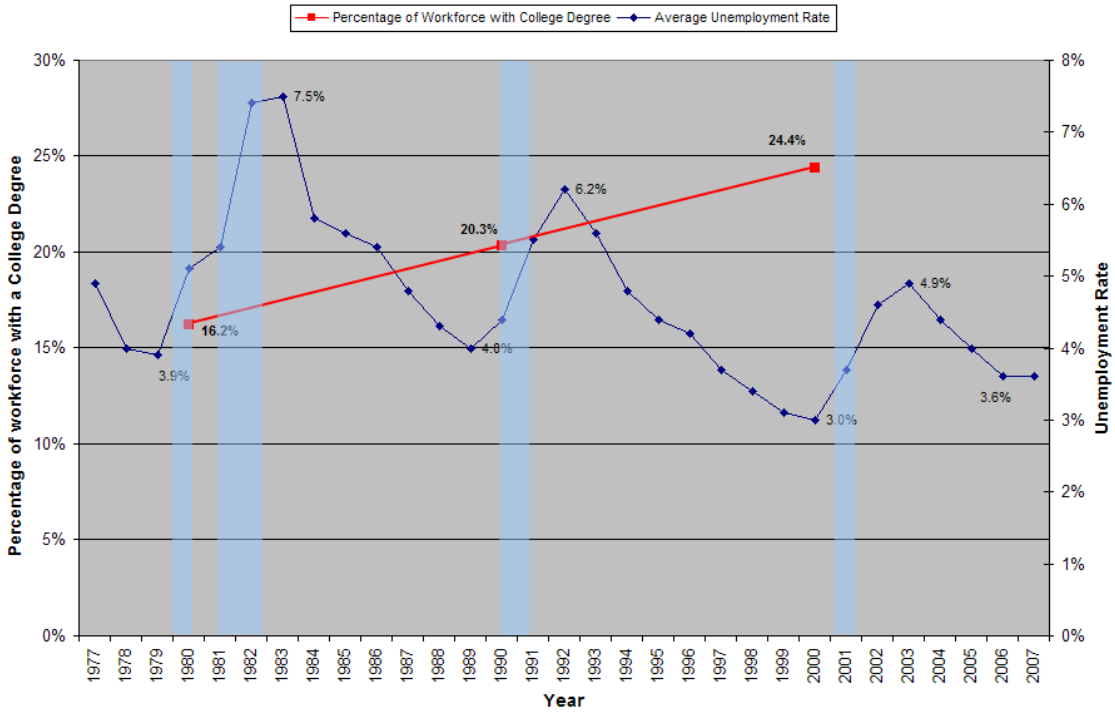
The U.S. has a long history of using its educational system to both prepare people to earn a living and to teach them the values and knowledge necessary to participate in a democratic society (Levy & Murnane, 2004). In line with a commitment to expanding public education, the educational attainment of the U.S. workforce has grown steadily over the years. This investment in education seems to have paid off. Research has shown (Mincer, 1991) that a major benefit of education is the lower risk of unemployment at higher educational levels. In fact, this benefit seems available not only to individuals, but to the workforce as a whole. As the overall educational attainment of the workforce has increased over the last three decades, the average overall unemployment rate has decreased (FRBSF, 2005).

During good economic times, unemployment tends to decrease while during bad economic times unemployment tends to increase. Economic expansions – “good economic times” – provide an opportunity to raise all boats by providing work to people of all educational backgrounds. Figure 1.1 illustrates the rise and fall of the unemployment rate during business cycle expansions and contractions (recessions). The vertical, light blue shaded areas represent business cycle contractions as defined by the National Bureau of Economic Research (NBER): January 1980 to July 1980, July 1981 to November 1982, July 1990 to March 1991, and March 2001 to November 2001. The non-shaded areas represent business cycle expansions.

Figure 1.1 also illustrates the relationship between education and the official unemployment rate using data from the U.S. Census data and the U.S. Bureau of Labor Statistics Current Population Survey (CPS) data. The red line represents the percentage of the workforce 25 years old and older who have a college degree. The blue line represents the overall unemployment rate of the same age cohort from 1977 to 2007. While the unemployment rate fluctuates with business cycle expansions and contractions, there is a clear downward trend over this thirty-year period while the education level of the workforce is marked by a monotonic upward trend. With each passing decade, the percentage of the workforce with a college degree has been increasing while the unemployment rate has been trending downward. It appears as though the advice of our parents and teachers to “Go to school; get a good education so you can get a good, secure job" was in fact sound advice. Given this evidence, should our goal not be for everyone in the U.S. workforce to get a college degree? Would this not lead to an overall reduction in the unemployment rate?

Figure 1.1

Annual Adult (Age 25+) Unemployment Rate vs. Percentage of Age 25+ Workforce with College Degrees



Source: National Bureau of Economic Research

In general, workers are more vulnerable to job loss and financial insecurity during economic recessions, but is this trend true for all workers? Do workers in all industries and occupations experience the same rise and fall in unemployment rates? Examining the insurance industry and the food services industry during the 2001 recession may provide insight in order to answer these questions.

The food services industry is comprised of occupations such as cooks, waiters, and first-line supervisors of food preparation and serving workers. Although trade-related training is certainly needed, these occupations do not typically require a college education. In contrast, the insurance industry is comprised of occupations such as claims adjusters, underwriters, and sales agents. These occupations are more apt to require a college education. The Table 1.1 provides the educational distribution of the insurance industry and the food services industry. Each column represents the percentage of workers with a given educational attainment. For example, an estimated 3.4 percent of workers in the insurance industry have a Masters degree. The column “Less than Bachelors” is the sum of the columns “Less than High School” through “Associate Degree” while the column “Bachelors degree and above” is the sum of the columns “Bachelors Degree” through “PhD.”

Table 1.1

Educational Distribution of Insurance Industry and Food Services Industry

	Less than High School	High School Graduate	Post HS	Associate Degree	Less than Bachelors	Bachelors Degree	Masters Degree	Professional Degree	PhD	Bachelors and above
Food services (722)	48.7%	37.2%	8.9%	1.9%	96.7%	1.6%	0.3%	0.0%	1.4%	3.3%
Insurance (524)	2.3%	31.9%	28.0%	12.4%	74.6%	20.0%	3.4%	1.0%	0.7%	25.1%

Source: Author’s calculations using LMAT with OES and O*NET data

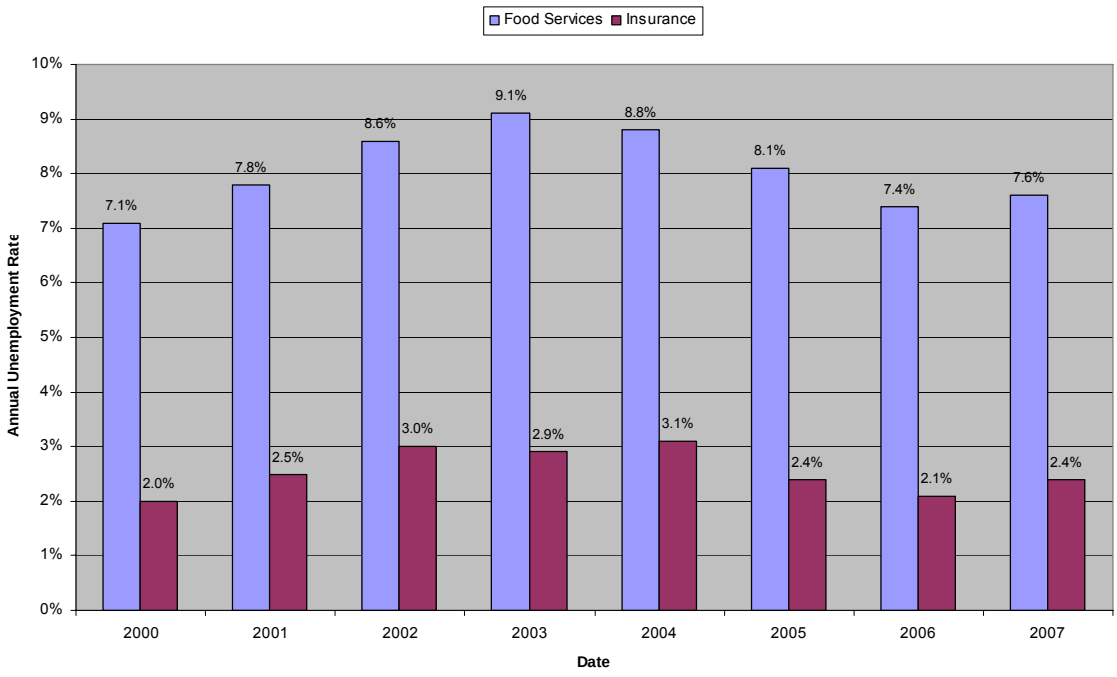
With an estimated 3.3 percent of the workforce having a college degree and above, the food service industry has a relatively low concentration of occupations requiring a Bachelors degree. Conversely, with an estimated 25.1 percent of the workforce having a college degree or more, the insurance industry has a relatively high concentration of occupations filled by those with at least a Bachelors degree. Furthermore, close to half of the workers in the food services industry have less than a high school diploma

(48.7 percent). In contrast, only an estimated 2.3 percent of workers in the insurance industry have less than a high school diploma.

Given this disparity in educational attainment, conventional wisdom would suggest that workers in the food services industry would not only experience higher overall unemployment rates, but also larger increases in unemployment rates during recessions. One may use CPS data in order to compare the unemployment rates between these two industries. Figure 1.2 shows the annual unemployment rate of the insurance industry compared to the food services industry.

Figure 1.2

Annual Unemployment Rate Comparison of Food Services Industry versus Insurance Industry



Source: Author's calculations using Bureau of Labor Statistics data

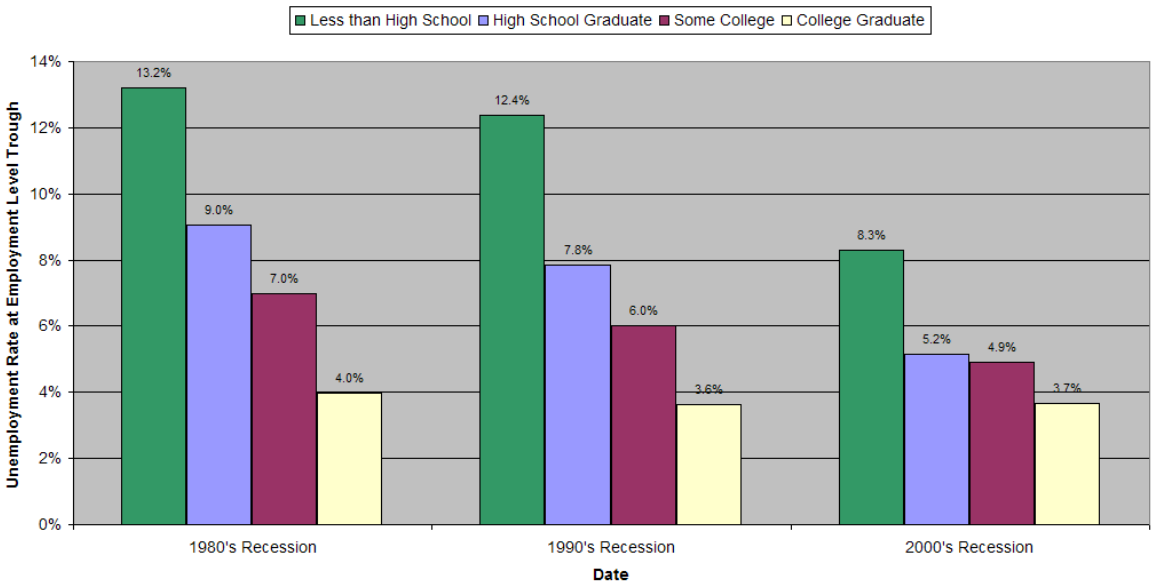
The graph clearly shows that the food service industry suffers higher overall rates of unemployment over all segments of the business cycle as well as a higher percentage point change in unemployment compared to the insurance industry as the economy weakens. In 2003, the unemployment rate of the food services industry was more than three times as high as the unemployment rate of the insurance industry. From a low of 7.1 percent in 2000 to a high of 9.1 percent in 2003, the food services industry experienced a 2.0 percentage point change in unemployment while the insurance industry experienced a 0.9 percentage point change in unemployment over the same period. Thus, the conventional wisdom apparently holds true. Workers with more education appear to be less susceptible to increases in unemployment during recessions.

This comparison shows that at least between these two industries in the 2001 recession that our parents and teachers were right – more education means more job security. What if we were to broaden our perspective by comparing the labor market outcomes for all workers by educational attainment over the last three recessions? Has the conventional wisdom held up in recent years? If so, one would expect to see consistently large differences in the unemployment rates between workers with less education compared to workers with more education. One would also expect to see consistently larger increases in unemployment rates during recessions for workers with less education compared to workers with more education.

For purposes of this example and the remainder of the research, I define recession in terms of the labor market as the period over which the economy moves from its high point of employment to its low point. I also define expansion in terms of the labor market as the period over which the economy moves from its low point of employment to its high point. This definition does not coincide precisely with the standard established by NBER. Given that a variety of economic indicators are used to determine the beginning and ending dates of a recession for the economy as a whole, the dates do not necessarily correspond perfectly to labor market recessions and expansions (Mishel, Bernstein, & Boushey, 2003). Using the labor market recession dating method and the seasonally adjusted CES Total Employment Level data, the last three complete labor market recessions occurred from February 1980 to December 1982, March 1990 to May 1991, and March 2001 to January 2002. According to this definition of labor market recession, the U.S. is currently in its fourth recession since 1979. National employment peaked in December of 2007 and as of December 2008 was 2.5 million jobs below its most recent peak. Using CPS data for workers age 25 and older, Figure 1.3 provides the unemployment rate by educational attainment at the employment level trough for each of the last three complete labor market recessions.

Figure 1.3

Unemployment Rate by Educational Attainment at Labor Market Trough



Source: Author's calculations using Bureau of Labor Statistics data

Workers with more education have indeed historically experienced lower unemployment rates than workers with less education. Total unemployment for all workers in the 1980's recession peaked at 10.8 percent in the fourth quarter of 1982. When the unemployment rate is disaggregated by educational attainment, workers with less than a high school diploma clearly experienced higher unemployment rates compared to workers with more education.

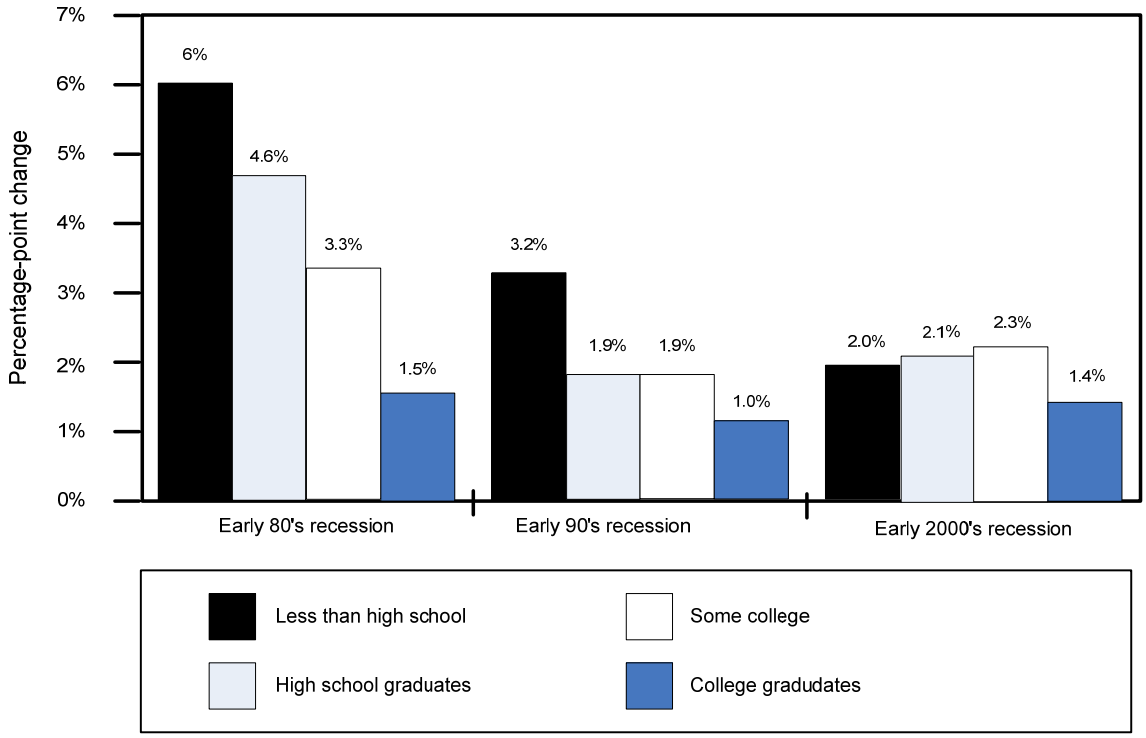
Yet the unemployment experience during the early 2000 recession appears to be different from that in the 1980's or 1990's labor market recessions. In the last recession, the difference in peak unemployment rates across educational groups seems substantially attenuated. For example, in the 1980's recession, workers with less than a high school diploma experienced 9.2 percent more unemployment than workers with a

college degree. In the 2000's recession, however, this gap was cut in half to only a 4.6 percent difference. Indeed, the ratio of unemployed workers with less than a high school diploma compared to unemployed workers with a college degree dropped substantially in the 2000's recession compared to previous recessions. In the 1980's recession, the unemployment rate for high school dropouts was 3.3 times that of college graduates and 3.4 times that of college graduates in the 1990's recession. In the 2000's recession however, the ratio dropped to only 2.2 times that of college graduates. In the 1980's recession, workers with a high school diploma experienced 2.0 percent more unemployment compared to workers with some college education (including Associate Degrees). By the 2000's recession, the difference between these two groups was almost erased.

An analysis of the change in the unemployment rate over the course of a labor market recession reveals an even stronger trend toward an equal sharing of the burden of unemployment. During the early 1980's recession (defined as February 1980 to December 1982), there are visible, descending steps between the four groups. Figure 1.4 shows the percentage point change in unemployment across educational groups over the last three labor market recessions from the employment level peak to trough (Mishel, Bernstein, & Boushey, 2003).

Figure 1.4

Percentage point Change in Unemployment Rate by Educational Attainment from Employment Level Peak to Trough



Source: Mishel, Bernstein, & Boushey, 2003

Workers with less than a high school education experienced the greatest increase in unemployment while each group with higher levels of educational experienced progressively smaller increases in unemployment with workers earning a Bachelors degree or higher experiencing the smallest increase. During the early 1990's recession, there was a leveling of the percentage point increase between workers with high school diplomas and some college (including associate degrees) while there remained a sizable difference between workers with less than a high school education and workers with a bachelors degree and higher. The leveling across educational groups was most

pronounced during the early 2000's recession. Workers with a high school diploma and some college experienced a higher percentage point increase in unemployment than did workers with no high school diploma and workers with a bachelors degree or higher.

As with unemployment rates by educational attainment, there is also a decline in the percentage point change in unemployment by educational attainment over the last three recessions. In the 1980's recession, workers with less than a high school diploma experienced four times the percentage point change in unemployment than workers with a college degree. In the 1990's recession, this difference was reduced to 3.2 times as much. By the 2000's recession, the difference in the percentage point increase in unemployment rates of workers with less than a high school diploma was only 1.4 times that of workers with a college degree.

The changing face of unemployment

How could high school dropouts fare less poorly during a recession than workers with a high school diploma and even those with an Associates degree? These data seem inconsistent with the comparison above between the food industry and the insurance industry. What if we were to change the comparison by replacing the insurance industry with another industry that has high concentrations of workers with a Bachelors degree or more such as the information services industry? Would we continue to see consistently higher unemployment rates in the industry with low concentrations of workers with a Bachelors degree and above?

As previously noted, the food services industry is comprised of occupations such as cooks, waiters, and first-line supervisors of food preparation and serving workers – all of which do not typically require a college education. Using a different industry with high concentrations of Bachelors degrees, the information services industry is comprised of occupations such as librarians, editors, and computer support specialists. Although a college degree is not mandatory for these occupations, they do have far higher concentrations of workers with a Bachelors degree compared to occupations in the food services industry. Using a new labor market assessment tool that will be described in Chapter 4, Table 1.2 provides the educational distribution of the information services industry and the food services industry.

Table 1.2

Educational Distribution of Information Services Industry and Food Services Industry

	Less than High School	High School Graduate	Post HS	Associate Degree	Less than Bachelors	Bachelors Degree	Masters Degree	Professional Degree	PhD	Bachelors and above
Information services (519)	2.9%	28.4%	23.9%	7.9%	63.1%	23.2%	12.4%	0.3%	0.5%	36.4%
Food services (722)	48.7%	37.2%	8.9%	1.9%	96.7%	1.6%	0.3%	0.0%	1.4%	3.3%

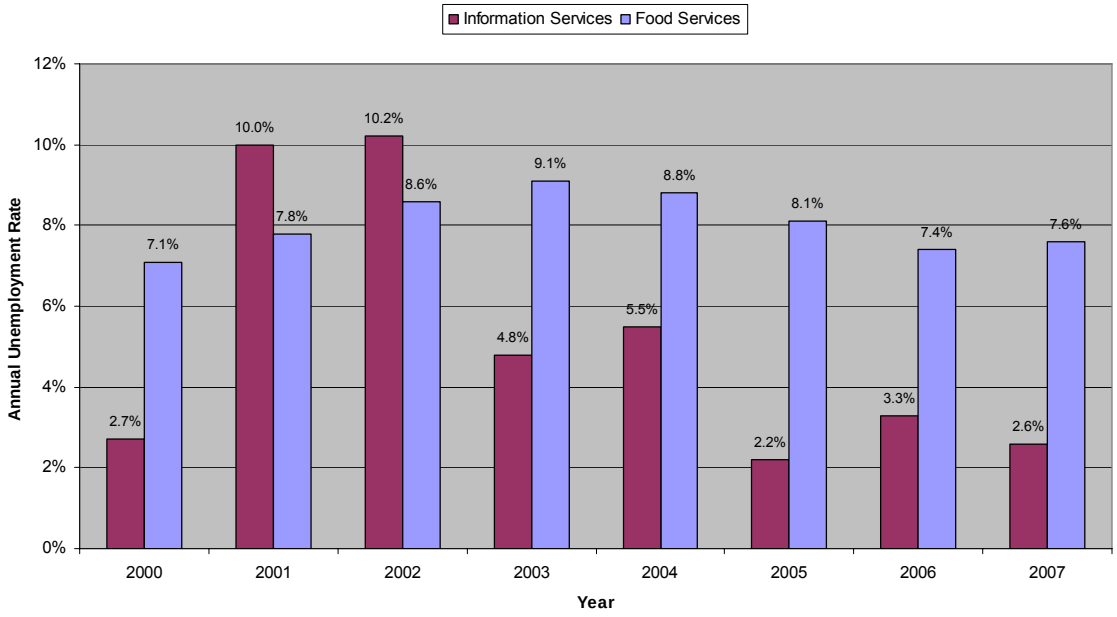
Source: Author's calculations using LMAT with OES and O*NET data

In the information services industry an estimated 36.4 percent of the workforce has a Bachelors degree and above. This is more than 10 times the percentage of workers with the same level of education in the food services industry. Conversely, only 2.9 percent of the workforce in the information services industry has less than a high school diploma. The food services industry has percentage wise almost 17 times more workers with less than a high school education. Clearly, the information services industry is comprised of workers with higher levels of education compared to the food services industry.

The information services industry has an even higher concentration of workers with a Bachelors degree than the insurance industry. Given this higher concentration of well-educated workers, conventional wisdom would suggest that one would expect to see even lower rates of unemployment for workers in the information services industry. Figure 1.5 shows the annual unemployment rate of the food services industry, but replaces the insurance industry with the information services industry.

Figure 1.5

Annual Unemployment Rate Comparison of Information Services Industry versus Food Services Industry



Source: Author's calculations using Bureau of Labor Statistics data

In 2001 and 2002, the unemployment rate in the information services industry exceeded the unemployment rate in the food services industry, with more than a two percentage point difference in 2001. In other words, an industry with a high concentration of workers

with a Bachelors degree fared worse during the 2001 recession compared to an industry with a low concentration of workers with a Bachelors degree. Librarians, editors, and computer support specialists appear to have been hit harder by the 2001 recession than cooks, waiters, and food service supervisors. Furthermore, the percentage point variance in the unemployment rate during the recession was larger in the information services industry than the food services industry. Between 2000 and 2002, the unemployment rate in the information services industry almost quadrupled, increasing from 2.7 percent to 10.2 percent – a 7.5 percent point increase. During this same time, the food services industry experienced only a 2 percentage point increase in the unemployment rate, going from 7.1 percent to 9.1 percent.

Is this observation a real trend or just an isolated anomaly? Are the percentage point changes in unemployment rates by educational attainment over the course of the last three recessions statistically significant? If so, what factors might have lead to such a change in the educational profile of unemployed workers? One explanation might be that the apparent shift in the educational attainment of the unemployed is correlated with industry-specific conditions. In other words, recessions may differ in terms of the particular industries most affected and given difference in the educational profiles in each industry, the educational distribution of unemployment itself may be affected. An alternative hypothesis might be that the U.S. is developing a segmented labor market in which the supply of less educated workers is shrinking while the level of demand for those same workers remains constant, or even grows. In this case, the variance in the education profiles of unemployment would presumably continue to shrink over time.

This research will try to confirm whether the apparent trend toward smaller education differentials in unemployment rates indeed occurred, and if it did, discuss the magnitude of the trend as well as explain this trend with the hope of predicting what might occur in the future and suggest policy implications if it does. In doing so, I will examine trends in the demographic characteristics of unemployed workers in the U.S. between 1980 and 2006, describe how the profile of the unemployed has changed over that period, estimate the future educational distribution of unemployment, and discuss possible implications of these changes for labor market policy.

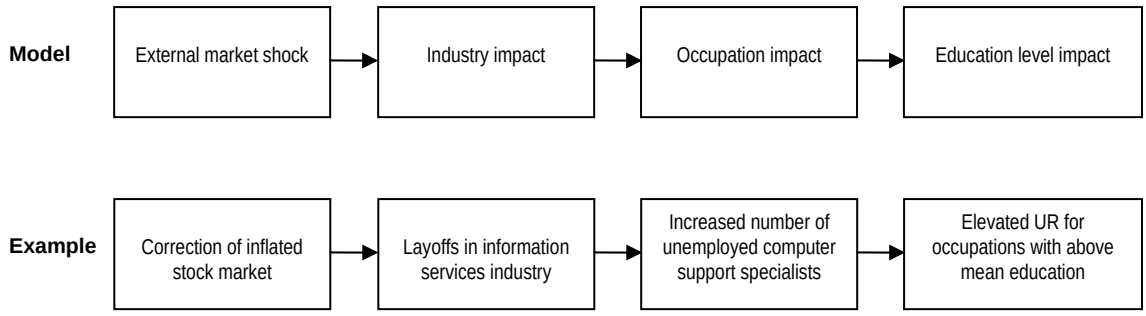
Answering these questions will require an understanding of the generating factors of unemployment. In order to model the chain of events that generate unemployment, I will start by reviewing external shocks to a market and their impact on various industries. The impact on various industries will then lead to an analysis of the differences in occupational composition in various industries and the associated educational differences across industries. The educational requirements of various occupations finally result in a discussion of different unemployment profiles in terms of which workers are affected under given economic conditions.

Modeling the distribution of unemployment

To study these apparent changes in the education distribution of unemployment, we need to trace how external market shocks have a differential industrial impact leading to variation in occupational impact, and finally a change in educational outcomes. The following model illustrates the relationship between these generating factors and the unemployment rate (UR).

Figure 1.6

Model of Unemployment Generating Factors



Source: Author

As we see in the example, a sharp correction of an inflated stock market due to irrational exuberance in the information technology sector would likely yield an increased number of displaced workers in the information services industry. The information services industry has a higher concentration of computer support specialists, who, relative to the rest of the workforce, have an above-average educational level. By linking changes in industrial composition to occupational composition and then occupational composition to employment levels by educational attainment, one can begin to model the effects of an external market shock on the labor force by educational attainment. In other words, as an industry adds or sheds jobs in response to a market shock, the varying concentrations of occupations within those industries will shift the educational attainment distribution of unemployed workers and thus the unemployment rate.

Massive occupational shifts have gone along with changes in industrial composition of the United States as the nation was transitioning from an agrarian-based economy to

one based in manufacturing to a services-based economy. As the industrial composition of the economy changed, the workers affected by recession change. During the agrarian era, farmers bore the brunt of rising unemployment. During the industrial era, “blue collar” workers were the most adversely affected. Now, in an information age, other workers are more likely to experience unemployment. Given the current industrial and occupational composition of the U.S. economy coupled with trade and technological influences, the traditional face of unemployment may be changing and this could affect the educational distribution of unemployment. By studying changes in the fortunes of individual industries, we may begin to develop a better understanding of changes in the composition of unemployment. This potential “democratization of unemployment” – a disregard for the educational class of the worker with respect to the unemployment rate – is the focus of this research.

In summary, the intent of the following research is to describe the possible changing face of unemployment, explain the generating factors of unemployment, and then forecast future economic scenarios to see if these changes in unemployment will continue. In doing so, Chapter 2 provides a review of the literature pertaining to the historical relationship of unemployment and education, the evolution of the generating factors of unemployment, and the forces that influence these generating factors. Chapter 3 outlines three hypotheses that are designed to confirm or contest changes in the profile of the unemployed, confirm or contest that industries have varying educational distributions, as well as confirm or contest whether or not the apparent change is permanent or a passing anomaly. Chapter 4 describes in detail how these hypotheses are tested while Chapter 5 contains the results of the tests. Finally, I discuss the

implications of the findings for public policy as well as conclusions and future considerations for research in the field of labor market policy and workforce development.

Chapter 2 – Review of Literature

To begin this study of changes in the education distribution of unemployment, this chapter provides a general overview of the research relevant to unemployed workers. I will review the relevant literature using a historical approach. In order to frame the issues, I will use the economics literature to outline business cycles, market forces, types of unemployment, and industrial composition. I will draw on labor market literature to profile employed and unemployed workers, occupational composition by industry, and the educational requirements by occupation. Finally, I will also use public policy literature to discuss what has been done or could be done to address problems pertaining to unemployment.

Education and unemployment in the United States have historically had a close relationship. Workers with less education experienced more unemployment compared to workers with more education. As a result, the historical expectation has been that higher levels of education translate into job security and insulation from unemployment (Mishel, Bernstein, & Boushey, 2005). In order to probe further into the historical relationship between unemployment and education, the ensuing analysis will be divided into four time periods: pre-1900, 1900 to 1939, 1940 to 1979, and 1980 to present. This historical analysis will use market shocks, industrial composition, occupational composition, and educational composition of the time period discussed to frame the relationship between unemployment and education.

Pre-1900

The Industrial Revolution in the United States ran from approximately 1820 to 1870. Prior to this time, the United States was predominately an agrarian economy. In 1790 approximately 90 percent of the United States labor force were farmers (total population was 3,929,214), with the remaining 10 percent in such occupations as carpenters and blacksmiths (USDA, 2007). Formal education played only a small role in the 19th century economy of the United States (Reese, 2005).

The percentage of the United States labor force engaged in farming declined throughout the 19th century. By the end of the Industrial Revolution in 1870, farmers represented 53 percent of the labor force and by the turn of the 20th century, they represented only 38 percent of the labor force (USDA, 2007). Although significant attention will be paid to contemporary occupational distributions in the United States later in this literature review, it is worth mentioning at this point that by 1990 farmers represented only 2.6 percent of the United States labor force (USDA, 2007).

Table 2.1

Percentage of Workforce, Farmers 1970 to 1990

Year	Total U.S. Population	Farm Population	% Workforce, Farmers
1790	3,929,214	3,536,293	90%
1870	38,558,371	18,373,000	53%
1900	75,994,266	29,414,000	38%
1990	261,423,000	2,987,552	2.6%

Source: USDA, 2007

The economic shift toward and then away from agriculture as the overwhelming product of early America is reflected by the rise and fall in the percentage of exports represented

by agricultural products. United States agricultural exports as a percentage of total exports peaked between 1810 and 1819 at approximately 87 percent and valued at $40 million per year. Since this peak, the relative percentage of agricultural exports has almost monotonically declined (USDA, 2007).

Table 2.2

Value and Percentage of Agricultural Exports

Year	Total Annual Value of Agricultural Exports	% of Total Exports
1790	$4,000,000	44%
1870	$453,000,000	79%
1900	$917,000,000	58%
1990	$35,600,000,000	15%

Source: USDA, 2007

During the Industrial Revolution there were massive migrations from farms to cities and a push from an agricultural-based economy to a manufacturing-based economy. Despite these mass migrations, the years from 1889 to 1919 were still considered a time of relative farm prosperity (USDA, 2007). Nowhere in the United States was this shift more pronounced nor better documented than in Massachusetts.

Founded in 1869 as the Massachusetts Bureau of Labor Statistics - 15 years before the forerunner of the federal Department of Labor - the Massachusetts Department of Labor is the oldest labor agency in the United States (Massachusetts DOL, 2007). As a result, data about the incidence and distribution of unemployment prior to 1930 are more abundant for the Commonwealth of Massachusetts than for any other state in the United States (Keyssar, 1986). From these data, we know that the share of the Massachusetts labor force engaged in farming plummeted by nearly 60 percentage points to

approximately 13 percent between 1820 and 1870. By the end of this same period, almost half of the labor force was working in the manufacturing sector (Keyssar, 1986). This represented an enormous shift in both the industrial and occupational composition of Massachusetts. The same was happening in the national economy.

A small proportion of the population at this time attended primary or secondary school with an even smaller proportion attending college (Reese, 2005). Although schools existed in the United States since colonial times, the form and focus of schools – and more importantly the approach to education in general – would change significantly. Prior to the 1900's schools were only one of the four primary institutions that were responsible for the education of the young. The others were the family, the church, and apprenticeships. Free, public education was not widely available until the 1870s and even then issues of race, gender, geography, and class greatly influenced access. For most of American history up to this point and for previous centuries in Europe, either learning the family trade or entering apprenticeship was the most common way for young males (at the time, apprenticeships were almost exclusively for boys) to learn a vocation and subsequently join the labor force (Reese, 2005). The building of textile mills in New England in the decades following the American Revolution signaled the early stages of mechanization and the introduction of the factory system. Skilled craftsmen were increasingly replaced by machines that routinized tasks and increased the demand for less skilled workers. Long-standing occupations such as handcrafted shoemaking largely disappeared leading to the disappearance of corresponding apprenticeships (Reese, 2005).

Table 2.3 is taken from the Twelfth Census of the United States (1900), Census Reports Volume VII – Manufactures – Part I. The row “Number of establishments” refers to the estimated number of manufacturers in the United States during a given decade, starting with 123,025 in 1850 and ending with 512,339 by 1900 – a more than four fold increase. Along with the significant increase in the number of establishments was a powerful surge in the number of wage-earners employed in manufacturing. In 1850 the average number of wage earners employed in manufacturing was 957,059. By 1900, the number had ballooned to 5,316,802 – an almost six-fold increase.

Table 2.3

Number of Manufacturers in the U.S. in 1900

TABLE I.—COMPARATIVE SUMMARY, 1850 TO 1900, WITH PER CENT OF INCREASE FOR EACH DECADE.

	DATE OF CENSUS.						PER CENT OF INCREASE.				
	1900[1]	1890	1880	1870	1860	1850	1890 to 1900	1880 to 1890	1870 to 1880	1860 to 1870	1850 to 1860
Number of establishments	512,339	355,415	253,852	252,148	140,433	123,025	44.2	40.0	0.7	79.6	14.1
Capital	$9,835,086,909	$6,525,156,486	$2,790,272,606	$2,118,208,769	$1,009,855,715	$533,245,351	50.7	133.9	31.7	109.8	89.4
Salaried officials, clerks, etc. number	397,174	[2]461,009	(3)	(3)	(3)	(3)	[4]13.8	.....	.....	.....	.....
Salaries	$404,230,274	[2]$391,988,208	(3)	(3)	(3)	(3)	3.1	.....	.....	.....	.....
Wage-earners, average number	5,316,802	4,251,613	2,732,595	2,053,996	1,311,246	957,059	25.1	55.6	33.0	56.6	37.0
Total wages	$2,328,691,254	$1,891,228,321	$947,953,795	$775,584,343	$378,878,966	$236,755,464	23.1	99.5	22.2	104.7	60.0
Men, 16 years and over	4,110,610	3,327,042	2,019,035	1,615,598	1,040,849	731,187	23.7	64.8	25.0	55.3	42.3
Wages	$2,021,349,508	$1,659,224,483	(3)	(3)	(3)	(3)	21.8	.....	.....	.....	.....
Women, 16 years and over	1,031,609	808,683	531,030	323,770	270,897	225,922	28.4	51.2	64.2	19.5	19.9
Wages	$281,680,054	$215,367,970	(3)	(3)	(3)	(3)	30.8	.....	.....	.....	.....
Children, under 16 years	168,583	120,885	181,921	114,628	(3)	(3)	39.5	[4]33.6	58.7	.....	.....
Wages	$25,661,692	$16,625,862	(3)	(3)	(3)	(3)	54.3	.....	.....	.....	.....
Miscellaneous expenses	$1,028,035,611	$631,225,035	(5)	(5)	(5)	(5)	62.9	.....	.....	.....	.....
Cost of materials used	$7,848,144,755	$5,162,044,076	$3,396,828,549	$2,488,427,242	$1,031,605,092	$555,123,822	42.3	52.0	36.5	141.2	85.8
Value of products, including custom work and repairing	$13,014,287,498	$9,372,437,283	$5,369,579,191	$4,232,325,442	$1,885,861,676	$1,019,106,616	38.9	74.5	26.9	124.4	85.1

[1] Includes, for comparative purposes, 85 governmental establishments in the District of Columbia having products valued at $9,887,355, the statistics of such establishments for 1890 not being separable. (See Report on Manufactures, Part II, page 120.)
[2] Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this table. (See general Table 3, page 59.)
[3] Not reported separately.
[4] Decrease.
[5] Not reported.

Source: Twelfth Census (1900) Report Volume VII – Manufactures - Part I

Even in the early days of the industrialization of the United States, there was already evidence of differences in unemployment rates by educational attainment. In 1878 the Massachusetts Bureau of Labor Statistics began to track overall unemployment rates as

well as unemployment rates by occupation (Keyssar, 1986). The Bureau used the police or assessors in each community to investigate local conditions by producing an inventory of all able-bodied, jobless workers over eighteen and actively seeking employment. Contrary to other surveys of the time, not all able-bodied people were included in the survey. Jobless men who appeared insufficiently eager to find work were not counted as unemployed. People included were only those experiencing “forced idleness” who were unable to find jobs because of the condition of the economy, but who were seeking or were in want of employment. Also omitted from the count were the thousands of children and young teenagers who normally worked in the local industries (Keyssar, 1986).

Unemployment rates by educational attainment, however, were not specifically tracked. But if we assume today’s educational requirements for similar occupations, one might roughly infer the unemployment distribution by educational attainment in the late 19th century Massachusetts economy. Table 2.4 outlines the occupations with the five lowest and five highest rates of unemployment in Massachusetts in 1890 as reported by the Massachusetts Bureau of Labor Statistics (Keyssar, 1986) along with the 2007 median reported educational attainment for those, or similar, occupations by the Occupational Information Network (O*NET). The O*NET system is an online database and set of tools developed by the U.S. Department of Labor with continually updated information on job-skill requirements, including education and occupational characteristics. The O*NET data provide the educational attainment distribution by occupation through the reported educational level attained by respondents to the Current

Population Survey (CPS). Conducted by the Bureau of the Census for the Bureau of Labor Statistics, the CPS is a monthly survey of approximately 50,000 households.

Table 2.4

High and Low Unemployment Rates in Massachusetts, 1890

1890 Occupation	1890 Annual Unemployment Rate	2007 O*NET Median Educational Attainment
Physicians and surgeons	0.30%	Bachelor's degree or higher
Lawyers	0.30%	Bachelor's degree or higher
Clergymen	0.70%	Bachelor's degree or higher
Bankers and brokers	0.80%	Bachelor's degree or higher
Publishers	1.00%	Bachelor's degree or higher
Dye works operators	11.70%	High school or less
Shovel makers	12.00%	High school or less
Shoe makers and repairers	12.10%	High school or less
Masons	13.00%	High school or less
Brick makers and potters	13.80%	High school or less

Source: Keyssar, 1986

The educational requirements for these occupations have certainly changed over the last 100 years; however, the educational requirements in relative terms are arguably comparable between 1890 and today. As will be discussed later, this noticeable disparity in unemployment rates by educational attainment will continue throughout the remainder of the twentieth century.

1900 to 1939

It was not until the twentieth century that unemployment became a dominant economic and political issue in the United States (Vedder & Gallaway, 1997). Nineteenth-century America was more concerned with such economic and political issues as inflation and

deflation, tariffs and taxes, slavery, the disposition of public lands, central banking, and the regulation of monopolies (Vedder & Gallaway, 1997). Neither the concept nor the term “unemployment” was in broad use until the early 1900’s. Joblessness had certainly existed, but it had been perceived in a significantly different way (Sautter, 1991). It was believed that joblessness was a function of personal character, rather than economic conditions (Sautter, 1991). It was assumed that work was available to those who looked for it and that idleness of employable persons was the result of ones own self-doing (Sautter, 1991).

The early 1900’s saw a change in how society perceived unemployment and the role of government in ameliorating its effects. Governmental behavior toward joblessness at this time was initially guided by laissez-faire tenets, but the increasing industrialization of the economy and its associated cycles of mass unemployment during economic downturns began to exert pressure on the status quo. While the subject was practically absent from previous political debates, unemployment became one of the most important issues in the 1932 presidential campaign and rising public concern over unemployment forced political action to address the unemployment problem (Vedder & Gallaway, 1997).

The year 1929 saw one of the most severe drops in the United States stock market. From August 1929 to June 1932 the Dow Jones industrial average went from 374 down to 45 – shedding approximately 88 percent of its value. This crash followed a speculative boom that had taken hold in the late 1920s, which had led millions of Americans to invest heavily in the stock market, many of them borrowing on margin. The wake of this market shock resulted in America’s Great Depression, which lasted from 1929 to 1941

and had a profound impact on the nation's perception of unemployment. Prior to the Wall Street crash, the general public did not treat unemployment with any sense of urgency. In the wake of the crash, however, both awareness and a sense of urgency increased dramatically (Sautter, 1991).

The first national accounting of unemployment was not conducted until 1930 in conjunction with the decennial census that year. William M. Steuart, the Director of the Census at the time, said "the results of the unemployment census will furnish a picture of the unemployment situation as indicated not only by the number of unemployed but by the attendant circumstance of unemployment. It will bring the answer to certain fundamental questions about which nothing definite is known at present. Obviously, something more than a mere knowledge of the number of persons out of work is needed, if we are to measure fairly and accurately, without exaggeration and without understatement, the gravity of the unemployment situation. We need the census to know the facts (U.S. Census Bureau, 2007)."

The unemployed were grouped into two classes of "gainful workers," which in census usage at the time included all persons 10 years old and over, who usually follow some form of occupation. "Class A" were gainful workers who were out of a job, able to work, and looking for a job while "Class B" had jobs, but on lay-off without pay, excluding those sick or voluntarily idle. The unemployment census provided data concerning the number of unemployed workers by gender, age, marital status, length of unemployment, and the leading reasons for unemployment. Data were published for the nation as a whole as

well as individual segments of the population by age, race, marital status, nativity, etc (U.S. Census Bureau, 2007).

Existing unemployment data may be used to gain a glimpse of the aftermath of the 1929 stock market crash. Unemployment estimates for 1929 averaged 1.5 million workers. By 1932 this estimate increased to approximately 12 million workers, which represented 24 percent of the civilian labor force (Sautter, 1991). The number of employees on nonagricultural payrolls fell from 31.3 millions in 1929 to 23.6 million in 1932. The impact across industries varied, with the construction, mining, and heavy industry sectors hit the hardest. The construction industry, for example, experienced a production decline of more than 70 percent from its peak in the 1920s to the trough of the depression. In 1932 only 34 percent of the entire industry's workforce was estimated to have been employed (Sautter, 1991). Table 2.5 was created using 1930 census data and illustrates the unemployment levels and rates in 1930 by industry.

Table 2.5

U.S. Unemployment Rates by Industry, 1930

Industry Group	Total Gainful Workers	Total Percent Unemployed
Agriculture	10,482,323	1.4%
Forestry and fishing	270,125	10.4%
Extraction of minerals	1,158,064	16.3%
Coal mines	691,507	20.2%
Manufacturing and mechanical industries	14,317,535	10.7%
Construction	2,561,541	19.0%
Automotive	897,907	11.6%
Iron and steel	2,385,066	9.4%
Textile	1,187,431	11.5%
Transportation	4,438,605	6.4%
Trade	7,537,026	3.9%
Public service	1,057,904	2.8%
Professional service	3,425,844	2.8%
Domestic and personal service	4,812,098	5.1%
Industry not specified	1,333,065	25.9%

Source: Sautter, 1991

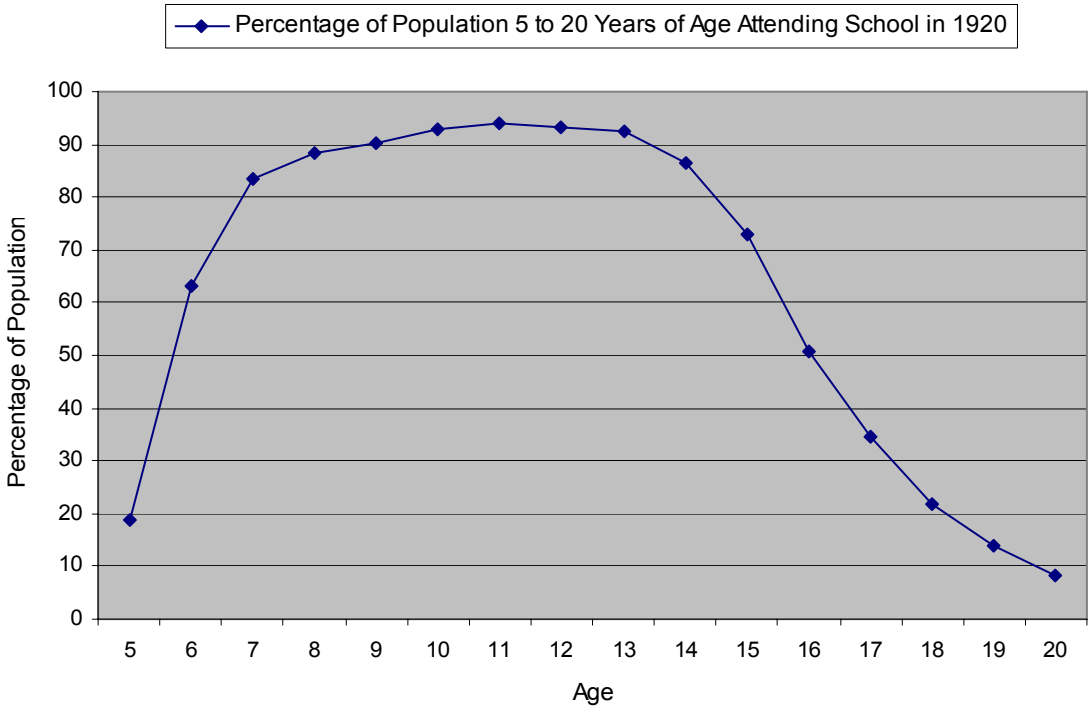
The construction sector and professional services sector had comparably sized labor forces yet experienced markedly different rates of unemployment. The construction sector experienced 19 percent total unemployment while the professional services sector experienced only 2.8 percent total unemployment.

During this time, the educational attainment of the labor force was still relatively low. It was not until 1918 that every state required students to complete elementary school. Comprehensive data on the educational attainment of the labor force during this time is generally lacking. However, as part of the Fourteenth Census a detailed accounting of school participation rates was collected. The proportion of all “school age” persons (5 to 20 years of age) attending school in 1910 was 59.2 percent. This proportion increased to

64.3 percent in 1920 – a 5.1 percentage point increase. Important insight is gained by further detailing the school participation rate by age group. Figure 2.1 was reproduced from a graph provided in the Fourteenth Census School Attendance report.

Figure 2.1

Percentage of Population Attending School, 1920



Source: Fourteenth Census School Attendance Report, 1924

Several observations are immediately obvious. School participation rates climbed rapidly between five and seven years of age, but peak at age eleven at 93.9 percent. After age eleven, participation rates slowly taper off until age fourteen when the participation rate begins to decline rapidly. It was hypothesized in the 1920 Census report that by age fourteen children had either “lost interest” in school and preferred to seek gainful employment or were encouraged to begin working due to family financial necessity (U.S.

Census Bureau, 1924). With participation rates below 80 percent for ages less than seven and greater than fourteen, the vast majority of the population was only completing the equivalent of elementary and middle school. Although participation rates were similar between genders, significant discrepancies remained based on geography, race, and class.

Although participation rates in college were, not surprisingly, much lower than that of elementary and secondary schools, the rate of participation was also increasing rapidly. The early 1900's saw a wave of public and private investment in the building and expansion of colleges and universities (Thelin, 2004). These investments signaled a transition in access to American higher education from being an opportunity for the socioeconomic elite to an opportunity for the general public. Between World War I and World War II the enrollment in colleges and universities increased more than fivefold from 250,000 to 1.3 million. In 1917 fewer than 5 percent of Americans between the ages of eighteen and twenty attended college. By 1937 this figure had increased to 15 percent (Thelin, 2004).

Unemployment rates by educational attainment at this time were still not specifically tracked. Again assuming today's educational requirements for similar occupations, one might roughly infer the unemployment distribution by educational attainment in the 1930's. Table 2.6 uses data available from the 1930 census to outline selected occupations from two industries (construction and extraction of minerals) that were severely affected by the market shock and subsequent depression as well as two industries (professional services and trade) that were not as severely affected. The

boom in the stock market and in real estate, along with the expansion in credit and high profits for a few industries, concealed basic problems. Technology had eliminated more industrial jobs than it had created and the supply of goods continued to exceed demand. Median educational attainment data for the occupations are based on 2007 O*NET data reported by the same or comparable occupations. Although educational attainment levels in 2007 are undoubtedly higher than in 1930, one might infer relative educational attainment differences between the occupations.

Table 2.6

Occupational Unemployment Rate, 1930

1930 Industry	1930 Occupation	1930 Total Gainful Workers	1930 Total Percentage Unemployed	2007 O*NET Median Educational Attainment
Professional Services	College professors and presidents	61,905	0.3%	Bachelor's degree or higher
Trade	Bankers, brokers, money lenders	221,504	1.3%	Bachelor's degree or higher
Trade	Insurance agents and officials	286,235	1.5%	Bachelor's degree or higher
Professional Services	Teachers	1,062,615	1.6%	Bachelor's degree or higher
Professional Services	Authors, editors, reporters	64,293	2.0%	Bachelor's degree or higher
Trade	Real estate agents and officials	240,030	2.2%	Bachelor's degree or higher
Professional Services	Chemists, assayers, metallurgists	47,068	2.9%	Bachelor's degree or higher
Professional Services	Technical engineers	226,249	3.6%	Bachelor's degree or higher
Professional Services	Trained nurses	294,189	4.2%	Bachelor's degree or higher
Professional Services	Designers, draftsmen, inventors	102,730	4.6%	Bachelor's degree or higher
Extraction of minerals	Copper mine operatives	30,939	13.5%	High school or less
Extraction of minerals	Oil and gas well operatives	105,224	15.2%	High school or less
Construction	Plumbers and fitters	237,814	15.7%	High school or less
Construction	Building industry operatives	18,433	17.9%	High school or less
Construction	Carpenters	929,426	18.9%	High school or less
Extraction of minerals	Coal mine operatives	621,661	21.5%	High school or less
Construction	Roofers and slaters	23,636	21.7%	High school or less
Construction	Building construction laborers	419,802	24.1%	High school or less
Construction	Brick and stone masons	170,903	26.2%	High school or less
Construction	Plasterers	70,053	28.0%	High school or less

Source: Fifteenth U.S. Census Unemployment Report, 1931

The average unemployment rate for the combined professional services and trade occupations was 2.4 percent while the average unemployment rate for the combined construction and extraction of minerals occupations was 20.3 percent. A clear distinction is evident between the unemployment rates of the occupations with higher levels of

educational attainment versus the occupations with lower level of educational attainment. As previously stated, the educational requirements for these occupations have certainly changed over the years. However, the educational requirements in relative terms are arguably comparable between 1930 and today. This noticeable disparity in unemployment rates by educational attainment will continue throughout the remainder of the twentieth century and is further substantiated by increasingly more comprehensive and rigorous data.

1940 to 1979

There are two reasons I have chosen to divide the World War II era and subsequent decades into 1940 to 1979 and 1980 to present. The first reason is that starting in 1976 the BLS started specifically tracking unemployment rates by educational attainment. Therefore, the data available to adequately research the subject really begins at this time. Second, the first complete business cycle covered by this data begins in January 1980.

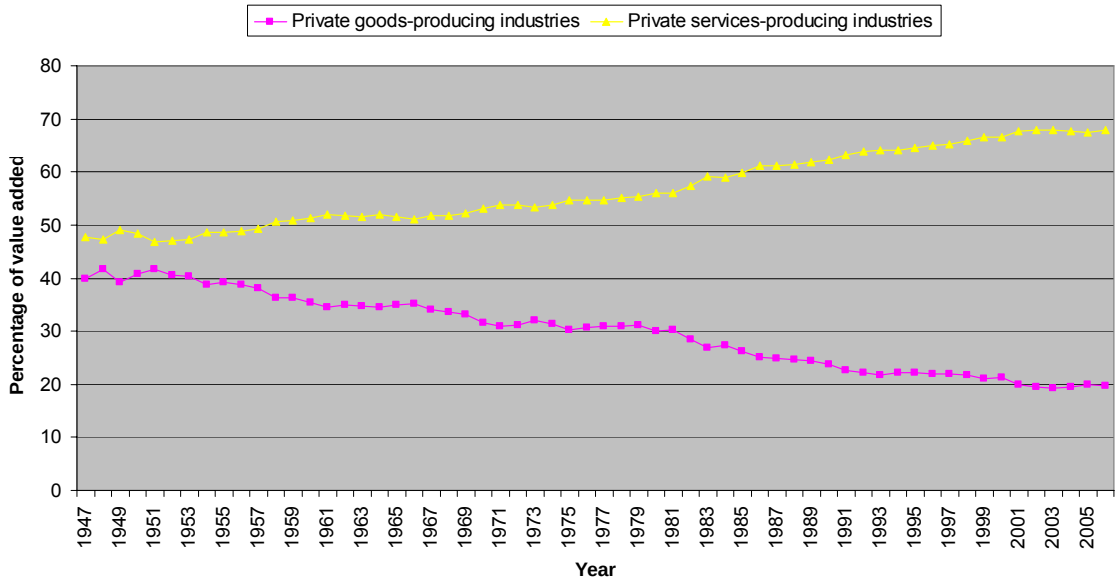
The onset of World War II was a significant event in terms of its political and economic implications. The industrial demands of World War II pulled the United States out of its protracted depression resulting in significant declines in the unemployment rate and positioned the United States for several decades of industrial growth. The United States emerged from World War II with the strongest national economy and military in the world as well as the foremost lender and creditor to former allies and enemies (Bluestone & Harrison, 1982). From 1946 to 1971 United States corporations dominated the global economy. After its peak in 1971, however, the subsequent quarter century saw a decline

in the American share of world trade (Bluestone & Harrison, 1982). This rise and fall of economic dominance was accompanied by an ever changing industrial and occupational composition in the economy, an increasingly educated labor force, and better means through which to track and account for these changes.

After World War II, in 1951, domestic goods-producing industries peaked when as a whole they generated 41.7 percent of gross domestic product. Since that time, the value added by manufacturing as a percentage of gross domestic product has steadily declined with the largest increases in value-added attributed to services-producing industries. Using data from the United States Bureau of Economic Analysis (BEA), Figure 2.2 below plots the growing shift in industrial composition between 1947 (earliest data available) and 2006.

Figure 2.2

Percent Share of Value Added by Industry Group, 1947 to 2006



Source: BEA Gross-Domestic-Product-by-Industry Accounts, 2008

To better understand the particular changes in the industrial composition between World War II and 1980, Table 2.7 illustrates the percentage point change in value added for selected industry sectors as a percentage of gross domestic product between 1947 and 1980.

Table 2.7

Change in Value Added by Industry, 1947 to 1980

Value Added by Industry as a Percentage of Gross Domestic Product	1947	1980	Percentage point change in value added
Manufacturing	25.6	20	-5.6
Transportation and warehousing	6	3.7	-2.3
Retail trade	9.4	7.2	-2.2
Arts, entertainment, recreation, accommodation, and food services	3.2	3	-0.2
Wholesale trade	6.3	6.8	0.5
Utilities	1.4	2.2	0.8
Mining	2.3	3.3	1.0
Construction	3.7	4.7	1.0
Information	2.5	3.5	1.0
Professional and business services	3.7	6.7	3.0
Educational services, health care, and social assistance	1.9	5	3.1
Finance, insurance, real estate, rental, and leasing	10.4	15.9	5.5

Source: BEA Gross-Domestic-Product-by-Industry Accounts, 2008

During this time manufacturing experienced the largest decline in share of GDP. The financial, educational, health care, and professional services sectors saw the largest increases. Employment level changes followed from changes in industrial composition. In other words, industries that had a declining percent share of GDP also had either declining or slower growth in employment levels while industries that had an increasing share of GDP also had either increasing or faster growth in employment levels. This evolution was greatly accelerated in October 1973 when the United States experienced a market shock commonly known as the 1973 Oil Crisis.

Although a number of factors lead up to this event, this market shock was finally triggered when the members of the Organization of Petroleum Exporting Countries announced, because of the ongoing Yom Kippur War, that they would no longer ship petroleum to nations that supported Israel in its conflict with Syria and Egypt (Margonelli, 2008). This market shock subsequently drove the United States into a recession where employment levels peaked at 64.4 million workers in June of 1974 and bottomed out in

April of 1975 at 61.7 million workers, a loss of approximately 2.7 million jobs. Using Current Employment Statistics (CES) data, Table 2.8 details the employment level changes by sector from the employment level peak to the employment level trough during this recession. Conducted by the Bureau of Labor Statistics, the CES data provide total employment level by industry from 1939 to the present.

Table 2.8

Employment Level Change by Sector, 1974 to 1975

Sector	Employment Level Change, Thousands	Change as Percentage of 1974 Employment
Mining	44.8	6.7%
Construction	-581	-14.0%
Manufacturing	-1931	-10.3%
Wholesale trade	-41.9	-1.10%
Retail trade	-51.2	-0.60%
Transportation	-139.3	-5.00%
Utilities	-4.5	-0.80%
Information	-118	-5.40%
Financial	-3	-0.10%
Professional services	-10	-0.20%
Education, Health	114	2.10%
Leisure and Hospitality	-1	0.00%

Source: BLS CES data, 2007

The two industries that experienced the largest change as a percentage of employment were construction (14 percent) and manufacturing (10.3 percent). Manufacturing along was responsible for 1.9 million of 2.8 million job losses. When combining manufacturing, construction, and transportation, the three industries were responsible for 92 percent of all employment losses. All three of these industries tend to have occupations typically held by workers with lower levels of educational attainment. The two sectors to experience employment growth during this recession were the mining sector (6.7 percent) and the education and health sector (2.1 percent). The reason for

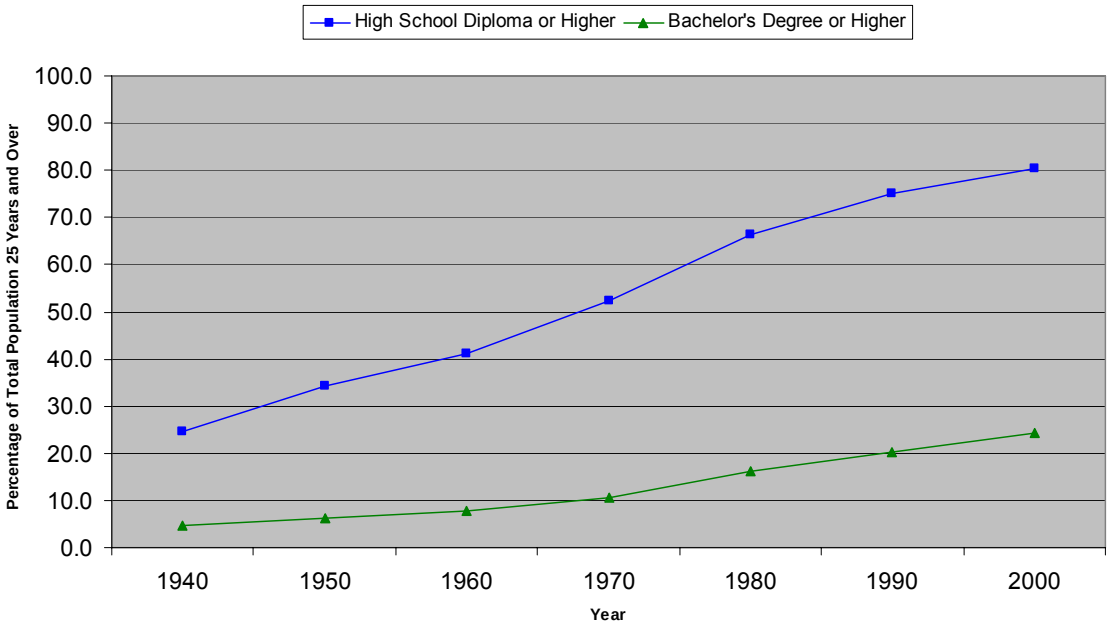
employment growth in the mining sector is due to the fact that the United States responded to the external oil supply restrictions by bolstering domestic production capabilities. During this time, the oil and gas extraction industry alone increased employment levels by 7.6 percent.

Detailed data tracking unemployment by educational attainment during this time was limited. However, beginning in the 1940's there were many changes and advances beginning to take place in the collection of labor market and demographic data. In 1940 the federal government began to measure the unemployment rate by conducting a monthly survey of sample households (the Current Population Survey). Specific criteria were established to distinguish unemployed workers from people who were either "employed" or "not in the labor force (Keyssar, 1986)." Demographic information also began to improve at this time with the collection of educational attainment estimates of the American population.

The systematic collection of information on the educational attainment of the United States population as a whole began in 1940 with that year's decennial census. Educational attainment data were collected for every person enumerated in the 1940 census and on a sample basis thereafter (U.S. Census Bureau, 2007). These data from the U.S. Census Bureau were used to create Figure 2.3 which depicts the educational attainment of men and woman in the United States population age 25 and over between the years 1940 and 2000.

Figure 2.3

Educational Attainment of U.S. Population, 1940 to 2000



Source: U.S. Census Bureau, 2007

The obvious trend in the educational attainment of the United States population has been steadily increasing. In the 1940's a little less than 80 percent of the adult population did not have a high school diploma, whereas by 2000 this statistic became reversed, when just over 80 percent of the population had earned a high school diploma. Additionally, the percentage point increase in the attainment of high school diplomas (56 percentage points) proportionally outpaced the increase in the attainment of Bachelor's degrees (20 percentage points).

Translating the educational attainment gains from 1940 to 1980 into industry-specific educational attainments is at best an imprecise exercise. Using a combination of data from the Bureau of Labor Statistics, however, one might begin to infer the educational

attainment of a particular industry and the subsequent impact on the change in employment levels by educational attainment. Conducted by the Bureau of Labor Statistics, the Occupational Employment Statistics (OES) program produces employment and wage estimates for over 800 occupations. These are estimates of the number of people employed in certain occupations, and estimates of the wages paid to them. Using OES data to estimate employment levels of a given occupation by industry and O*NET data to estimate educational attainment by occupation, Table 2.9 provides a rough estimate of educational attainment by industry.

Table 2.9

Proportion of Industry Workforce by Estimated Educational Attainment, 1980

Industry	High school or less	Some college	Bachelor's or higher
Construction	65%	24%	11%
Leisure, Hospitality	61%	24%	14%
Transportation	51%	32%	17%
Mining	56%	26%	18%
Manufacturing	54%	28%	19%
Utilities	44%	31%	24%
Wholesale trade	42%	31%	27%
Retail trade	38%	30%	32%
Financial	31%	34%	35%
Information	32%	30%	38%
Professional services	25%	30%	44%
Education, Health	24%	26%	50%

Source: Author's calculations using OES data

This distribution provides a hypothetical starting point to estimate the impact on the change in employment levels by educational attainment. It is true, however, that the concentration of occupations has changed between 1970 and 2004, and that the educational requirements of certain occupations have changed, and it is also true that

the overall educational attainment of the population has increased during that time. With that said, it is arguable that the relative educational attainment of occupations and industries is similar enough to make a meaningful comparison. For example, in the 1970's most college professors, physicians, lawyers, and scientists still had high concentrations of workers with a Bachelor's degree or more education while brick masons, truck drivers, mine cutters, waiters, and utility field technicians did not.

In order to grossly interpret what the increases in the educational attainment of the population meant to specific industries, I will combine the previous CES, OES, and O*NET data to estimate changes in employment levels by educational attainment following the 1973 Oil Crisis. In making these comparisons, I divided twelve industries into two groups, the first group representing the six industries with the lowest overall educational attainment (the "lower-half") and the second group representing the six industries with the highest overall educational attainment (the "upper-half"). Table 2.10 illustrates the results.

Table 2.10

Estimated Impact of 1973 Oil Shock on Employment Levels by Industry Educational Attainment, from 1973 to 1974

Industry	High school or less	Some college	Bachelor's degree or higher	Employment Level Change, Thousands	Change as Percent of 1974 Level
Upper Half					
Education, Health	24%	26%	50%	114	2.1%
Professional services	25%	30%	44%	-10	-0.2%
Information	32%	30%	38%	-118	-5.4%
Financial	31%	34%	35%	-3	-0.1%
Retail trade	38%	30%	32%	-51.2	-0.6%
Wholesale trade	42%	31%	27%	-41.9	-1.1%
Upper Half Industry Average	**32%**	**30%**	**38%**	**-18**	**-0.9%**
Lower Half					
Utilities	44%	31%	24%	-4.5	-0.8%
Manufacturing	54%	28%	19%	-1931	-10.3%
Mining	56%	26%	18%	44.8	4.0%
Transportation	51%	32%	17%	-139.3	-5.0%
Leisure, Hospitality	61%	24%	14%	-1	0.0%
Construction	65%	24%	11%	-581	-14.0%
Lower Half Industry Average	**55%**	**28%**	**17%**	**-435**	**-4.4%**

Source: Author's calculations using CES, OES, and O*NET data

The industries in the upper-half educational group have more than twice the concentration of workers with a Bachelor's degree or higher. The average percentage loss of jobs in the lower-half educational group is approximately 5 times larger than the number of jobs lost in the upper half educational group. More importantly, the industries in the lower half of the educational attainment lost close to 2.9 million jobs, approximately 92 percent of all the job losses. Furthermore, the vast majority of these job losses were concentrated in just three sectors: manufacturing, construction, and transportation.

Other researchers have found similar results (Woirol, 1996; Mishel, Bernstein, & Boushey, 2005) which substantiate the assertion that less educated workers have historically experienced higher levels of unemployment relative to workers with higher levels of education. During the early 1960's popular concerns were growing about

increased unemployment due to automation and the employment effects of new technology (Woirol, 1996). Training, retraining, and worker education programs gained popularity during this time as evidenced by the 1962 Manpower Development and Training Act (MDTA) and its mandate for a Manpower Report of the President to supplement the Economic Report of the President (Woirol, 1996). The economist Charles Killingsworth suggested in January and March 1962 papers that automation was significantly affecting the structure of demand for labor in the United States (Woirol, 1996).

Killingsworth's hypothesis was based on three points: (1) that automation was different from past technological change, (2) that the major effect of automation was to shift demand for labor rapidly away from low-level skills to higher levels of education and skill, and (3) as a result of this "demand twist" effect of automation, public policy should put emphasis on structural measures over demand-stimulation policies (Woirol, 1996). The problem Killingsworth saw with this phenomenon was that due to the speed and broad sweep of change, labor supply could not adjust quickly enough to the new structure of labor demand and that those with the least amount of education were the most adversely effected by these shifts (Woirol, 1996).

To illustrate his point, Killingsworth performed a review of unemployment trends between 1950 to 1962 by educational attainment, age, and sex. His analysis encompassed three full business cycles: the July 1953 peak to May 1954 trough, the August 1957 peak to April 1958 trough, and the April 1960 peak to February 1961 trough. He used standard CPS data for analyzing unemployment trends by age and sex. For analyzing

unemployment trends by educational attainment, however, he found it necessary to use decennial Census of Population data that he adjusted to align with the corresponding CPS data (Woirol, 1996). What he found was that the aggregate unemployment levels were comparable between 1950 and 1962. However, between these two cycles, the unemployment rates went down for workers with higher levels of educational attainment while unemployment rates went up significantly for workers with lower levels of educational attainment (Woirol, 1996). More specifically, Killingsworth found that over the period of 1950 to 1962 practically all improvements in unemployment were enjoyed by workers with a college education, while the remainder of the workforce experienced significantly higher unemployment rates (Woirol, 1996). For example, he reported that between 1950 (near business cycle trough) and 1957 (August 1957 business cycle peak) college level unemployment had fallen 73 percent, while unemployment of those with eight years of education (e.g. less than a high school diploma) had fallen only 25 percent with the subsequent two business cycles seemingly erasing these gains for the workers with lower levels of education (Woirol, 1996). Killingsworth also found that changes in labor force participation rates exacerbated these differences due to the fact that the participation rates at the lower end of the educational scale declined while participation rates at the higher end of the educational scale went up (Woirol, 1996).

Killingsworth confirmed his findings with other studies of unemployment by educational attainment through the late 1960s (Woirol, 1996). As a result of this research, Killingsworth suggested that public policy must be more refined than simply increasing the aggregate demand for labor if policymakers hoped to address this unemployment problem (Woirol, 1996). In other words, although cutting taxes might be desirable in

some ways, it would only mildly ameliorate unemployment at the lower end of the educational attainment scale while creating a shortage of labor at the higher end of the educational scale. Killingsworth believed that automation and the changing pattern of consumer wants greatly increase the importance of investment in people as a factor in economic growth (Woirol, 1996).

Denis Johnston of the Bureau of Labor Statistics published similar results in the 1963 and 1965 *Monthly Labor Review* citing that he had found indications of a shift in demand from lower to higher educated workers (Woirol, 1996). In 1968 Johnston went on to retest Killingsworth "education-twist" hypothesis for the periods 1950 to 1960 and 1960 to 1967 (Woirol, 1996). Johnston used 1950 and 1960 Census data as well as Current Population Survey data from 1960 to 1967 on unemployment, education, and labor force participation by age, sex, and race (Woirol, 1996). He found that the 1950's was indeed a period of declining labor force participation among less educated men at all age levels (both white and non-white) while the rates for the most educated were rising – with the heaviest withdrawals among the least educated (Woirol, 1996). He also found evidence of Killingsworth's education-twist during this time period. During the 1960 to 1967 period, however, the results were less clear and could not be used to support Killingsworth's hypothesis (Woirol, 1996).

1980 to present

In reviewing the literature from 1980 to the present, this final period began with mounting evidence that education and the unemployment rate were inextricably linked. Ashenfelter and Ham (1979) reported that by the late 1970's it was common knowledge that

unemployment rates were inversely related to the educational attainment of workers. They cited as an example that in the 1970 U.S. census the unemployment rate of males without a high school degree was 5.3 percent, while males with a high school degree was 2.8 percent and males with more than a high school degree was 1.4 percent.

The 1970's and 1980's were times of substantial growth in the number of high school and college graduates in the labor force. This was due primarily to the entry of the "baby-boom generation into the labor force, whose educational levels were much higher than those of earlier generations. In the mid 1980's approximately one in four members of the labor force aged 25 to 64 had completed four or more years of college. This ratio represents twice the number of college graduates compared to the mid 1960's (Howe, 1988). During this same time, the proportion with one to three years of college had more than doubled to 20 percent. As a result, the proportion of the adult labor force with less than four years of high school dropped substantially (Howe, 1988).

The labor market's response to the rising educational level of an expanding labor force was a relative weakening of the labor market position for high school graduates, compared to those with higher levels of education. This weakened position was evident in the employment outcomes during business cycle fluctuations, which influenced the rate of unemployment for various educational groups of workers (Howe, 1988). High school graduates experienced a larger increase in their rate of unemployment during recessions and had only a slightly larger unemployment rate decrease during recovery periods. Although unemployment rose and fell during this time for all educational groups

over the course of the business cycle, the degree of cyclical movement was generally smaller for the higher educated groups (Howe, 1988).

The labor force share of college graduates between 1979 and 1987 rose by 4 percentage points to 25 percent of the total labor force. Despite this increase, they accounted for only 11 percent of the change in the unemployment rates during this time. In explaining why this might have happened, Howe (1988) suggested that the educational distribution of the workforce and occupational composition of the workforce were related. He suggested that the smaller share of unemployment for more educated workers was due to the growth in the number of managerial, professional, and technical jobs that required a college education.

The improved job market for college graduates between 1972 and 1987 was evidenced in the fact that occupations with comparatively high proportions of college graduates grew, while those with low ratios of college graduates generally declined. Among the major occupational groups, professionals, managers, and technicians have the highest proportion of their work force with college degrees. During this time, the proportion of all workers in these occupations increased by six percentage points to 28 percent of the total workforce. In contrast, the employment share of operators, fabricators, and laborers dropped by six percentage points to 15 percent. This latter occupational group has much lower concentrations of workers with college degrees.

Another important connection Howe (1988) highlighted was the relationship between occupational and industrial composition. One of the factors contributing to the increased

demand for college graduates was the considerable employment growth in the service-producing sector of the economy, which at the time employed more than 80 percent of all college graduates. Howe (1988) presumed that in addition to their greater knowledge and skills, another reason that college graduates are less vulnerable to business cycles expansions and contractions was that they worked in industries that were less susceptible to swings in business cycles. He cited that in March 1987 approximately 42 percent of all college graduates were employed in professional services. At the time, this industry was relatively unaffected by changes in the business cycle. He contrasted this to the fact that only 15 percent of all high school graduates were employed in the professional services industry. Furthermore, approximately 30 percent of high school graduates were employed in goods-producing industries, which were the most sensitive to business cycle fluctuations, while only 18 percent of college graduates were employed in these industries. Howe (1988) suggested that this competitive advantage held by college graduates would continue into the future and would be particularly important during downturns in the business cycle, when the unemployment rate differential between high school and college graduates typically increased.

Going into the twenty-first century, educational attainment continued to rise. Between 1976 and 2004, the percentage of the workforce who attended at least some college rose from 33 to 57 percent, with a corresponding drop in the share of individuals possessing a high school degree or less (Valletta and Hodges, 2005). The educational attainment of the workforce has continued to increase through the year 2007, again reflecting the rising share of individuals possessing a college degree and the declining share of individuals who lack a high school diploma (Daly, Jackson, & Valletta, 2007). As

the labor force becomes better educated, it would not be surprising to see the better-educated workers responsible for a larger share of rising unemployment. Taken to a hypothetical extreme, if all workers were college educated, all changes in the unemployment rate would be accounted for by these workers. Given that such a scenario is unlikely to happen, what, then are more probably unemployment outcomes?

Shortly after the recession in 2001 ended, researchers began noticing that workers with more education did not fare as well compared to previous recessions and that the differences in employment outcomes by educational attainment were shrinking. Schmitt (2004) reported that workers with a college degree had a 3.9 percent displacement rate compared to a 4.4 percent rate for workers with just a high school diploma. Displaced workers are defined as persons 20 years of age and older who lost or left jobs because their plant or company closed or moved, there was insufficient work for them to do, or their position or shift was abolished (BLS, 2008). Schmitt calculated the share of all displaced workers by educational attainment over two three-year periods (1991-1993 and 2001 to 2003) and noted that the share of displacement shifted towards workers with higher levels of educational attainment. Table 2.13 provides the results of Schmitt's calculations.

Table 2.13

Share of all displaced workers by educational attainment, comparison of 1991-1993 and 2001-2003.

Educational Attainment	1991-1993	2001-2003	Percentage point change in share of displacement
Less than high school	11.4	7.9	-3.5
High school	35.7	34.3	-1.4
Some college	30.3	29.2	-1.1
College	16.9	20.1	3.2
Advanced degree	5.7	8.5	2.8

Source: Schmitt, 2004

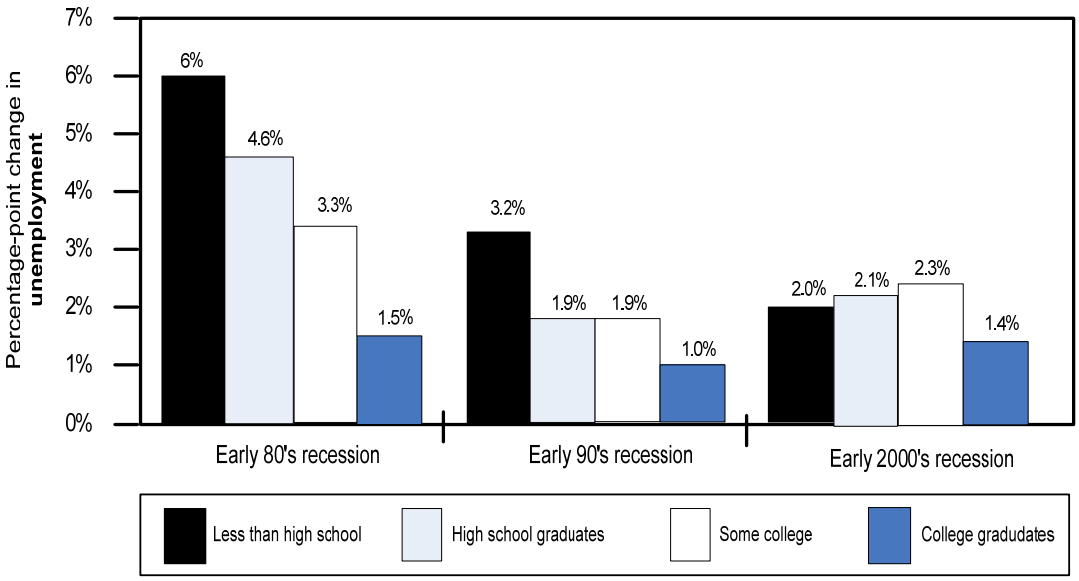
By combining the three categories of less educated workers (less than high school, high school, and some college) and combining the two categories of more educated workers (college and advanced degree), the less educated workers experienced a 6 percent decline in their share of displacement while the more educated workers experienced a corresponding 6 percent rise in their share of displacement. Although it is important to note that displacement and unemployment measurements are materially different, the displacement measurements provide another perspective on the employment outcomes of workers with different educational attainment levels during business cycles.

Turning back to unemployment rates by educational attainment, Daly, Jackson, and Valletta (2007) reported that the pattern of unemployment rates by educational attainment had been historically consistent, but during the recession in 2001 there was a noticeable leveling in the increase of unemployment across educational levels. Mishel, Bernstein, and Boushey (2005) provided a glaring example of how this historical relationship may have changed. The authors performed an analysis of BLS 2002 data by

calculating the percentage point change in unemployment rates by educational attainment over the course of the last three recessions. The authors defined their own data ranges for each of the recessions, which roughly correspond to the NBER business cycle dates. The early 1980's recession was defined as the first quarter of 1980 to first quarter of 1983, the early 1990's recession was defined as the second quarter of 1990 to the first quarter of 1993, and the early 2000's recession was defined as the fourth quarter of 2000 to the second quarter of 2002. They then calculated the percentage point change from the first quarter to the last quarter of the recession. Figure 2.4 below illustrates the percentage point change in unemployment level by educational status (Mishel, Bernstein, & Boushey, 2005).

Figure 2.4

Percentage point Change in Unemployment Rate by Educational Attainment



Source: Mishel, Bernstein, & Boushey, 2005

Over the course of the early 1980's recession, there was an obvious downward trend between the four groups. Workers with less than a high school education experienced the greatest increase in unemployment while each group with higher levels of educational attainment experienced progressively smaller increases in unemployment with workers earning a bachelors degree or higher experiencing the smallest increase. During the early 1990's recession there was a leveling of the downward trend between workers with high school diplomas and some college (including associate degrees) while there remained a sizable difference between workers with less than a high school education and workers with a bachelors degree and higher. The leveling across educational groups was most pronounced during the most recent recession. Workers with a high school diploma and some college experienced a higher percentage point increase in unemployment than did workers with no high school diploma and workers with a bachelors degree or higher.

Until recently, virtually all research suggested an inverse correlation between educational attainment and susceptibility to unemployment. The findings of Schmitt (2004), Mishel, Bernstein, and Boushey (2005), and Daly, Jackson, and Valletta (2007) are contrary to a substantial body of research purporting that workers with less education should not only experience greater levels of unemployment, but also greater increases in unemployment rates during recessions. This dynamic appears to be changing. The purpose of the following research is to explore this apparent change in attempts to ascertain if and why there was a change in the 2001 recession and then forecast what future education attainment distributions of the unemployment rate might look like.

Chapter 3 – Hypotheses

Has there really been a change in the education distribution dynamics of the unemployment rate? If there is a real difference, why has there been a change and will this change continue in future recessions? It is possible that the change in the educational attainment distribution seen in the 2001 recession will be a temporary anomaly. In other words, future educational attainment distributions of the unemployment rate would not resemble the 2001 distribution. Conversely, it is possible that extraneous variables will in the future again result in similar educational attainment distributions as seen in the 2001 recession. In other words, some thing or things are influencing the generating factors of unemployment.

In order to frame the hypotheses of this research, I will first model the chain of events that generate unemployment. The model entails four interrelated factors: external market shocks, the impact of each type of shock on given industries, the occupational composition of the industries affected, and the educational requirements of the occupation. In order to model the chain of events that generate unemployment, I will start by reviewing various economic shocks and their impact on various industries, explaining how a given market shock may effect one set of industries to a much greater extent than others. This will then lead to an analysis of the differences in occupational composition across different industries. Occupational composition data will provide input for a discussion of the educational differences among various occupations. The

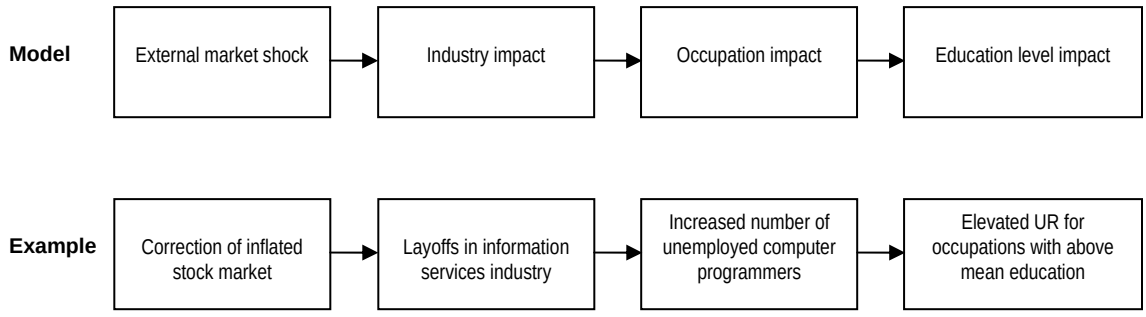
educational requirements of these occupations finally result in a discussion of the education distribution of unemployment.

An analysis of market shocks

To illustrate the relationship between these four concept areas, one might consider the following hypothetical example of an inflated stock market. A sharp drop in technology related stock will likely yield an increased number of displaced workers in the information services industries. The information services sector has a higher concentration of computer specialists, who, relative to the rest of the workforce, have an above-average educational level. Figure 3.1 illustrates the theoretical relationship:

Figure 3.1

Model of Unemployment Generating Factors



Source: Author

Market shocks may take many forms. Simply put, they are events that, in the case of supply shocks, increase or decrease output or, in the case of demand shocks, increase or decrease demand for goods or services. One can imagine a variety of shocks, perhaps to energy prices, such as the oil shock of 1973 and the 1979 energy crisis or financial market shocks such as Black Monday in 1987, the stock market downturn of

2001, and of course the current credit crisis. These events may have temporary, long-lasting, or even permanent affects on output or demand, and thus could have a different affects on the education distribution of unemployment. For example, the terrorist attack on 9/11 has resulted in a seemingly permanent change in the demand for security workers. According to O*NET (2008), only 12 percent of security guards report having a college degree, thus putting them in the lower end of the education attainment distribution of occupations. With increased demand for lower educated workers, the unemployment rate for less educated workers declines.

These various market shocks have varying affects on different industries. For example, an extremely cold winter with frequent frosts may adversely affect agricultural output, thereby increasing unemployment rates in the agricultural sector. On the other hand, this same winter may positively affect the energy sector, thereby decreasing unemployment rates at companies that benefit from high energy prices. As another example, the 2008 credit crisis adversely affected companies directly involved in credit markets such as large investment banks. As banks failed or were rescued by the federal government, significant consolidation took place thus generating sizable employment losses. Other credit-dependent industries such as real estate, automotive, and furniture manufacturers experienced significant losses in revenue as their customers were unable to obtain credit.

As industries add or shed jobs in response to market shocks, one may observe the concentrations of various occupations affected. The types of occupations affected are a function of industries affected (both directly and indirectly) because various industries

have different concentrations of occupations. To illustrate this point, consider the occupational concentrations of the mining sector and the information sector. According to the BLS, in May of 2005 construction-related occupations such as equipment operators and maintenance engineers represented more than 36 percent of all employment in the mining sector. During the same time period in the information sector, construction-related occupations represented only 0.11 percent of total employment. Table 3.1 provides a sample of these data by detailing specific jobs within the broad categories of mining occupations and information-related occupations.

Table 3.1

Occupational Composition of Two Industries

Mining	
Occupations	**Percent of employment**
Construction Equipment Operators	4.82%
Rotary Drill Operators	2.72%
Service Unit Operators	3.37%
Maintenance engineers	5.40%
Extraction Helpers	3.64%
Computer Software Engineers	0.16%
Editors	0.0%
Computer Support Specialists	0.11%
Customer Service Representatives	0.06%
Telecomm. Equipment Installers/Repairers	0.0%

Information	
Occupations	**Percent of employment**
Construction Equipment Operators	0.03%
Rotary Drill Operators	0.0%
Service Unit Operators	0.0%
Maintenance engineers	0.0%
Extraction Helpers	0.0%
Computer Software Engineers	4.68%
Editors	2.24%
Computer Support Specialists	2.12%
Customer Service Representatives	6.80%
Telecomm. Equipment Installers/Repairers	4.61%

Source: Author’s calculations using OES data

Occupations such as computer software engineer, editor, computer support specialist, customer service representative, and telecommunications equipment installer/repairer represent a relatively small percentage of the employment levels within the Mining sector, but a relatively large percentage of the employment levels in the Information sector.

Different occupations have different educational requirements. Brain surgeons obviously require more formal education than truck drivers. One might envision an educational continuum from low educational requirements to high educational requirements. As one adds more and more occupations to the educational continuum, however, it starts to become less obvious which occupations have higher educational requirements and which have lower educational requirements. Table 3.2 was constructed using data from the Department of Labor's Occupational Information Network (O*NET) to illustrate the educational attainment of the same 10 occupations introduced above.

Table 3.2

Educational Distribution by Occupation

	Educational Attainment		
Occupations	High School or Less	Some College	Bachelor's degree or higher
Construction Equipment Operators	78%	20%	2%
Rotary Drill Operators	77%	23%	0%
Service Unit Operators	77%	23%	0%
Maintenance engineers	67%	24%	8%
Extraction Helpers	79%	18%	3%
Computer Software Engineers	4%	13%	83%
Editors	5%	11%	84%
Computer Support Specialists	16%	42%	41%
Customer Service Representatives	37%	41%	22%
Telecomm. Equipment Installers/Repairers	41%	46%	13%

Source: BLS O*NET data, 2007

Note that most computer software engineers (83 percent) have a Bachelors degree or higher while only a small minority of construction equipment operators (2 percent) have this much education. By bringing together these educational distributions by occupation and the occupational employment levels within an industry, one can construct a picture of the educational attainment distribution within a given industry. Table 3.3 illustrates such an educational attainment distribution for the Information sector and the Mining sector.

Table 3.3

Educational Distribution by Industry

	Educational Attainment		
Sector	High School or Less	Some College	Bachelor's degree or higher
Information	32%	30%	38%
Mining	56%	26%	18%
Difference	24%	-4%	-20%

Source: Author's calculations using BLS OES and O*NET data

There are roughly 20 percent more people in the Information sector who have a Bachelors degree or higher as compared to the Mining sector. Conversely, there are roughly 24 percent more people in the Mining sector who have a high school diploma or less. This disparity in the educational attainment distribution between the two sectors suggests that Information-related industries have, on average, substantially higher educational requirements than Mining-related industries.

By pulling together how industrial composition helps drive occupational composition and how occupational composition helps drive educational attainment levels, one can begin to model the effects of a market shock on the level of employment by educational attainment. If an adverse market shock were to affect the industries in the Information sector more than the industries in the Mining sector, one would expect to see a proportionately larger increase in the unemployment rate of workers with Bachelors degrees as compared to people with only a high school diploma. In other words, as an industry adds or sheds jobs in response to a market shock, the varying concentrations of

occupations within those industries should shift the educational attainment distribution of unemployed workers and thus the structure of unemployment by education.

Given this baseline of factors that generate unemployment, I will compare and contrast the differences in these factors across the last three recessions – those that began in early 1980, 1990, and 2001. In addition to the industrial and economic descriptors, particular attention will be focused on the educational profile of the people who were affected as a means to describe the changes over time.

Changes in industrial composition

Over the last twenty years, the industrial composition continued to shift from a manufacturing and goods-based economy to more of a service-based economy. Table 3.4 below illustrates this shift using Bureau of Economic Analysis (BEA) data by providing the percentage point change in value added by industry as a percentage of the gross domestic product between 1980 and 2006.

Table 3.4

Change in Value Added by Industry, 1980 to 2006

Value Added by Industry as a Percentage of Gross Domestic Product	1980	2006	Percentage point change in value added
Manufacturing	20.0	12.1	-7.9
Mining	3.3	1.9	-1.4
Transportation and warehousing	3.7	2.7	-1.0
Wholesale trade	6.8	6.0	-0.8
Retail trade	7.2	6.5	-0.7
Utilities	2.2	2.0	-0.2
Construction	4.7	4.9	0.2
Arts, entertainment, recreation, accommodation, and food services	3.0	3.6	0.6
Information	3.5	4.4	0.9
Educational services, health care, and social assistance	5.0	7.8	2.8
Finance, insurance, real estate, rental, and leasing	15.9	20.8	4.9
Professional and business services	6.7	11.8	5.1

Source: Author's calculations using BEA data

Between 1980 and 2006 manufacturing experienced a 7.9 percentage point decline in its value added. Professional and business services experienced significant growth with a 5.1 percentage point increase. Finance, insurance, real estate, rental, and leasing also experienced significant growth with a 4.9 percentage point increase. Of the six industrial groups that experienced growth during this time, the finance, professional and business services, information, educational services, and health care sectors have higher concentrations of occupations that require more education than other industries such as mining, manufacturing, and transportation.

Changes in the industrial composition were also reflected in employment levels by industry. As their share of total value added declined, manufacturing, mining, and utilities experienced substantial reductions in employment levels. Figure 3.5 demonstrates the change in overall employment by industry from 1980 to 2006.

Table 3.5

Change in Employment Levels by Industry from 1980 to 2006

Industry	Employment level in 1980, thousands	Employment level in 2006, thousands	Employment level change, thousands	Change as a percent of 1980 employment level
Mining	990	620	-370	-37%
Manufacturing	18,732	14,158	-4,574	-24%
Utilities	651	548	-103	-16%
Information	2,361	3,037	676	29%
wholesale trade	4,557	5,904	1,347	30%
Retail trade	10,243	15,356	5,113	50%
Transportation and warehousing	2,960	4,470	1,510	51%
Finance, insurance, real estate	5,025	8,328	3,303	66%
Construction	4,454	7,693	3,239	73%
Leisure and hospitality	6,720	13,107	6,387	95%
Professional and business services	7,544	17,572	10,028	133%
Education services and health care	7,072	17,825	10,753	152%

Source: Author's calculations using BLS CES data

Over the course of the 26 years from 1980 to 2006, the manufacturing sector posted a decline in employment levels, from 18.7 million to 14.1 million workers. At the beginning of this time period, manufacturing was by far the single largest source of jobs in the United States, close to twice that of the next largest employer, retail trade at 10.2 million. By the end of this time period, manufacturing dropped to fourth place, behind education and health services, professional and business services, and retail trade.

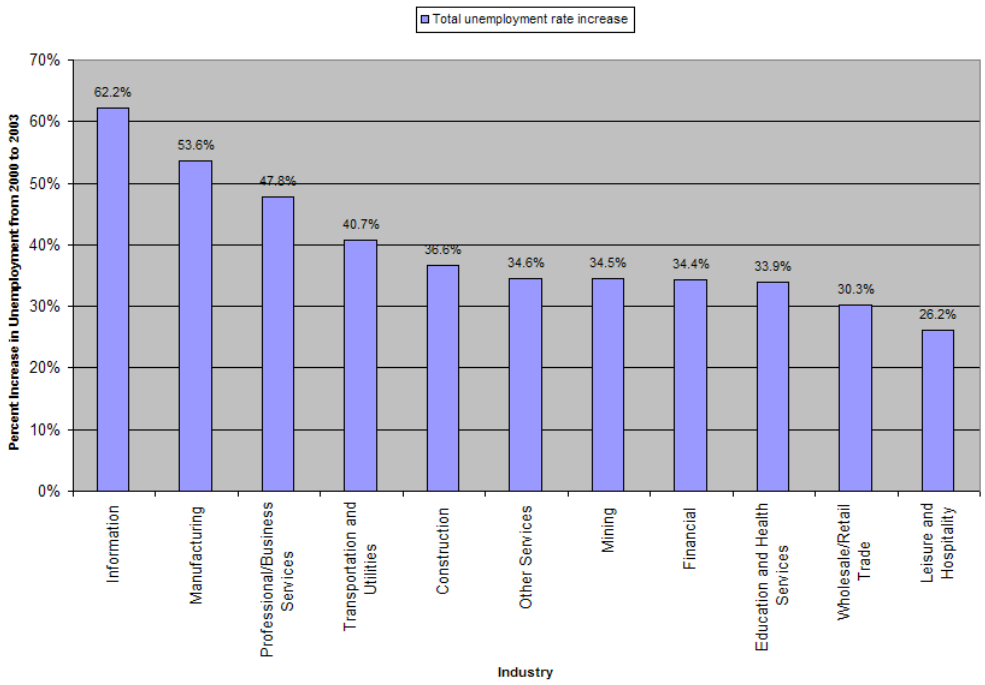
As a result of these changes, if an economic shock were to hit either the education and health services industry or professional and business services industry, two of the largest employment bases in the economy and ones containing the highest concentrations of well educated workers, the result would not only be a significant employment loss for the economy as a whole, but would also result in a non-traditionally large percentage of unemployed well educated workers.

In addition to total employment levels, monitoring the unemployment rate within an industry gives further insight into the labor market effects of economic downturns. In analyzing the 2001 recession and continuing labor market declines shortly after the end of the recession, the three industries with the highest proportional increases in unemployment rates were information (62.2 percent), manufacturing (53.6 percent), and professional and business services (47.8 percent). Conversely, the industries with the smallest increase in unemployment rates were leisure and hospitality (26.2 percent), wholesale and retail trade (30.3 percent), and education and health services (33.9 percent). Thus, the information, manufacturing, and professional and business services industries experienced the greatest percentage increase in unemployment

during this particular economic downturn. Figure 3.2 provides the percent increase in unemployment rates for each industry from 2000 to 2003.

Figure 3.2

Percent Increase in Unemployment Rate from 2000 to 2003



Source: Author's calculations using BLS CPS data

To further substantiate this claim, we can also look at long-term unemployment for each of these industries. Long-term unemployment is defined as occurring when unemployed workers have been seeking work for 27 weeks or more. Table 3.6 shows long-term unemployment growth for selected industries after the most recent recession (Mishel, Bernstein, & Boushey, 2005).

Table 3.6

Long-term Unemployment Growth By Industry, 2000 to 2003

Industry	2000 Totals	2003 Totals	Percentage Change 2000-03
Information	17,990	81,601	353.6%
Professional and business services	72,103	277,844	285.3%
Manufacturing	102,311	367,323	259.0%
Wholesale and retail trade	83,486	268,470	221.6%
Construction	51,605	149,895	190.5%
Financial activities	32,875	91,028	176.9%
Transportation and utilities	28,848	75,716	162.5%
Educational and health services	66,542	173,562	160.8%
Leisure and hospitality	72,058	172,042	138.8%

Source: Mishel, Bernstein, & Boushey, 2005

The industry with by far the largest percentage change in long-term unemployment was the information industry with a 353.6 percent increase. Professional and business services had the second largest increase (285.3 percent) while manufacturing was third (259.0 percent). By contrast, the transportation and utilities industry experienced less than half the increase experienced by the information industry (162.5 percent). Significant increases in capital investments in information were accompanied by significant increases in the number of workers in those industries. After the technology bubble burst, the rapid rise in employment levels was then followed by a rapid decline. Not only did the employment levels drop, they remained well below their original February 2001 levels until February 2005.

When industries with a large workforce experience increases in unemployment, they make larger, relative contributions to the unemployment rate compared to industries with a relatively smaller workforce. For example, in the year 2000 the manufacturing industry employment level represented 16.5 percent of the workforce while the information industry represented just 3.4 percent of the workforce. Changes in the manufacturing

sector thus have a proportionately larger effect on aggregate unemployment rates compared to the information sector.

As with the employment level itself, variance in the employment level also matters. Labor market variance, in this context, is defined as the total absolute change in labor market size over the last three labor market recessions. In other words, if “Industry A” shed eight percent of its labor force during a recession while “Industry B” shed six percent of its labor force, “Industry A” would have greater variance. Similarly, if the labor force of “Industry A” grew by eight percent during a recession while “Industry B” grew by six percent, “Industry A” would still be considered to have greater employment level variance. As previously discussed, various market shocks may affect industries differently, thus one would expect particular recessions to hit certain industries much harder than others. With little variance in employment levels, one would expect the education distribution of the unemployment rate to be relatively invariant across recessions. Conversely, with substantial variance in employment levels, one would expect the education distribution of the unemployment rate to reflect the education distribution of the industries most affected by the particular recession. Table 3.7 combines the employment level share of twelve major industry groups in 2000 with the employment level variance during each of the last three labor market recessions.

Table 3.7

Employment Share and Variance

Industry	Employment Share in 2000	Employment variance early 1980's recession	Employment variance early 1990's recession	Employment variance early 2000's recession	Average variance
Manufacturing	16.5%	-13.1%	-4.6%	-15.6%	-11.1%
Professional, business services	15.6%	4.6%	-1.5%	-5.0%	-0.6%
Retail trade	14.4%	0.7%	-2.9%	-3.1%	-1.8%
Education, health services	14.2%	8.1%	6.4%	7.7%	7.4%
Leisure, hospitality	11.1%	2.3%	0.2%	1.4%	1.3%
Financial, insurance, real estate	7.3%	4.9%	-1.5%	2.9%	2.1%
Construction	6.4%	-13.2%	-12.5%	-1.3%	-9.0%
Wholesale trade	5.7%	-1.3%	-2.0%	-4.3%	-2.6%
Transportation, warehousing	4.2%	-8.4%	-0.6%	-6.1%	-5.0%
Information	3.4%	-4.8%	-1.4%	-14.9%	-7.0%
Natural resources, mining	0.6%	-0.3%	-7.1%	-5.8%	-4.4%
Utilities	0.6%	8.3%	-1.0%	4.3%	3.9%

Source: Author's calculations using CES data

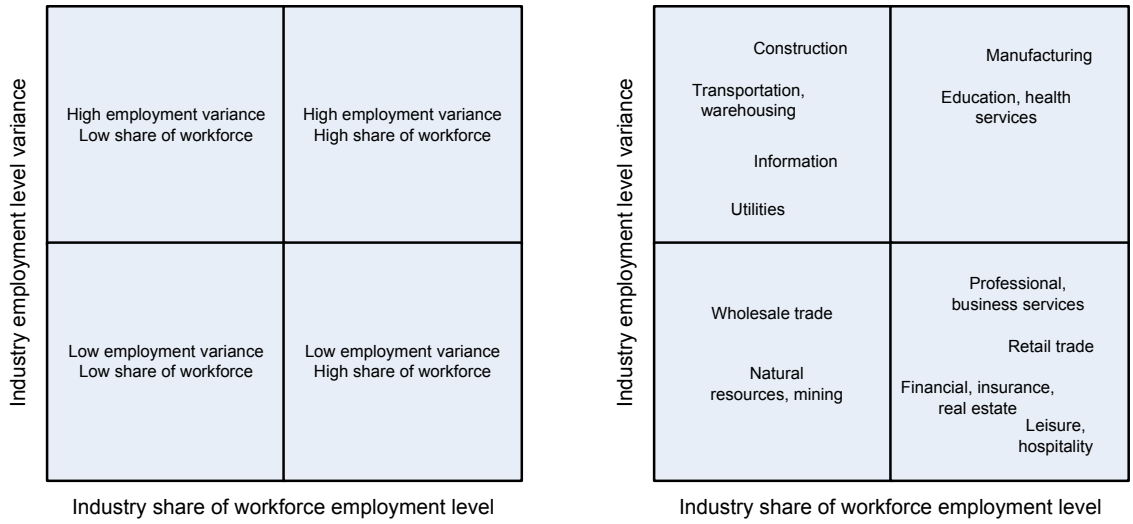
For purposes of this illustration, the industries were divided into two groups according to employment share in 2000: (1) relatively high percentage of the workforce, and (2) relatively low percentage of the workforce. The industries with the six largest shares of the total workforce were labeled "high share of workforce" while the other six industries were labeled "low share of workforce." Similarly, the industries were also divided into two groups according to average variance across the last three labor market recessions: (1) relatively high employment variance, and (2) relatively low employment variance. The industries with the six highest absolute employment level changes were labeled as "high employment variance" while the other six industries were labeled as "low employment variance."

Figure 3.3 illustrates the intersection of labor market size and variance. The matrix on the left shows the four possible combinations: (1) low employment variance and low share of workforce, (2) low employment variance and high share of workforce, (3) high employment level variance and low share of workforce, and (4) high employment

variance and high share of workforce. Using the CES data from the Table 3.7, the matrix on the right shows how the twelve major industry groups are dispersed among these four combinations.

Figure 3.3

Industry Workforce Market Share and Variance Matrix



Source: Author's calculations using CES data

The manufacturing sector and the education, health services sector were the two industry groups in the "high employment variance" and "high share of workforce" quadrant. In other words, during the last three labor market recessions these two industries have, in the case of the educational and health services sectors added a relatively large number of workers or, in the case of the manufacturing sector, shed a relatively large number of workers. Due to their relative size and propensity to either add or shed jobs, these two sectors could be expected to have the greatest effect on aggregate labor market outcomes during recessions. In contrast, the wholesale trade

sector and natural resources, mining sector have relatively low employment variance and a low share of the workforce. Compared to the other ten sectors, the wholesale trade sector and natural resources, mining sector might be expected to have less of an effect on aggregate labor market outcomes during recessions. The remaining eight sectors are dispersed between either the low employment variance and high share of workforce quadrant or the high employment level variance and low share of workforce quadrant.

Given the size and variance of the manufacturing sector shedding less educated workers (potentially increasing the number of less educated unemployed) and the educational, health services adding more educated workers (potentially decreasing the number of more educated unemployed), one would require a severe market shock to other industries with high concentrations of well-educated workers to shift the educational attainment distribution of the unemployment rate towards the more educated. The impact on the information sector and professional and business services sector in 2001 was indeed severe. As seen in figure 3.7, the market shock triggering the 2001 recession had a substantial impact on employment level changes in these industries, apparently contributing to the leveling of the unemployment rate seen in figure 2.4.

Changes in occupational composition

In addition to significant changes over the years in employment levels and unemployment rates by industry, there have also been significant changes in employment levels and unemployment rates by occupation. Table 3.8 was produced

using *Current Population Survey* (CPS) data to illustrate employment level changes for selected occupations from 1988 to 2008. Occupational categories contain groups of similar jobs. For example, the production occupations category contains a wide variety of jobs such as bakers, jewelers, machinists, refinery operators, semiconductor assemblers, structural metal fabricators, tool and die makers, and potters.

Table 3.8

Employment Level Change by Occupation, 1988 to 2008

Occupation	Employment Level 1988	Employment Level 2008	Employment Level Change between 1988 and 2000	Change as percent of 1988 level
Professional and related	19,716	30,702	10,986	56%
Management and financial operations	14,889	22,059	7,170	48%
Sales and related	13,253	16,295	3,042	23%
Construction and extraction	7,152	8,667	1,515	21%
Installation, maintenance, and repair	4,282	5,152	870	20%
Transportation and material moving	8,180	8,827	647	8%
Office and administrative support	18,599	19,249	650	3%
Farming, fishing, and forestry	1,068	988	-80	-7%
Production	10,319	8,973	-1,346	-13%

Source: Author's calculations using BLS CPS data

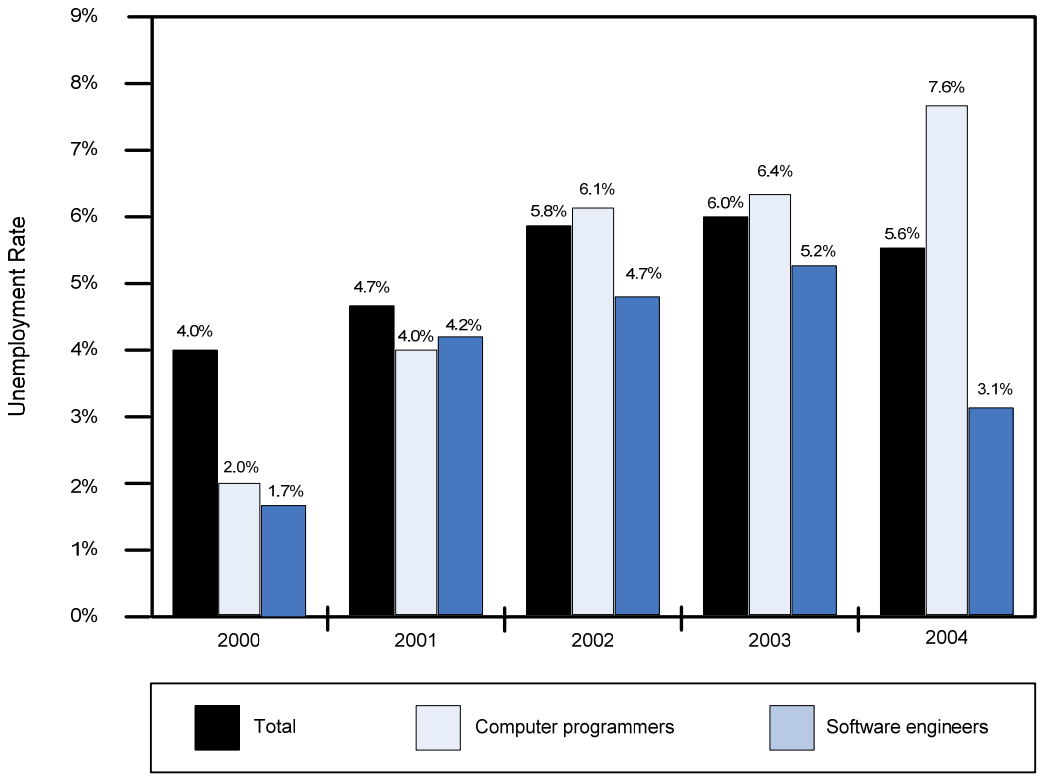
In reviewing Table 3.8, two observations are readily apparent. First, there was substantial growth in the professional and related occupations as well as management and financial operations occupations. Professional occupations grew by 56 percent while management and financial operations grew by 48 percent. These groups of occupations contain jobs such as advertising managers, chief executives, information systems managers, compensation and benefits managers, training and development managers, and engineering managers, all of which are typically held by workers with a bachelor's degree. By 2008, these were the two largest occupational groups and represented approximately 44 percent of all jobs. Second, production and agricultural (farming, fishing, and forestry) related occupations were the only two classes of occupations to

decline. Even though total employment levels in the U.S. economy increased over these twenty years from 116 million workers in December 1988 to 143 million workers in December 2008, these two groups of occupations were shedding jobs. In contrast to the professional and management occupations, the production and agricultural occupations are typically held by workers with lower levels of educational attainment. Thus, the labor force in 2008 comprised a larger number of occupations with higher levels of education and a smaller number of occupations with less education.

This shift in occupational composition does not necessarily translated into lower unemployment rates for workers that are more educated. On the contrary, let us look at the unemployment rates of two jobs that are usually held by workers with higher levels of education during and after a recession. By comparing unemployment rates of these occupations to the average unemployment rate, a clear relationship emerges between the unemployment impact on a particular industry and the subsequent impact on occupations prevalent within that industry. For example, computer programmers and software engineers are common occupations within the information technology industry, an industry that was adversely affected by the 2001 recession. Not only did both occupations experience a greater relative increase in their unemployment rates, computer programmers surpassed the economy-wide unemployment rate in 2002, 2003, and 2004. Figure 3.4 compares the unemployment rates for computer programmers and software engineers to the overall unemployment rate (Mishel, Bernstein, & Boushey, 2005).

Figure 3.4

Unemployment Rate for Computer Programmers and Software Engineers



Source: Mishel, Bernstein, & Boushey, 2005

Computer programmers and software engineers require more education than the average worker in the labor market. According to O*NET Online, most computer programmer occupations and software engineer occupations require a four year bachelor's degree. The educational requirements are exemplified by the responsibilities of the role. According to O*NET, computer programmers are expected to convert project specifications and statements of problems and procedures to detailed logical flow charts for coding into computer language. They may also be expected to develop and write computer programs to store, locate, and retrieve specific documents, data, and information. Similarly software engineers may be expected to research, design, develop,

and test operating systems-level software, compilers, and network distribution software for medical, industrial, military, communications, aerospace, business, scientific, or general computing applications. They may also set operational specifications and formulate and analyze software requirements. The software engineer must apply principles and techniques of computer science, engineering, and mathematical analysis. All things considered, the occupation requires relatively complex thinking and the application of mathematical and process models that are traditionally obtained through post-high school forms of education.

Changes in workforce educational attainment composition

As highlighted in the review of literature, the educational attainment composition of the United States workforce continues to evolve. Table 3.9 illustrates this ongoing evolution by providing the educational composition of the workforce in 1992 and compares that to the educational composition in 2007.

Table 3.9

Educational Composition of Workforce, 25 Years and Older

Educational Attainment	1992 percentage of workforce	2007 percentage of workforce	Percentage point change in share of workforce
Less than High School	13%	10%	-3%
High School Graduate	36%	30%	-6%
Some college	25%	27%	2%
Bachelors degree and greater	26%	33%	7%

Source: Author's calculations using BLS CPS data

Within only the last fifteen years, workers in the labor force 25 years and older with at least some college or higher has gone up by nine percentage points while those with

only a high school diploma or less have gone down by a corresponding amount. While the rapid increases in educational gains seen between the 1940's and 1980's has slowed in recent years, there continues to be a shift towards a more educated workforce. Will this trend continue in the future? If it does, what are the implications of an increasingly well-educated workforce on the educational attainment distribution of the unemployment rate?

Forecasting the face of unemployment

Given the changes in the industrial composition, occupational composition, and workforce educational attainment, what might future unemployment rate educational attainment distributions look like? There are at least three possible scenarios.

One scenario might be that regardless of the labor market share of less educated workers, they still might experience the highest increases in unemployment rates during recessions. Let's say that occupations requiring less than a high school education nearly disappear. It is still possible that in a recessional all workers in occupations requiring less than a high school education are laid off, while workers in other, more education intensive occupations hold on to their jobs. This would suggest that occupations usually filled by workers with higher levels of education are less susceptible to unemployment compared to occupations usually filled by workers with less education. In this scenario, the leveling of the educational attainment distribution of unemployment seen in the 2001 recession would be a one-time anomaly simply due to industry output effects.

A second scenario would be that as the industrial and occupational composition of the economy shift towards industries and occupations with higher concentrations of well educated workers, by simply increasing the percentage of well educated workers there will be an increased probability of highly educated workers becoming unemployed. In this scenario, the education attainment distribution of unemployment would correlate with the education distribution of the workforce. In other words, as the education attainment of the workforce increases, the variance in the education distribution of unemployment might decline. If the supply of high school dropouts were declining faster than demand, the unemployment rate for this group would go down. If the supply of college graduates and above is expanding faster than demand then the unemployment rate for this group would rise. If the differences in the unemployment rates by education category decline due to the labor force as a whole becoming better educated, this would suggest a permanent change in the education attainment distribution of the unemployment rate.

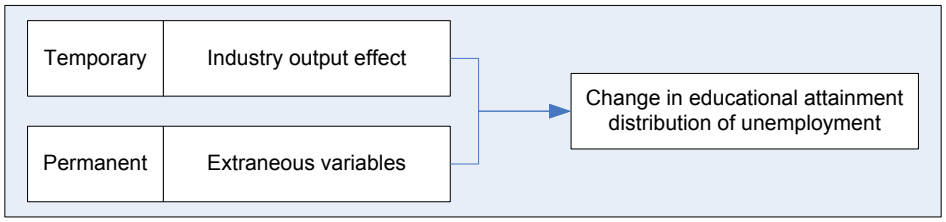
A third scenario, would suggest a temporary change in the educational attainment distribution of the unemployment rate. In this scenario the most important factor is the industry affected by a given market shock, regardless of the overall educational attainment of the workforce. The educational attainment distribution of unemployment will change based on the educational attainment distribution of the particular industry affected by the market shock or recession. If industries with highly educated workers were most affected by the market shock, then the educational attainment distribution of the unemployment rate would resemble the 2001 recession. Conversely, if industries with high concentrations of workers with lower levels of education were most affected by

the market shock, then the educational attainment distribution of the unemployment rate would resemble historical distributions seen in the recessions of the 1980's and 1990's. If this were the case, future educational attainment unemployment distributions may take either form, depending on the industry affected. In other words, the educational attainment distribution of unemployment is a function of the market shock and its subsequent affect on various industries.

Figure 3.5 below summarizes these two scenarios. In the first path, the change in the educational attainment distribution seen in the 2001 recession might be a temporary anomaly. In other words, future educational attainment distributions of the unemployment rate would not resemble the 2001 distribution. In the second path, there are extraneous variables that might in the future again result in similar educational attainment distributions as seen in the 2001 recession. In other words, some thing or things are influencing the generating factors of unemployment.

Figure 3.5

Temporary or Permanent Change in Educational Attainment Distribution of Unemployment



Source: Author

Why might the educational attainment distribution of the unemployment be a permanent change? What are the potential extraneous variables that might influence the generating factors of unemployment? Although there might be numerous variables, two prime suspects appear to be technology and trade.

The factors that affect the education distribution of unemployment

The way that companies are getting work done influences the changing face of unemployment. Technology innovation in the form of robotics, telecommunications, and software as well as trade influences such as offshoring and importing H-1B visa workers are among the primary factors. Technology influences the occupational and educational composition of the labor force by continuously changing the structure of work. For example, robotics in the automobile industry enables the production of more cars at lower costs with less labor. Similarly, software enables information technology departments to manage increasingly larger user communities with lower costs and less labor. Trade influences the occupational and educational composition of the labor force by either importing labor from or exporting work to locations with at least cheaper and perhaps even better skilled labor compared to the United States. For example, India has grown to be a significant market for providing well-educated, low cost labor for information technology services (Friedman, 2005). Exporting work outside the United States or importing labor from other countries may influence unemployment domestically (McKinsey, 2003). The following paragraphs further explore these two forces potential relationship to the changing educational composition of unemployment.

Technological changes may result in the same level of output being produced with less labor (Hyclak, Johnes, & Thornton, 2005). In looking at an individual firm, this does not necessarily mean the elimination of jobs. The technological change may mean that the cost of producing output has fallen, which may in turn result in a reduction of the prices of producing the product and an increase in the quantity demanded by consumers. Whether the scale effects of this change will be strong enough to increase the level of employment beyond its initial levels is uncertain. Even if the level of employment is lower for the firm, it does not mean the employment in the entire economy will be lower. If the technological change results in lower prices, the real incomes of consumers generally have increased. With higher real incomes, the level of spending on goods and services elsewhere in the economy will rise and along with the additional spending, new jobs may be created (Hyclak, Johnes, & Thornton, 2005).

Building upon the example of an individual firm, we can now turn to the economy as a whole. Although technological change does not necessarily reduce the overall number of jobs in the economy, it may reduce the number of particular jobs. The elasticity of employment with respect to technological change is related to the growth of output and productivity. If output grows by 3 percent and at the same time, productivity grows by 3 percent, then there will be no change in employment levels. If the output growth rate is greater than the productivity growth rate, then employment levels grow. Conversely, if the output growth rate is less than the productivity growth rate, then the employment levels decline.

Technology can affect employment outcomes by displacing some types of workers and increasing demand for others (Mishel, Bernstein, & Allegretto, 2007). Given that it is difficult to measure the extent of technological change and its general character, it is difficult to identify the influences of technological change on recent employment outcomes. From a high-level perspective, technology can change the way goods and services are produced as well as the subsequent demand for different types of workers. The automated self-check out lanes at grocery stores are a technological replacement for low skilled check out clerks while the design and development of the automated self-checkout system itself required relatively well-educated computer and industrial engineers. One complication in assessing any technology explanation is that technology's impact on employment outcomes can vary in different periods and situations, sometimes adversely affecting the least educated while other times adversely affecting more educated workers (Mishel, Bernstein, & Allegretto, 2007). For example, more than half of all tax preparers who calculate the tax returns for individuals or small businesses report having a college degree or more. The employment level for this occupation is forecasted to decline 3 percent to 9 percent between 2006 and 2016 (O*NET, 2008). This decline is not due to the simplification of U.S. tax law, rather the introduction of easy to use software applications that help individuals and small businesses do their own returns without the help of a tax preparer.

Technology advances, particularly in software and telecommunications, are also making the sourcing of labor a more geography-neutral decision. With today's software and telecommunications infrastructure, the location of labor is far less important than it was twenty, even ten years ago (Friedman, 2005). These investments in technology coupled

with freer trade result in the easier movement of investment capital and labor across borders. With the shifting industrial composition of the U.S. and its trading partners, modern transportation, software and communications technologies, deregulation, and the removal of trade barriers have led to increased flows of both multinational labor and capital between countries (Bluestone & Harrison, 1982 and Friedman, 2005).

The Office of the United States Trade Representative (USTR) is responsible for negotiating and managing international trade agreements. They negotiate directly with foreign governments to create trade agreements, resolve disputes and participate in global trade policy organizations. It is through the USTR office that agreements such as the General Agreement on Trade in Services (GATS) have been enabled. It is through such trade agreements that some of the high paying technology and service jobs are now going overseas.

Significant differences in the cost of labor are motivating companies to move their labor-intensive service jobs to countries with low labor costs. For example, software developers who cost $60 an hour in the United States cost only $6 an hour in India (McKinsey, 2003). A firm must simply establish a partnership with an existing, Indian software development company or setup its own remote office. Once the operation or office is in place, the management of the software production may be done from anywhere with internet connectivity and a phone. Although moving the software development capabilities from one country to another does indeed involve time and expenses, the difference in labor costs are so dramatic that even after incurring the moving costs, total production costs are still less than if they remained in the U.S.

Any knowledge-based task that can be digitized can be offshored (Friedman, 2005). Examples of such work include accounting, news publishing, customer relationship management, and a broad array of information technology services. The technological advances of the 1990's came together around 2000 and created a technology platform from which intellectual work and service work could be performed from anywhere in the world. The effective educational systems in China and India, coupled with significant technological advances and investments, produced a massive, low cost, highly skilled, offshore, white-collar labor force (Friedman, 2005). Researchers estimate that by 2015 roughly 3.3 million U.S. business-processing jobs will have moved abroad (McKinsey, 2003). As part of this July 2003 estimate, approximately 400,000 business-processing jobs had already moved and the number of U.S. service jobs lost to offshoring was expected to accelerate at a rate of 30 to 40 percent over the next several years (McKinsey, 2003).

Data used to identify trade as a factor in the democratization of unemployment include such trade deficit induced job losses. Has the importation of certain goods and services really replaced the domestic production of those goods and services? In periods of low unemployment, it may be true that a trade deficit does not cause actual job loss because workers displaced by rising imports have found employment in non-traded sectors. A trade deficit will effect, however, the composition of jobs. As the composition of jobs change, one may observe shifts in the allocation of trade induced job losses by educational attainment.

The table 3.10 illustrates the relative share of trade deficit related job loss by educational level between 1979 and 2002 (Mishel, Bernstein, & Allegretto, 2005). The analysis used information on the types of jobs in each industry and the changes in the trade deficit by industry. Using BLS and U.S. Bureau of the Census data, the researchers performed and input-output analysis to examine how jobs across the economy were affected, including jobs that feed into other industries.

Table 3.10

Changing Share of Trade Induced Job Loss by Educational Attainment, 1979 to 2002

Education level	1979-89	1989-94	1994-2000	2000-02
College graduate	12.2%	8.0%	22.8%	23.9%
Some college	22.8%	14.2%	27.8%	28.0%
High school	37.0%	38.2%	36.3%	34.8%
Less than HS	28.0%	39.5%	13.1%	13.4%

Source: Mishel, Bernstein, & Allegretto, 2005

The share of trade deficit related job loss for college graduates nearly doubled between the 1980's and 2000 while the share of trade deficit related job loss for workers with less than a high school diploma was cut in half. The share of trade deficit related job loss for workers with some college and a high school diploma during this time stayed relatively the same. Were the jobs held by workers with less than a high school diploma less susceptible to trade?

There are numerous non-tradable jobs in the economy and many of these non-tradable jobs require very little to no education. For example, a person can become a janitor even if he or she has never worked before. The role of the janitor cannot be offshored because it requires a physical presence to perform the job. The characteristics of no

previous work-related skill, knowledge, or experience coupled with the need for a physical presence is indicative of a wide range of occupations including: waiters and waitresses, ushers and lobby attendants, taxi drivers and chauffeurs, stock clerks, service station attendants, parking lot attendants, janitors and maids, landscaping and grounds keeping workers, food preparation workers, truck drivers, service and sales representatives, dishwashers, cashiers, baggage porters and bellhops, and amusement and recreation attendants (O*NET, 2008). Indeed, the nature of these jobs has insulated the workers from the affects of trade induced job loss.

In summary, the apparent change in the educational attainment distribution of the unemployment rate in the 2001 recession may be due to one time, idiosyncratic forces or may represent a permanent change in the nature of unemployment. If the specific industry shocks in the form of a stock market correction and dot.com bust were only particular to that recession then the leveling of the educational attainment distribution of unemployment was simply a one-time event. On the other hand, if there is a relationship between the specific industry shocks and the educational attainment distribution of the unemployment rate, and that relationship persists, distribution seen in the 2001 recession may happen again. If employers are finding higher educated workers too expensive and are replacing them in favor of alternatives such as new technology or offshore labor, then these influencing factors may suggest a permanent shift in the educational attainment distribution of the unemployment rate. Alternatively, if the supply of less educated workers is consistently shrinking to the point that the supply no longer meets demand, less educated workers may have a lower unemployment rate. As we have seen in recent years, as the economy changes, some sectors that used to be safe

havens for well-educated workers such as high technology and financial services, are now vulnerable. Could the health care and education industries be next? What market shocks might hit these two industries?

Hypotheses to be tested

As my discussion of the generating factors of unemployment illustrates, there is a logical connection between market shocks, the industrial composition, occupational composition, and the educational attainment composition of unemployed workers. This model walks through the series of events and factors that lead to a particular educational distribution of the unemployment rate. The hypotheses chosen for this research were similarly designed to test whether or not this model helps explain what has transpired over the last three recessions as well as estimate the outcomes of alternative, future recessions. In this dissertation, I will test three hypotheses:

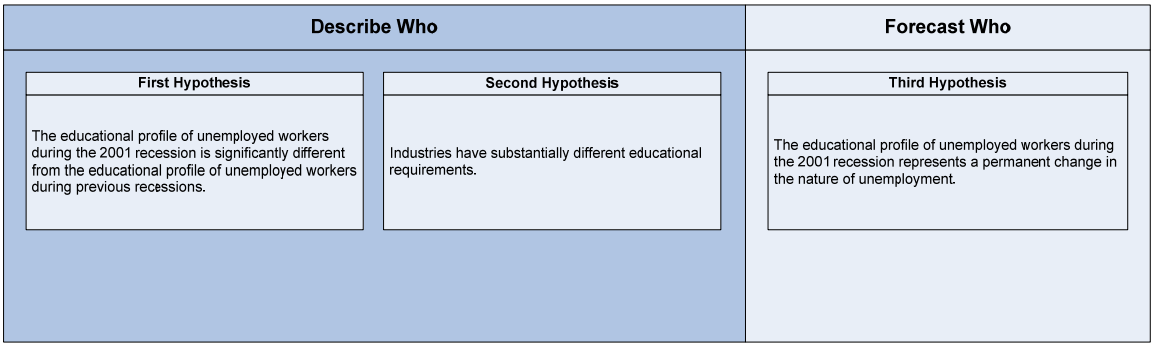
1. The educational profile of unemployed workers during the 2001 recession is significantly different from the educational profile of unemployed workers during previous recessions.
2. Industries have substantially different educational requirements.
3. The educational profile of unemployed workers during the 2001 recession represents a permanent change in the nature of unemployment.

In order to answer the question of whether or not there has been a permanent change in the nature of unemployment, one must first answer a series of smaller questions. The three hypotheses are intended to provide a logical path following the model of the

generating factors of unemployment. Figure 3.6 summarizes the two-step process I outlined for this research starting from left to right. The first step was to describe who was impacted by the last three recessions and how the profiles of these people differ with regard to educational attainment, industry, and occupation. The second step was to determine if the changes in the unemployment profile were an anomaly or a permanent change in the nature of unemployment.

Figure 3.6

Hypotheses Map



Source: Author

The purpose of the first hypothesis is to determine whether there was a statistically significant difference between the educational profile of unemployed workers during the 2001 recession versus the early 1980's recession and early 1990's recession. In order to identify the variation in the educational profile of the unemployment rate, I must determine if there was indeed a significant difference in the profiles. If there is a statistically significant difference, I will then explain why there has been a change in the educational profile of the unemployed.

The purpose of the second hypothesis is to determine whether different industries have notably different educational requirements. Although I will not be establishing statistical significance, it should be readily apparent that there is indeed substantial variation. Demonstrating the differences in educational requirements of different industries will help explain why there is a difference in the educational profile of unemployed workers. The first and second hypotheses are linked, in that after determining if there is a statistically significant difference in the unemployment rate by educational attainment, this second hypothesis picks up the next step by explaining why this may have happened using the model outlined in Figure 3.1.

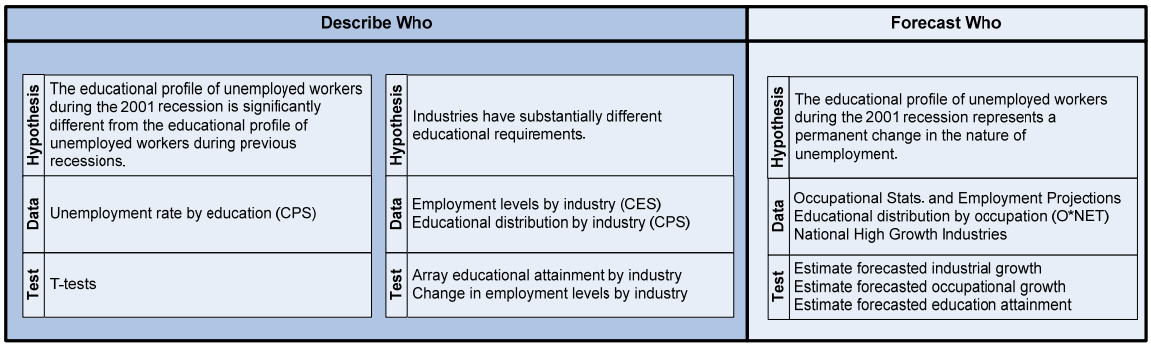
Using the foundation provided by the first two hypotheses, the third hypothesis will attempt to determine whether the changes in the educational profiles of unemployed workers represent a permanent change in the nature of unemployment. If the model holds true for previous recessions, then one may be able to apply the model to future recessions. The third hypothesis is tested by applying the model to future estimates of the industrial and occupational composition of the U.S. economy. From these forecasted estimates, one may infer that the change is either permanent or a temporary anomaly of the 2001 recession.

Chapter 4 – Methodology

This study will use research methods and data sources that have previously contributed to the body of knowledge pertaining to unemployment. I will use a combination of existing survey data, basic statistical tests, and historical analysis. A two-step process will be used to test the hypotheses. To begin, I will use labor force data from the U.S. Bureau of Labor Statistics (BLS) to describe who was most affected by the last three recessions and how the profiles of these people differ with regard to education level, industry, and occupation. I will then use data from the BLS Office of Occupational Statistics and Employment Projections and the National High Growth Industries initiative to provide descriptive statistics regarding forecasted occupational growth by educational attainment and the occupational composition of high growth industries. This data will be used to estimate future unemployment rate distributions by educational attainment. Adding to the hypotheses map introduced in Chapter 3, Figure 4.1 links the data sets and tests used in order to test each hypothesis.

Figure 4.1

Hypotheses, Data, Test Map



Source: Author

The first step was to describe who was impacted by the employment changes in the last three recessions and how the profiles of these people differ with regard to education level, industry, and occupation. The second step was to determine if the changes in the unemployment profile are an anomaly or a permanent change in the nature of unemployment.

Definition of Unemployment

The U.S. Department of Labor's Bureau of Labor Statistics (BLS) is the organization that officially defines and tracks unemployment within the U.S. According to the BLS (BLS, 2003), unemployed persons in the CPS household survey are defined as all persons who: (1) had no employment during the reference week prior to the interview; (2) were available for work, except for temporary illness; and (3) had made specific efforts, such as contacting employers, to find employment sometime during the 4-week period prior to the interview. Persons who were waiting to be recalled to a job from which they had been laid off need not have been looking for work to be classified as unemployed, as

long as they were available to work. The definition of unemployment is further limited to only the civilian labor force, which is the total of all civilians classified as employed and unemployed. The civilian labor force includes only persons 16 years or older, and excludes persons who are out of the labor force, members of the armed forces, and "institutionalized" persons such as those in prisons. The unemployment rate then is the proportion of the civilian labor force that is unemployed (BLS, 2003).

In contrast, the BLS defines employment as wage and salary workers (including domestics and other private household workers, as well as self-employed persons and persons working in a family owned business) who worked 15 hours or more during the reference week. Additionally, persons are considered employed who had jobs but were not at work during the reference week – that is, were not working but had jobs from which they were temporarily absent because of illness, vacation, bad weather, child care problems, labor-management disputes, or because they were taking time off for various other reasons, even if they were not paid by their employers for the time off.

The non-institutionalized population aged 16 and over may therefore be divided into three mutually exclusive and exhaustive categories: employed (N), unemployed (U), and out of the labor force (OLF). The following graphic illustrates these categories of the non-institutionalized population (Pop.) aged 16 and over (Shapiro, 1996).

Figure 4.2

Labor Force Classification

Labor Force (LF) = N + U

Pop. = LF + OLF

Source: Shapiro, 1996

Although an effective measure of unemployment, the BLS definition may fall short in explaining the severity of economic downturns and weak labor markets. The statistic does not take into consideration more subtle characteristics of the labor force. For example, people who have jobs, but not in the desired capacity, whether in terms of compensation or level of skill and experience are considered employed (malemployment). People who would like to be employed full time but can only find part-time work are counted as employed (involuntary part-time employment). Additionally, people who would like to work but believe no work is available and have thus stopped looking are counted as being out of the labor force (discouraged workers). These shortcomings have led some critics to argue that official unemployment figures do not always accurately reflect the state of the labor market. This criticism is most applicable in times of recession, when involuntary part-time employment, discouraged workers, and

underemployment are most common (Shapiro, 1996). Although underemployment, involuntary part-time employment, and discouraged workers will not be explored as part of this research, it is important for the reader to simply understand how these factors might “color” the interpretation of unemployment-related statistics.

Describing the changing face of unemployment

Two hypotheses will be tested in order to describe the changing face of unemployment. As outlined in the review of the literature, the profile of the unemployed appears to have changed over the course of the last three recessions. More specifically, the first hypothesis for this research is designed to confirm or deny whether the educational profile of the unemployed has changed. In order to test the first hypothesis I will use data from the Current Population Survey (CPS).

The CPS is a monthly survey of approximately 60,000 households conducted by the U.S. Bureau of the Census for the Bureau of Labor Statistics. The survey has been conducted for more than fifty years and is the primary source of information on the labor force characteristics of the U.S. population. Based on the definitions of employment and unemployment outlined above, respondents are interviewed to obtain information about the employment status of each member of the household 16 years of age and older. The survey provides estimates for the nation as a whole and provides inputs for model-based estimates for individual states and other geographic areas. Estimates obtained from the CPS include employment, unemployment, weekly earnings, hours of work, and other indicators along with demographic characteristics including age, gender, and educational attainment.

I will use these data to compare the percentage point changes in unemployment during the last three business cycle contractions (recessions) by educational attainment from the employment level peak to the employment level trough within each recession. For purposes of this research, I define recession in terms of the labor market as the period over which the economy moves from its high point of employment to its low point. This definition does not coincide precisely with the standard established by the National Bureau of Economic Research (NBER), a non-governmental organization generally regarded as the official source on recessions' beginning and ending dates. Given that a variety of economic indicators are used to determine the start and end dates of a recession for the economy as a whole, the dates do not correspond to labor market recessions and expansions (Mishel, Bernstein, & Boushey, 2003).

According to NBER, the last three national recessions took place between July 1981 through November 1982, July 1990 through March 1991, and March 2001 through November 2001. The first month and year listed is the business cycle peak and the second month and year listed is the trough. Given that employment levels lag business cycle recoveries, using the labor market recession dating method and the seasonally adjusted CES total employment data for workers 16 years and over, the last three labor market recessions occurred March 1980 to December 1982, June 1990 to November 1991, and February 2001 to August 2003.

I will then use the CPS unemployment data to test for significant differences in unemployment rate changes across educational groups across the last three recessions.

I will start by cross tabulating the number of unemployed workers by educational group across the last three recessions. This will be presented as a 3x5 table. The variable "Educational group" will have five categories: Less than high school, High school graduates, Some college, Bachelors degree, and Masters degree or higher. The variable "Recession" will have three categories: Early 1980's recession (March 1980 to December 1982), Early 1990's recession (June 1990 to November 1991), and Early 2001's recession (February 2001 to August 2003).

I will use a series of t-tests to test for significance of differences between various unemployment rates. First, the percentage point change in unemployment rates by educational attainment for each recession will be calculated based on the quarterly average of the employment level peak quarter and the employment level trough quarter. Second, the standard error will be calculated for each quarter, the difference in two proportions, and the difference in the difference of these proportions. The t-tests are designed to provide three different perspectives on the question of whether or not the unemployment profile of workers during the 2001 recession was significantly different compared to previous recessions.

First, did the unemployment rate for a given educational group (e.g. high school dropouts) significantly rise between the peak and the trough of the labor market cycle? To answer this question, I will use a simple t-test of the difference between two sample proportions. For the following formula, let the education group be called A, let UR_P equal unemployment rate at the peak quarter of the labor market business cycle, let UR_T equal unemployment rate at the trough quarter of the cycle, and let sigma equal the standard

error of the difference between the unemployment rate at the trough quarter and the unemployment rate at the peak quarter of the business cycle.

Figure 4.3

T-test Formula for Significance of the Unemployment Rate Rise of a Given Educational Group

$$t = \frac{UR_T - UR_P}{\sigma \; UR_T - UR_P}$$

Second, were the unemployment rate changes between educational groups during a given cycle significantly different from one another? For example, let the two educational groups be called A and B and let the cycle be the 1990's recession. I will calculate a t-test of the difference in differences in the unemployment rates of these two groups using the following formula.

Figure 4.4

T-test Formula for Unemployment Rate Difference Between Two Groups within a Business Cycle

$$t = \frac{(UR_T - UR_P)\,A - (UR_T - UR_P)\,B}{\sigma \quad (UR_T - UR_P)\,A - (UR_T - UR_P)\,B}$$

Finally, were the changes in the unemployment rates significantly different between two recessions for a given educational group? I will perform a t-test of the difference

between the changes in the unemployment rates of a given educational group over two recessions (e.g. the 1990/91 recession and the 2001 recession) using the following formula.

Figure 4.4

T-test Formula for Unemployment Rate Difference of Group Over Two Recessions

$$t = \frac{(UR_T - UR_P)\, A_{90} - (UR_T - UR_P)\, A_{2001}}{\sigma\ (UR_T - UR_P)\, A_{90} - (UR_T - UR_P)\, A_{2001}}$$

I will then repeat this same process, using the three t-tests listed above, to compare the percentage point changes in the unemployment rates by educational attainment for each of the last three labor market recessions.

Turning now to the second hypothesis, I will determine whether industries have substantially different education requirements. This will be tested by first detailing the changes in employment levels by industry, providing the educational distribution within industries, and then identifying the change in employment levels by educational attainment. Assuming that there are different educational requirements across industries, by identifying the changes in employment levels by industry, I will infer the impact on various occupations and subsequently the unemployment impact on a given educational profile of worker.

I will start by using the Current *Employment Statistics* (CES) data to detail the percentage point changes in monthly employment levels for all workers by major

industries over each of the last three labor market recessions. Conducted by the Bureau of Labor Statistics, the CES program is a monthly survey of approximately 150,000 businesses and government agencies, representing approximately 390,000 individual worksites, which provide detailed industry data on employment, hours, and earnings of workers on nonfarm payrolls. The CES survey data provide total employment estimates by industry from 1939 to present. I will compare the total employment level by industry at the peak of the business cycle, using the dating method outlined above, with the total employment level by industry at the trough of the business cycle, and then calculate the change in jobs in each industry for each of the last three recessions.

For purposes of this test, industries will be organized according to the *North American Industry Classification System* (NAICS). The NAICS system groups establishments into industries based on the activity in which they are primarily engaged. Establishments using similar raw material inputs, similar capital equipment, and similar labor as well as similar goods and services produced are classified in the same industry. NAICS is a two- through six-digit hierarchical classification system, offering five levels of detail. Each digit in the code is part of a series of progressively narrower categories: the more digits in the code signify greater classification detail. The first two digits designate the 20 major economic sectors, the third digit designates the subsector, the fourth digit designates the industry group, the fifth digit designates the 1,170 individual NAICS-defined industries, and the sixth digit designates the national industry.

Setting aside the changes in employment levels by industry, I will then use CPS data to calculate the educational attainment distribution by industry. In order to test the second

hypothesis, I will use the CPS data to estimate the educational distribution of different industries, and then use the educational distribution by sector estimates with the change in employment level estimates by sector (CES data) to estimate the relative job loss by educational attainment over the last three recessions. To achieve an appropriate level of specificity, I will include industries at the sector (2-digit) level. Results will be displayed in table format with educational attainment presented by column and industries presented by row.

Forecasting the future face of unemployment

The second step in the process will be to determine if the changes in the unemployment profile over the recent cycles are an anomaly or a permanent change in the nature of unemployment. What will happen to the educational attainment distribution of the unemployment rate as the industrial and occupational composition of the economy shift toward industries and occupations with higher levels of educational attainment and the educational attainment of the workforce in general increases?

In order to estimate future educational distributions of unemployment I will use data from three sources in order to estimate future employment levels: (1) the BLS *Office of Occupational Statistics and Employment Projections*, (2) O*NET, and (3) the *National High Growth Industries* initiative. First, I will use these data to provide descriptive statistics regarding forecasted occupational growth by education attainment. Second, I will use these data to provide descriptive statistics regarding the occupational composition of high growth industries.

The *Office of Occupational Statistics and Employment Projections* publishes information about the labor market for the nation as a whole for 10 years in the future. The projections are usually released first in the November issue of the *Monthly Labor Review* in odd-numbered years and are published in the Occupational Outlook Handbook. The data I will use for this research is the employment projections for 2004 through 2014 (BLS, 2005).

I will use Office of Occupational Statistics and Employment Projections (OSEP) data by first creating an array of occupations organized by BLS educational attainment clusters. The educational clusters represent the predominant educational requirements for a given occupation. The BLS has six educational attainment clusters: (1) high school, (2) high school / some college, (3) high school / some college / college, (4) some college, (5) some college / college, and (6) college. For purposes of illustration I will condense the six clusters into three groups of educational attainment. The first two clusters will be merged and labeled “high school or less.” The third and fourth clusters will be merged and labeled “some college.” The fifth and sixth clusters will be merged and labeled “Bachelor’s degree or more.” The purpose of merging the clusters is to normalize the data between educational clusters and educational attainment distributions. I will then calculate the percentage point growth in each of the three educational attainment clusters. It is worth noting that variations exist in the educational attainment of occupations between difference industries. For example, the same occupation may have different educational attainment distributions in industry “A” versus industry “B.” This method does not attempt at identifying educational attainment differences of occupations between different industries.

Operated within the U.S. Department of Labor's Employment & Training Administration, the National High Growth Industries initiative is an effort to prepare workers to take advantage of new and increasing job opportunities in high growth, high demand and economically vital sectors of the American economy. The High Growth Job Training initiative targets worker training and career development resources toward helping workers gain the skills they need to build successful careers in these and other growing industries. National High Growth Industries are defined by the BLS as economically critical, projected to add substantial numbers of new jobs, or are being transformed by technology and innovation. There are 14 identified high growth industries: advanced manufacturing, aerospace, automotive, biotechnology, construction, energy, financial services, geospacial technology, health care, Homeland Security, hospitality, information technology, retail, and transportation. O*NET has occupational information for all 14 industries.

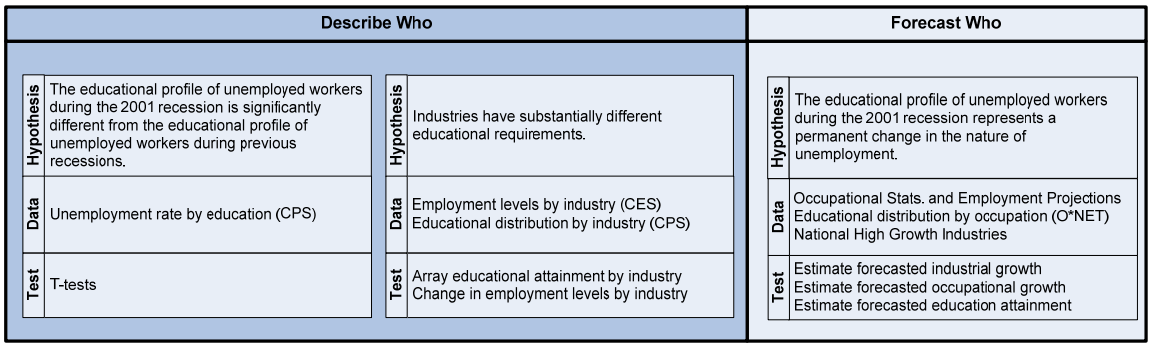
Using O*NET data, I will identify the occupations within these high growth industries that are forecasted to grow faster than average. These high growth occupations within high growth industries represent the greatest forecasted opportunities for employment growth in the U.S. economy between 2004 and 2014. Note, many of these occupations do exist in other industries, for example, there are computer support specialists in the mining industry. The number of employees in these occupations that they are projected to be adding, however, is nominal compared to the aforementioned high growth industries.

If the economy experiences shocks to industries with high concentrations of well-educated workers, the educational distribution of the unemployment profile may continue to level. Alternatively, these industries might just shed the jobs requiring less education. If in the future, industries with high concentrations of well-educated workers are immune to market shocks or experience only a mild impact, it could be that the future educational attainment unemployment distributions returns to the pre-2001 distribution. Alternatively, if industries with high educational attainment are susceptible to market shocks it would be more likely that the educational distribution would continue to level. I will discuss these potential outcomes in detail in the result section.

To reiterate, the Figure 4.6 summarizes the two-step process that has been outlined for this research by mapping each of the hypotheses to their respective data sets used to test each hypothesis.

Figure 4.6

Hypotheses, Data, Test Map



Source: Author

The first step was to describe who was impacted by the last three recessions and how the profiles of these unemployed people differ with regard to educational attainment, industry, and occupation. The second step was to determine if the changes in the unemployment profile are an anomaly or a permanent change in the nature of unemployment.

Chapter 5 – Results and Findings

In this section, I will report the results and findings of the calculations outlined in my research methodology. These results are in the form of statistical data, charts and tables, as well as an interpretation of this information. I will first review the results that help describe the changing face of unemployment then I will review the results that help forecast the future face of unemployment.

Describing the face of unemployment

A general belief is that if you have more education you are able to get a “safer” or “more secure” job than if you have less education. The better education / better job formula is thought to provide more insulation from the adverse effects of business cycles, particularly increases in unemployment during recessions. A detailed analysis of unemployment data from the past three recessions reveals that this formula seems to have held true for the recessions in the 1980’s and 1990’s. This relationship between educational attainment and job security began to deteriorate, however, in the 2001 recession. The changes in unemployment rates by educational attainment from the peak to the trough of the business cycle did not hold as in previous recessions.

There was a significant leveling of the increases in the unemployment rates across education groups – a “democratization” of unemployment – during the course of the last recession. To substantiate this assertion, we can turn to the results from testing the first two hypotheses, which were designed to help describe the changing face of unemployment. In doing so, the first hypothesis was intended to test whether or not the

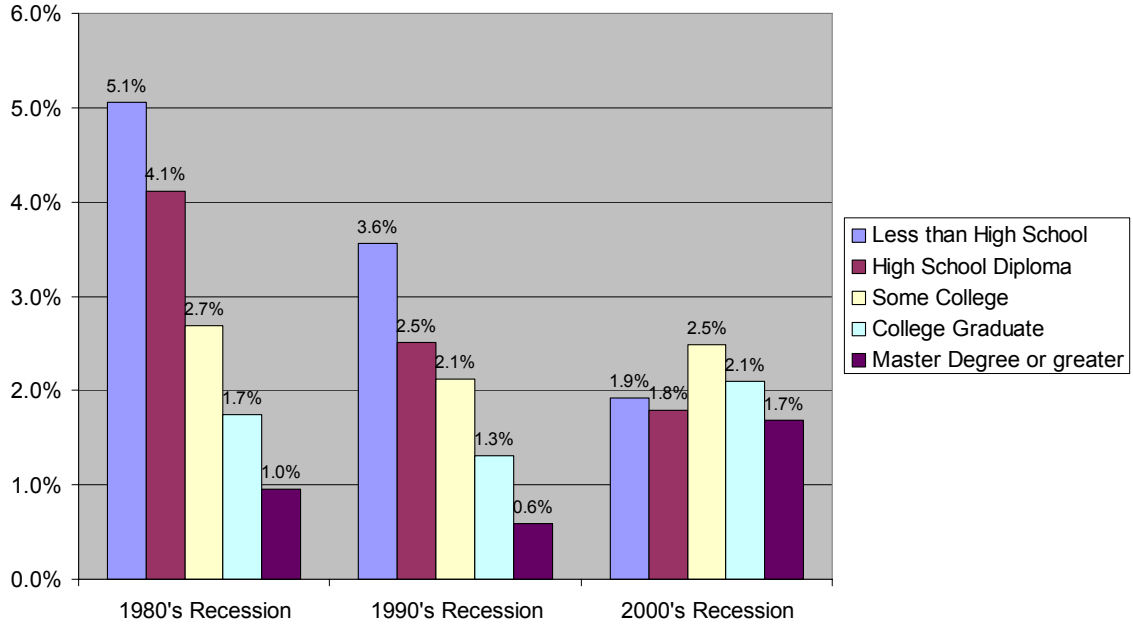
educational profile has changed and the second hypothesis was intended to test whether or not industries have significantly different educational requirements.

The first hypothesis questioned whether the educational profile of unemployed workers during the 2001 recession was significantly different from the educational profile of unemployed workers during previous recessions. A casual observation of Figure 5.1 below certainly suggests that there appears to have been a change. The 1980's recession shows a steep drop in the percentage point changes in unemployment rates as we move from workers without a high school diploma, down to workers with a Masters degree or greater. Although the percentage point increases in unemployment rates were not as large as the early 1980's recession, the 1990's recession exhibits a similar trend by educational attainment. The 2000's recession, however, shows a noticeably different shape. The unemployment rates across educational groups were visibly leveled. Workers with some college education as well as workers with a Bachelor's degree experienced a greater increase in their percentage point change in unemployment rates relative to the other educational groups.

Figure 5.1

Percentage Point Changes in Unemployment

	Less than High School	High School Diploma	Some College	College Graduate	Master Degree or greater	Average change
1980's Recession	5.1%	4.1%	2.7%	1.7%	1.0%	2.9%
1990's Recession	3.6%	2.5%	2.1%	1.3%	0.6%	2.0%
2000's Recession	1.9%	1.8%	2.5%	2.1%	1.7%	2.0%



Source: Author's calculations using BLS CPS data

To test whether or not these visible differences in unemployment rate changes were statistically significant, I used the t-test procedures outlined in Chapter 4. The first question was whether the unemployment rate for a given educational group (e.g. high school dropouts) significantly rose between the peak and the trough of the labor market cycle. Table 5.1 provides the t statistics for each time period and educational attainment group.

Table 5.1

T-test Results of Changes in Unemployment Rates from Peak to Trough for Given Education Groups

*** Two-tailed t-test of significance must be 2.58 or greater at the .01 level
** Two-tailed t-test of significance must be 1.96 or greater at the .05 level
* Two-tailed t-test of significance must be 1.65 or greater at the .1 level

1980's Less HS, peak to trough	17.16 **
1980's HS diploma, peak to trough	22.75 **
1980's Some college, peak to trough	12.19 **
1980's College graduate, peak to trough	8.76 **
1980's Masters or higher, peak to trough	4.58 **

1990's Less HS, peak to trough	10.91 **
1990's HS diploma, peak to trough	15.58 **
1990's Some college, peak to trough	12.24 **
1990's College graduate, peak to trough	8.03 **
1990's Masters or higher, peak to trough	3.42 **

2000's Less HS, peak to trough	6.38 **
2000's HS diploma, peak to trough	13.65 **
2000's Some college, peak to trough	19.66 **
2000's College graduate, peak to trough	16.74 **
2000's Masters or higher, peak to trough	11.15 **

Source: Author's calculations using CPS data

All t statistics were significant at the .01 level for all education groups in all three labor market recessions. Indeed, the unemployment rate for all educational groups rose significantly between the peak and the trough of the labor market cycle. In other words, through each of the last three labor market recessions, workers in all educational groups experienced a significant rise in their unemployment rates.

The second question was whether the size of the percentage point changes in unemployment rates between educational groups during a given cycle significantly differ from one another. Table 5.2 provides the t statistics for each time period and educational attainment combination.

Table 5.2

T-test Results Within Recessions

*** Two-tailed t-test of significance must be 2.58 or greater at the .01 level
** Two-tailed t-test of significance must be 1.96 or greater at the .05 level
* Two-tailed t-test of significance must be 1.65 or greater at the .1 level

	1980's Less HS	1980's HS diploma	1980's Some college	1980's College graduate	1980's Masters or higher
1980's Less HS	NA	2.02 **	4.55 ***	6.41 ***	8.28 ***
1980's HS diploma	2.02 **	NA	3.45 ***	5.91 ***	8.43 ***
1980's Some college	4.55 ***	3.45 ***	NA	2.10 **	4.28 ***
1980's College graduate	6.41 ***	5.91 ***	2.10 **	NA	2.14 **
1980's Masters or higher	8.28 ***	8.43 ***	4.28 ***	2.14 **	NA

	1990's Less HS	1990's HS diploma	1990's Some college	1990's College graduate	1990's Masters or higher
1990's Less HS	NA	2.11 **	2.84 ***	4.41 ***	5.65 ***
1990's HS diploma	2.11 **	NA	1.2	3.71 ***	5.62 ***
1990's Some college	2.84 ***	1.20	NA	2.39 **	4.30 ***
1990's College graduate	4.41 ***	3.71 ***	2.39 **	NA	2.01 **
1990's Masters or higher	5.65 ***	5.62 ***	4.30 ***	2.01 **	NA

	2000's Less HS	2000's HS diploma	2000's Some college	2000's College graduate	2000's Masters or higher
2000's Less HS	NA	0.22	1.31	0.44	0.42
2000's HS diploma	0.22	NA	2.68 ***	1.15	0.35
2000's Some college	1.31	2.68 ***	NA	1.56	2.80 ***
2000's College graduate	0.44	1.15	1.56	NA	1.4
2000's Masters or higher	0.42	0.35	2.80 ***	1.4	NA

Source: Author's calculations using CPS data

Significant differences in unemployment rate changes were found across all 10 educational attainment combinations for the 1980's recession as well as for 9 of the 10 educational attainment combinations for the 1990's recession (in the 1990's, the difference in unemployment rate changes between the Some college group and the High School diploma group was not significant) . For the 2000's recession, however, significant differences in unemployment rate changes were found for only 2 of the 10 educational attainment combinations: (1) Some college versus High School Diploma and (2) Some college versus Masters or higher degree. Thus, the large visible differences in the percentage point changes in unemployment rates for workers in the 1980's recession and 1990's recession were statistically significant, while most of these differences were erased in the 2000's recession. The percentage point increases in unemployment rates were indeed more evenly distributed across all educational groups during the last recession.

Workers in the "Some college" educational attainment group fared the worst during the last recession in terms of their percentage point increases in unemployment rates. Somewhat surprisingly, workers with only a high school diploma – less education – experienced a significantly smaller increase in their unemployment rates compared to workers with some college education. Additionally, workers with less than a high school diploma, a high school diploma, a Bachelors degree, and a Masters degree all experienced statistically comparable increases in their unemployment rates. In other words, workers with a Masters degree had no better protection from the effects of the recession than did a high school diploma – or even no diploma at all.

The final question was whether the changes in the unemployment rates significantly differed between two recessions for a given educational group. Table 5.3 provides the t-scores for each time period and educational attainment combination.

Table 5.3

T-test Results Between Recessions

* Two-tailed t-test of significance must be 2.58 or greater at the .01 level
** Two-tailed t-test of significance must be 1.96 or greater at the .05 level
*** Two-tailed t-test of significance must be 1.65 or greater at the .1 level

	1990's Less HS	1990's HS diploma	1990's Some college	1990's College graduate	1990's Masters or higher
1980's Less HS	2.38 **	5.41 *	6.14 *	7.39 *	9.16 *
1980's HS diploma	4.66 *	4.66 *	5.65 *	7.20 *	9.77 *
1980's Some college	1.55	0.52	1.51	3.60 *	5.23 *
1980's College graduate	1.35	1.89 ***	3.24 *	1.35	3.12 *
1980's Masters or higher	0.80	4.44 *	3.24 *	1.11	0.80

	2000's Less HS	2000's HS diploma	2000's Some college	2000's College graduate	2000's Masters or higher
1980's Less HS	5.35 *	7.13 *	5.64 *	6.52 *	7.13 *
1980's HS diploma	7.24 *	7.24 *	5.08 *	6.37 *	7.10 *
1980's Some college	0.55	2.46 **	0.55	1.91 ***	2.61 *
1980's College graduate	0.87	0.00	4.79 *	0.87	0.27
1980's Masters or higher	2.25 **	2.67 *	4.79 *	3.61 *	2.25 **

	2000's Less HS	2000's HS diploma	2000's Some college	2000's College graduate	2000's Masters or higher
1990's Less HS	2.70 *	3.57 *	2.19 **	2.99 *	3.67 *
1990's HS diploma	2.37 **	2.37 **	0.00	1.38	2.53 **
1990's Some college	1.32	0.98	1.32	0.00	1.22
1990's College graduate	2.74 *	1.69 ***	6.15 *	2.74 *	1.26
1990's Masters or higher	3.31 *	3.85 *	6.15 *	4.87 *	3.31 *

Source: Author's calculations using CPS data

Between the 1980's recession and the 1990's recession, the percentage point changes in unemployment rates were smaller for all five educational groups, but not all were significant differences. Workers with less than a high school diploma as well as workers with a high school diploma both observed significant differences in the percentage point change in their unemployment rates between the 1980's and 1990's recessions. Conversely, workers with some college education, college graduates, and a masters degree or higher observed no significant differences in the percentage point changes in their unemployment rates between the 1980's and 1990's recessions.

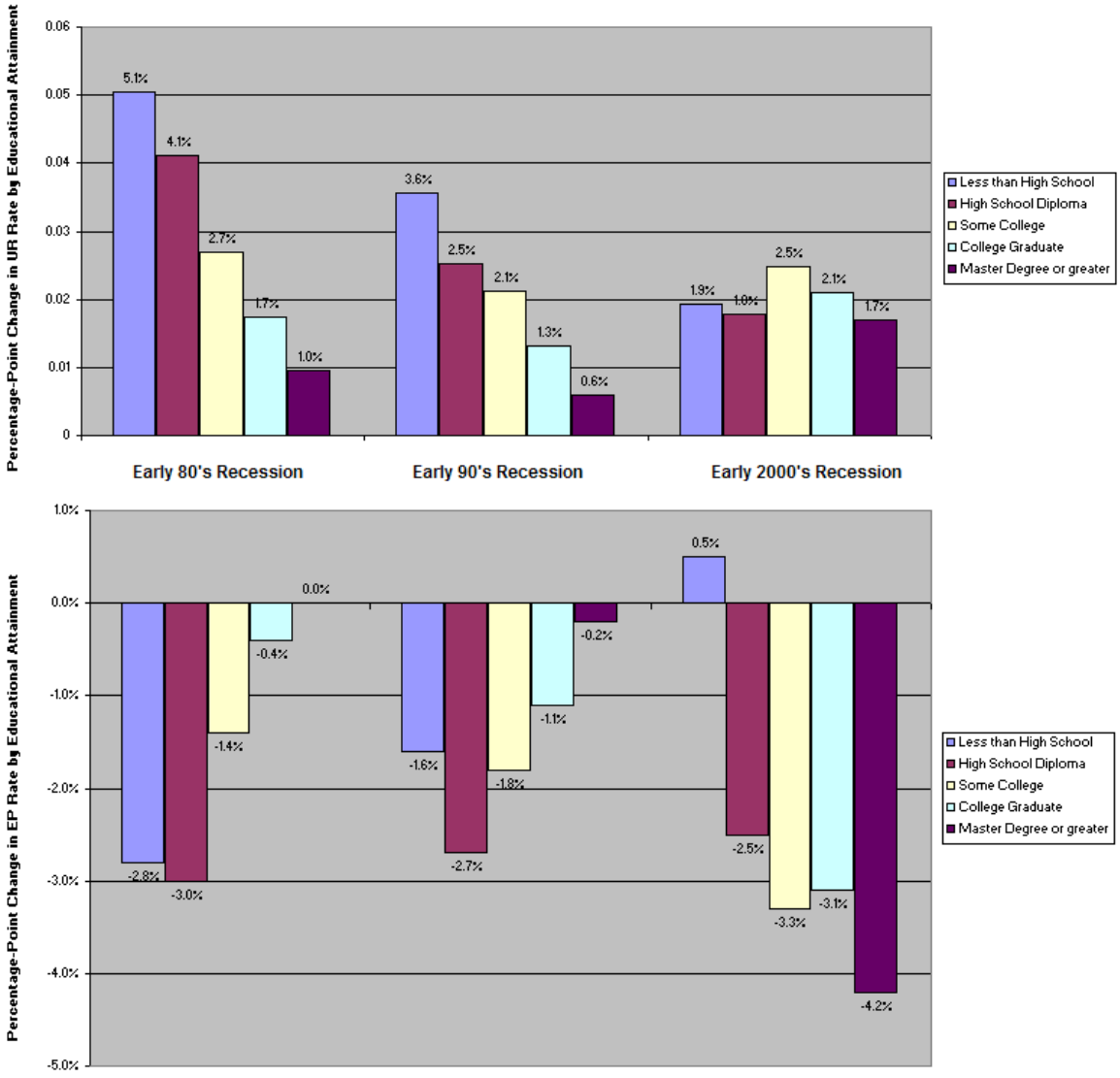
Between the 1980's and 2000's recessions, however, workers with less than a high school diploma as well as workers with a high school diploma observed significantly smaller percentage point changes in their unemployment rates. Workers with a Master's degree or higher observed a significantly larger increase in the percentage point changes in their unemployment rates. Conversely, workers with some college education and college graduates observed no significant differences in the percentage point change in their unemployment rates between the 1980's and 2000's recessions.

Workers with less than a high school diploma, a high school diploma, college graduates as well as workers with a Master's degree or higher observed significant differences in the percentage point change in unemployment rates between the 1990's and 2000's recessions. Conversely, workers with some college education observed no significant differences in the percentage point change in unemployment rates between the 1990's and 2000's recessions.

To further illustrate the labor market experiences of these five education groups, Figure 5.2 compares the percentage point change in unemployment rates by education attainment to the percentage point change in the employment-population ratio of each educational attainment group. The employment-population ratio is the proportion of employed persons to the total civilian, non-institutionalized population. Also termed the “employment rate” by some analysts, the employment population ratio is used as an additional gauge of the utilization of labor resources.

Figure 5.2

Percentage point Changes in Unemployment Rates Compared to Percentage point Changes in Employment-population Ratios by Educational Attainment



Source: Author's calculations using CPS data

Historically, less educated workers were more likely to drop out of the labor force during recessions while simultaneously experiencing increases in their unemployment rates. In

the early 2000's recession, the most educated (workers with a Masters degree or higher) had the greatest drop in their employment-population ratio while high school dropouts actually increased their employment rate. In other words, more people with a Masters degree or higher were dropping out of the labor force at a relatively high rate.

Turning now to the second hypothesis, the question asked was whether industries have substantially different educational requirements. Table 5.4 illustrates the educational distribution of workers by major industry groups (NAICS second level). The percentages represent the percentage of workers within the industry who have achieved a given level of educational attainment. Note that the Natural Resources and Mining sector (NAICS code S10) was reduced to only the Mining industry (NAICS code 21) given the lack of reported educational attainment data for the rest of the sector.

I have grouped the distributions into two additional categories – the percentage of workers who have less than a Bachelors degree and the percentage of workers who have a Bachelors degree and above. Additionally, I have organized the eighteen industries into three educational attainment groups: (1) an "Upper Third" group representing the six industries with the highest average educational attainment, (2) a "Lower Third" group representing the six industries with the lowest average educational attainment, and (3) a "Middle Third" group representing the six industries with average educational attainments between the Upper Third and Lower Third group.

Obvious differences are apparent between the industries. The Educational Services industry has the highest concentration of workers with a Bachelors degree and above

(62.9 percent) where as the Accommodation and Food Services industry has the lowest concentration of workers with a Bachelors degree and above (10.4 percent). The Educational Services industry has more than 6 times the percentage of workers with a Bachelors degree or greater. Between these two high and low end points, the other 16 sectors of the economy fill a gradual yet consistent educational attainment continuum.

Table 5.4

Educational Distribution by Industry, NAICS Level 2

Industry	NAICS Code	Less than High School	High School Graduate	Post High School	Associate Degree	Less than Bachelors	Bachelors Degree	Masters Degree	Professional Degree	PhD	Bachelors and above
Educational Services	61	3.1%	13.0%	15.5%	5.5%	37.1%	28.8%	27.1%	1.7%	5.3%	62.9%
Professional, Scientic and Technical	54	1.9%	10.7%	17.2%	8.2%	38.0%	35.5%	14.0%	9.5%	3.0%	62.0%
Management of Companies and Enterprises	55	3.4%	15.4%	20.8%	8.3%	47.9%	35.9%	12.8%	2.4%	1.0%	52.1%
Finanace and Insurance	52	1.6%	19.3%	24.9%	8.9%	54.7%	34.1%	9.1%	1.6%	0.5%	45.3%
Information	51	4.5%	19.2%	24.5%	9.0%	57.2%	31.3%	10.0%	0.8%	0.7%	42.8%
Health Care and Social Assistance	62	6.6%	21.9%	21.9%	14.8%	65.2%	19.0%	7.6%	6.5%	1.6%	34.7%
Upper Third Average		**3.5%**	**16.6%**	**20.8%**	**9.1%**	**50.0%**	**30.8%**	**13.4%**	**3.8%**	**2.0%**	**50.0%**
Real Estate, Rental and Leasing	53	7.2%	24.9%	26.5%	8.4%	67.0%	25.3%	6.1%	1.2%	0.4%	33.0%
Arts, Entertainment and Recreation	71	13.3%	24.9%	26.6%	7.1%	71.9%	21.0%	5.8%	0.6%	0.6%	28.0%
Wholesale Trade	42	10.2%	31.5%	23.4%	7.9%	73.0%	21.9%	4.3%	0.5%	0.3%	27.0%
Utilities	22	4.4%	32.7%	26.5%	10.9%	74.5%	18.7%	6.1%	0.4%	0.3%	25.5%
Manufacturing	31-33	14.4%	36.3%	19.4%	7.5%	77.6%	15.9%	5.3%	0.4%	0.8%	22.4%
Other Services (Except Public Administration)	81	15.7%	33.5%	22.1%	7.4%	78.7%	13.4%	5.7%	1.3%	0.9%	21.3%
Middle Third Average		**10.9%**	**30.6%**	**24.1%**	**8.2%**	**73.8%**	**19.4%**	**5.6%**	**0.7%**	**0.6%**	**26.2%**
Mining	21	13.5%	41.0%	21.0%	6.1%	81.6%	12.9%	4.3%	0.5%	0.7%	18.4%
Administrative Support and Waste Managemen	56	20.2%	33.7%	22.0%	7.3%	83.2%	13.5%	2.7%	0.5%	0.2%	16.9%
Retail Trade	44-45	13.6%	35.9%	27.0%	7.2%	83.7%	13.4%	2.1%	0.6%	0.3%	16.4%
Transportation and Warehousing	48-49	11.0%	39.1%	26.4%	8.0%	84.5%	12.8%	2.2%	0.3%	0.1%	15.4%
Construction	23	22.3%	41.1%	19.9%	5.9%	89.2%	8.9%	1.5%	0.3%	0.1%	10.8%
Accomodation and Food Services	72	26.8%	33.3%	24.1%	5.4%	89.6%	9.0%	1.1%	0.2%	0.1%	10.4%
Lower Third Average		**17.9%**	**37.4%**	**23.4%**	**6.7%**	**85.3%**	**11.8%**	**2.3%**	**0.4%**	**0.3%**	**14.7%**

Source: Author's calculations using CPS data

Furthermore, noticeable differences also occur within industry groups. Table 5.5 outlines the differences in educational attainment between industries within three different second level NAICS codes: educational services (NAICS code 61), manufacturing (NAICS codes 31-33), and accommodation and food services (NAICS code 72). Within the educational services industry, colleges, universities, and professional schools (NAICS code 6113) 15.6 percent of the workforce has a PhD whereas 1.1 percent of the workforce in the elementary and secondary schools (NAICS code 6111) has a PhD. Below each industry group I have calculated the percentage point difference between the industry subgroups. For example, 35.4 percent more workers in the pharmaceutical and medicine manufacturing industry have a Bachelors degree and above compared to workers in the beverage manufacturing industry.

Table 5.5

Educational Distribution within NAICS Level 3

Industry	NAICS Code	Less than High School	High School Graduate	Post High School	Associate Degree	Less than Bachelors	Bachelors Degree	Masters Degree	Professional Degree	PhD	Bachelors and above
Beverage manufacturing	3121	9.4%	34.2%	21.3%	8.6%	73.4%	19.3%	6.3%	0.5%	0.5%	26.6%
Pharmaceutical and medicine manufacturing	3254	3.0%	15.6%	12.9%	6.5%	38.0%	34.5%	17.5%	2.7%	7.3%	62.0%
Percentage Point Difference		**6.3%**	**18.5%**	**8.4%**	**2.2%**	**35.4%**	**-15.2%**	**-11.2%**	**-2.2%**	**-6.8%**	**-35.4%**
Elementary and secondary schools	6111	3.6%	14.8%	11.9%	5.3%	35.5%	31.6%	30.6%	1.2%	1.1%	64.5%
Colleges and universities, including junior colleges	6113	1.8%	9.1%	22.6%	5.6%	39.0%	21.6%	20.9%	3.0%	15.6%	61.0%
Percentage Point Difference		**1.8%**	**5.7%**	**-10.7%**	**-0.3%**	**-3.5%**	**10.1%**	**9.7%**	**-1.8%**	**-14.5%**	**3.5%**
Restaurants and other food services	7221	28.4%	33.3%	24.2%	5.0%	90.9%	8.0%	0.9%	0.2%	0.1%	9.1%
Drinking places, alcoholic beverages	7224	13.9%	32.6%	32.0%	7.1%	85.6%	12.6%	1.2%	0.4%	0.2%	14.4%
Percentage Point Difference		**14.5%**	**0.7%**	**-7.8%**	**-2.2%**	**5.3%**	**-4.6%**	**-0.3%**	**-0.2%**	**-0.2%**	**-5.3%**

Source: Author's calculations using CPS data

After reviewing the educational attainment distributions of various industry groups it is clear that industries do indeed have different educational requirements. These differences are evident when considering both highly aggregated industry groups as well as similar industries within a given industry sector. As previously stated, these differences are a function of the occupational composition of the industry given that different occupations have different educational requirements.

In addition to unemployment rates, another important measure of the effects of recessions on labor markets is changes in employment levels. Given that the official unemployment rates exclude people who have dropped out of the labor force, evaluating changes in employment levels can provide further insight into the magnitude of the impact of a recession. By analyzing both unemployment rate changes, employment-population ratios and employment level changes, one can build a more accurate picture of a recession's full impact on the labor force.

In the 1980's recession, the two industries hit the hardest were construction and manufacturing – both with double-digit losses in percentage terms of their employment levels. In the 1990's recession construction was the only double-digit loser, with mining and manufacturing a distant second and third. In both of these recessions the industries hit hardest employed an above average share of workers in the lower end of the educational attainment distribution, thus supporting the "more education, more safety" idea. In the early 2000's recession, however, the fate of the more educated workers was not as bright. The two industries with double-digit losses were in the manufacturing sector and the information sector. This was the first time an industry with a high

concentration of highly educated workers experienced such losses. Furthermore, the professional and business services sector came in third in terms of the percentage of job losses whereas in previous recessions, employment levels in this sector either grew or had only minor losses.

Table 5.6 combines the educational attainment distribution of employment by industry estimates (CPS data) with the change in employment level estimates by industry (CES data) to estimate the relative job loss by educational attainment over the last three recessions (numbers in thousands). Given that the size of the labor market grew between each recession, calculating the percentage share of employment loss provides better insight into the relative impact on each educational attainment level. Note that only the NAICS first level industries were used due to the fact that CES data prior to 1990 is not available for some NAICS second level industries (e.g. educational services and arts & entertainment). The column “Less than Bachelors” is the summation of the four educational levels below a Bachelors degree. The column “Bachelors and above” is the summation of the four educational levels from a Bachelors degree through a PhD.

Table 5.6

Relative Job Loss by Industry and Educational Attainment

Industry	Change in Employment Level During 1980's Recession	Percent Change	Less than High School	High School Grad	Post High School	Associate Degree	Less than Bachelors	Bachelors Degree	Masters Degree	Professional Degree	PhD	Bachelors and above
Information	-114	-4.9%	-5.2	-21.9	-27.9	-10.2	-65.1	-35.7	-11.5	-0.9	-0.8	-48.9
Professional and Business Services	342	4.4%	31.0	67.4	65.3	26.9	190.5	92.2	32.8	20.1	6.4	151.5
Financial Activities	242	4.7%	7.9	50.8	61.5	21.2	141.4	76.2	19.9	3.5	1.1	100.6
Mining	9	0.8%	1.2	3.7	1.9	0.6	7.3	1.2	0.4	0.0	0.1	1.7
Education and Health Services	564	7.7%	29.0	102.7	108.5	61.6	301.8	130.2	88.4	25.6	18.0	262.2
Other Services	215	7.5%	33.7	72.1	47.5	16.0	169.3	28.8	12.3	2.8	1.8	45.7
Manufacturing	-2527	-13.5%	-347.9	-914.8	-496.3	-194.0	-1952.9	-405.0	-138.8	-10.9	-19.3	-574.1
Trade, Transportation, Utilities	-191	-1.0%	-23.1	-68.3	-50.2	-14.6	-156.2	-28.3	-5.0	-1.0	-0.4	-34.8
Construction	-600	-14.0%	-133.6	-246.8	-119.5	-35.3	-535.3	-53.5	-8.8	-1.9	-0.5	-64.7
Leisure and Hospitality	152	2.2%	36.0	47.7	37.5	8.8	129.9	17.9	3.4	0.5	0.3	22.1
Total employment level change	**-1908**		**-371.0**	**-907.4**	**-371.7**	**-119.2**	**-1769.3**	**-176.1**	**-6.9**	**37.9**	**6.5**	**-138.7**
Share of employment level change in 1980's recession			**19.4%**	**47.6%**	**19.5%**	**6.2%**	**92.7%**	**9.2%**	**0.4%**	**-2.0%**	**-0.3%**	**7.3%**

Industry	Change in Employment Level During 1990's Recession	Percent Change	Less than High School	High School Grad	Post High School	Associate Degree	Less than Bachelors	Bachelors Degree	Masters Degree	Professional Degree	PhD	Bachelors and above
Information	-42	-1.6%	-1.9	-8.1	-10.3	-3.8	-24.0	-13.2	-4.2	-0.3	-0.3	-18.0
Professional and Business Services	-105	-1.0%	-9.5	-20.7	-20.0	-8.2	-58.5	-28.3	-10.1	-6.2	-2.0	-46.5
Financial Activities	-92	-1.4%	-3.0	-19.3	-23.4	-8.1	-53.7	-29.0	-7.6	-1.3	-0.4	-38.3
Mining	-53	-7.8%	-7.1	-21.7	-11.1	-3.3	-43.3	-6.8	-2.3	-0.3	-0.4	-9.7
Education and Health Services	942	8.6%	48.5	171.6	181.1	102.9	504.1	217.5	147.7	42.8	30.0	437.9
Other Services	-45	-1.1%	-7.1	-15.1	-9.9	-3.3	-35.4	-6.0	-2.6	-0.6	-0.4	-9.6
Manufacturing	-1039	-5.9%	-143.0	-376.1	-204.1	-79.8	-803.0	-166.5	-57.1	-4.5	-7.9	-236.0
Trade, Transportation, Utilities	-569	-2.5%	-68.8	-203.6	-149.6	-43.5	-465.4	-84.4	-15.0	-2.8	-1.3	-103.6
Construction	-780	-14.8%	-173.7	-320.9	-155.3	-46.0	-695.8	-69.6	-11.4	-2.5	-0.7	-84.2
Leisure and Hospitality	21	0.2%	5.0	6.6	5.2	1.2	17.9	2.5	0.5	0.1	0.0	3.1
Total employment level change	**-1762**		**-360.8**	**-807.2**	**-397.4**	**-91.7**	**-1657.2**	**-183.9**	**38.0**	**24.3**	**16.7**	**-104.8**
Share of employment level change in 1990's recession			**20.5%**	**45.8%**	**22.6%**	**5.2%**	**94.0%**	**10.4%**	**-2.2%**	**-1.4%**	**-0.9%**	**6.0%**

Industry	Change in Employment Level During Early 2000's Recession	Percent Change	Less than High School	High School Grad	Post High School	Associate Degree	Less than Bachelors	Bachelors Degree	Masters Degree	Professional Degree	PhD	Bachelors and above
Information	-531	-14.3%	-24.1	-101.8	-129.9	-47.6	-303.4	-166.4	-53.3	-4.4	-3.5	-227.6
Professional and Business Services	-847	-5.1%	-76.7	-166.8	-161.6	-66.5	-471.7	-228.3	-81.3	-49.9	-15.8	-375.3
Financial Activities	259	3.3%	8.5	54.4	65.8	22.7	151.3	81.6	21.3	3.7	1.1	107.7
Mining	-24	-4.5%	-3.2	-9.8	-5.0	-1.5	-19.6	-3.1	-1.0	-0.1	-0.2	-4.4
Education and Health Services	1268	8.2%	65.3	230.9	243.8	138.5	678.5	292.7	198.8	57.6	40.4	589.5
Other Services	202	3.9%	31.7	67.7	44.7	15.0	159.1	27.0	11.5	2.6	1.7	42.9
Manufacturing	-2774	-16.4%	-381.9	-1004.2	-544.8	-213.0	-2143.8	-444.6	-152.4	-12.0	-21.2	-630.2
Trade, Transportation, Utilities	-1125	-4.3%	-136.1	-402.5	-295.8	-85.9	-920.3	-167.0	-29.6	-5.6	-2.6	-204.7
Construction	-60	-0.9%	-13.4	-24.7	-11.9	-3.5	-53.5	-5.4	-0.9	-0.2	-0.1	-6.5
Leisure and Hospitality	170	1.4%	40.2	53.3	41.9	9.8	145.3	20.0	3.8	0.6	0.3	24.7
Total employment level change	**-3462**		**-489.8**	**-1303.4**	**-752.9**	**-232.0**	**-2778.1**	**-593.2**	**-83.2**	**-7.7**	**0.2**	**-683.9**
Share of employment level change in early 2000's recession			**14.1%**	**37.6%**	**21.7%**	**6.7%**	**80.2%**	**17.1%**	**2.4%**	**0.2%**	**0.0%**	**19.8%**

Source: Author's calculations using CPS and CES data

The share of employment loss for workers in the 1980's and 1990's recession was similar. In both the 1980's recession and the 1990's recession workers with less than a Bachelors degree represented between 93 and 94 percent of the employment level losses while workers with a Bachelors degree and above represented approximately 7 and 6 percent respectively. This pattern changed in the most recent recession. Workers with a Bachelors degree and above represented close to 20 percent of the employment level loss – approximately 3 times the share compared to previous recessions.

This change is even more striking when you exclude Bachelors degrees and just look at the workers with Masters, Professional Degrees, and PhDs. In the 1980's workers with Masters degree had mild losses while workers with a professional degree added a substantial number of jobs. In the 1990's both workers with a Masters degree and a professional degree added jobs. In the 2000's recession, however, both workers with a Masters or Professional degree experienced a net reduction in their total employment levels. For PhDs in the 2000's recession, although they still added jobs it was predominantly in the educational and health services sectors, which masked the reduction of employees with PhDs in other industries such as professional services, manufacturing, information, and trade. Conversely, although workers with less than a high school diploma, workers with a high school diploma, and workers with some form of post high school education still had the highest percent share of the employment level losses, all three showed smaller relative losses in the 2000's recession than in the previous recessions. Was this a permanent change in the nature of unemployment? Let

us explore further why this might be the case by forecasting what the educational distribution of unemployment might look like in the future.

Forecasting the face of unemployment

It is possible that the democratization of unemployment that occurred in the 2000's recession was likely not a one-time event, but the turning point of a trend that could continue in future recessions depending on the market shocks experienced in the future. Based on my hypothesis, this would all depend on the nature of market shocks experienced in the future. Assessing the likelihood of this more egalitarian sharing of unemployment and employment level losses is the focus of my third hypothesis, namely whether the future face of unemployment will be different from the current one. More specifically, to forecast whether the changing educational profile of unemployed workers during the 2001 recession likely represented a permanent change in the nature of unemployment.

To answer this question I rely on data from the *Office of Occupational Statistics and Employment Projections*, the *National High Growth Industries* initiative, and O*NET in order to paint a picture of what the future job market might look like. In doing so, I attempt to answer two questions: (1) what might the occupational and educational composition of the U.S. workforce look like in 2014? and (2) what is the occupational and educational composition of industries likely to experience growth? Using the methods outlined above in Chapter 4, Table 5.7 combines forecasted employment level growth between 2004 and 2014 with the corresponding educational distribution of the workforce (numbers in thousands). The number of employed college graduates in 2014 is estimated to be 40.4 million, an increase of 7 million college educated workers over

the 2004 number. The number of employed workers with a high school diploma or less, however, is forecast to increase by just 8.8 million workers.

Table 5.7

2004 to 2014 Employment Growth and Educational Distribution

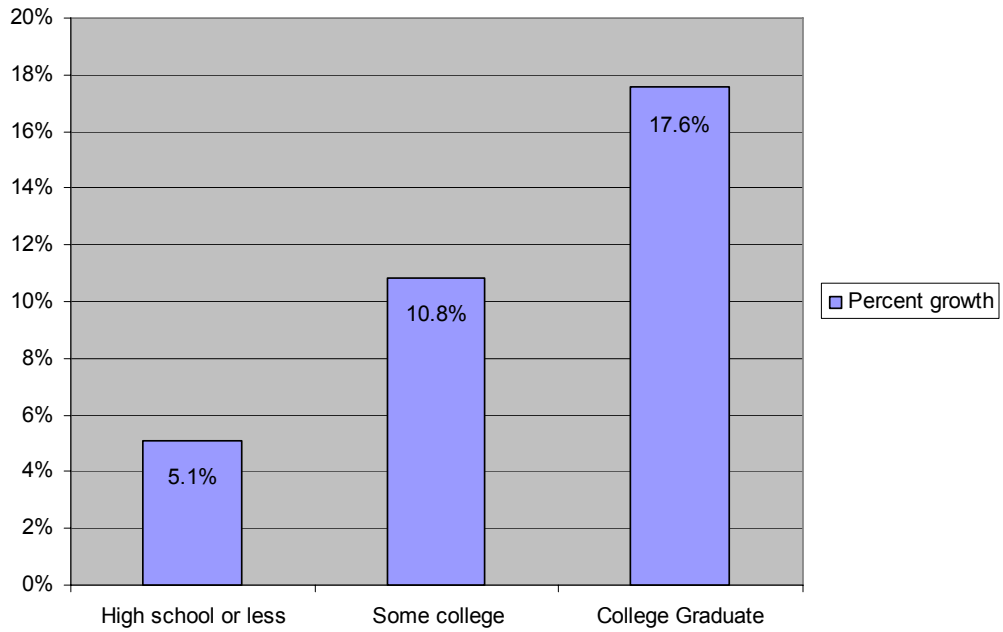
Employment Level	Employment level by educational attainment					
Year	High school or less	% of Employment	Some College	% of Employment	College Graduate	% of Employment
Employment level in 2004	87,107	60%	25,113	17%	33,397	23%
Employment level in 2014	95,786	58%	28,299	17%	40,469	25%
Total change	**8,679**		**3,186**		**7,072**	
Percent change	**5.1%**		**10.8%**		**17.6%**	

Source: Author's calculations using OSEP data

Although the increase in the total number of workers with a high school diploma or less will be greater than the total number of any other individual educational group, the percent growth in employment levels for college graduates and above is much greater. The following graph highlights the much greater rate of employment level growth for college graduates and above. For example, by 2014 the percentage of workers with a Bachelors degree and above is projected to increase by 17.6 percent while workers with a high school diploma or less are forecasted to grow by only 5.1 percent – a growth rate less than three times as fast as better educated workers.

Figure 5.4

Percent Growth in Employment Levels, Educational Attainment



Source: Author's calculations using OSEP data

This growth in employment levels for college graduates is driven largely by 140 occupations that are projected to grow more than 20 percent between 2004 and 2014. Table 5.8 combines the expected occupational growth with the corresponding educational distribution of those occupations. Of the occupations experiencing more than 20 percent growth in employment levels between 2004 and 2014, 46 percent of the workers in those occupations are college graduates. Conversely, of the occupations experiencing more than a 20 percent decline in employment levels between 2004 and 20014, 66 percent of the workers in those occupations have a high school diploma or less.

Table 5.8

Estimated Occupational Growth from 2004 to 2014

Forecast of occupational growth			Forecast of educational distribution		
Growth distribution	Number of occupations	Change in employment, thousands	High school or less	Some College	College Graduate
More than 20% growth	140	8,048	23	31	46
0 - 20% growth	477	31,240	41	26	34
0 - 20% decline	111	-846	55	28	12
More than 20% decline	27	-587	66	26	8

Source: Author's calculations using OSEP data

Worth noting is that there were no high growth occupations within the automotive industry while information technology, health care, and biotechnology had the highest concentrations of high growth occupations. These include occupations such as Veterinary Technologists and Technicians, Computer Software Engineers, and Registered Nurses. These occupations have high concentrations of highly educated workers.

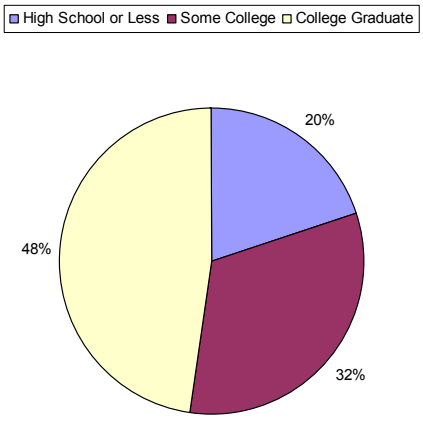
This change in educational composition is a function of changes in the occupational composition of the job market, which in turn is driven by the industrial composition of the economy. This educational shift is also driven by changes within occupations as well as increased domestic competition for the better jobs. For example, a customer service representative today must have a basic understanding of computer technology whereas 20 years ago such a requirement did not exist.

The industrial composition of the U.S. economy has always evolved. *The National High Growth Industries* initiative has identified 14 industries in particular that are likely to experience growth or at least maintain strategic importance to the national economy. As

previously stated, the 14 identified high growth industries are: advanced manufacturing, aerospace, automotive, biotechnology, construction, energy, financial services, geospacial technology, health care, Homeland Security, hospitality, information technology, retail, and transportation. Figure 5.5 merges data from *Office of Occupational Statistics and Employment Projections*, the *National High Growth Industries* initiative, and O*NET. When focusing on the *National High Growth* industries, the shift in job growth towards occupations with college graduates remains consistent. Within these 14 industries there are 70 occupations that are forecast to grow either "faster than average" or "much faster than average" when compared to the economy as a whole. Occupations with workers having a high school diploma or less are forecast to grow by 20 percent, while occupations with workers having some college education are forecasted to grow by 32 percent, and workers with a college degree or greater are forecasted to grow by 48 percent.

Figure 5.5

Occupational Growth in High Growth Industries



Source: Author's calculations using O*NET data

The table in Appendix B provides a detailed listing of the 70 occupations that are forecast to grow either “faster than average” or “much faster than average” when compared to the economy as a whole (*Occupational Statistics and Employment Projections* data) and aligns those occupations with the industries predominantly hiring those occupations (*National High Growth Industries* initiative data), along with each occupation’s corresponding educational attainment distribution (O*NET data).

A similar pattern emerges with the economy as whole, rather than just high growth industries. Table 5.9 provides the estimated change in employment levels of all major industry sectors between 2006 and 2016. The four industry sectors with the highest average, annual rate of employment gains are sectors with high concentrations of well-educated workers (see Table 5.5 for education attainment distributions by industry). The three sectors with an average annual rate of employment decline have moderate concentrations of workers with a Bachelors degree and above.

Table 5.9

Change in Industry Employment Levels between 2006 and 2016

Industry sector	Thousands of jobs		Numeric change	Average annual rate of change
	2006	2016	2006-16	2006-16
Health care and social assistance	14,919.80	18,954.10	4,034	2.4
Professional and business services	17,551.60	21,643.70	4,092	2.1
Educational services	2,918.40	3,527.40	609	1.9
Financial activities	8,363.20	9,570.10	1,207	1.4
Other services	6,234.60	7,077.20	843	1.3
Leisure and hospitality	13,143.40	15,016.70	1,873	1.3
Transportation and warehousing	4,465.80	4,962.00	496	1.1
Construction	7,688.90	8,469.60	781	1.0
Information	3,054.90	3,266.70	212	0.7
Wholesale trade	5,897.70	6,326.20	429	0.7
Retail trade	15,319.40	16,006.40	687	0.4
Mining	618.7	608.5	-10	-0.2
Utilities	548.5	517.6	-31	-0.6
Manufacturing	14,197.30	12,694.50	-1,503	-1.1

Source: Author's calculations using Employment Projections Program data

If my theory holds true – that the share of unemployment will continue to be driven by particular market shocks – then what we should see in the next recession is an allocation of unemployment based on the industries affected. Depending on the industries most affected by the recession, say residential construction and financial activities pertaining to credit intermediation, then the allocation of unemployment should follow suit with the educational composition of that particular industry.

The type of market shock leading to a recession will shed light on the subsequent unemployment profile. If the industries most affected by the shock are comprised of occupations requiring higher levels of education, there will be a more egalitarian spread of unemployment across the educational attainment groups. Market shocks may take the

form of sharp changes in interest rates, energy prices, currency valuations, availability of capital, or even the availability of work visas.

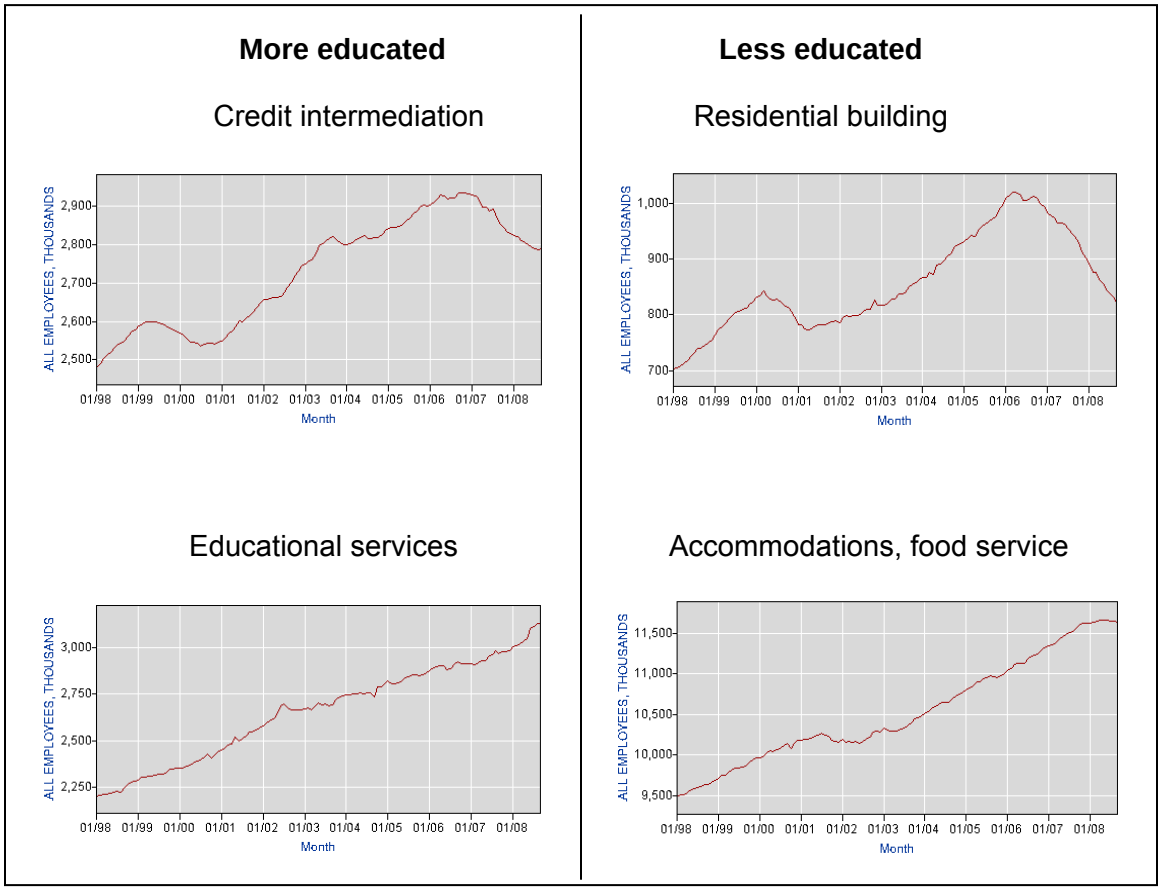
Using the interest rate example, sharp increases in interest rates would adversely affect industries in the durable goods manufacturing sector. The durable goods manufacturing sector does not have a high concentration of occupations requiring higher levels of education and thus this model would predict a more traditional, “non-democratic” allocation of unemployment. Alternatively, if the cap on H-1B visas was abolished, this labor supply shock would adversely affect the information and technical services sectors. The information and technical services sectors have a high concentration of occupations requiring higher levels of education, thus this model would predict greater numbers of unemployed workers with higher levels of educational attainment.

In order to get a better sense for what the future might hold, we shall compare and contrast the current experiences of four different industries – two “more educated” industries and two “less educated” industries. As of November 2008 two industries shedding jobs were residential building (less educated) and credit intermediation (more educated). At this same time, two industries believed to be doing relatively well compared to these industries are the educational services industry (more educated) and the accommodations and food service industry (less educated). Figure 5.6 illustrates the total employment levels (in thousands) for each of these four industries. Even though the credit intermediation industry has a higher concentration of workers with a Bachelors degree or higher as compared to the accommodations and food services industry, the credit intermediation industry was shedding jobs while the accommodations and food

service industry – the industry with the lowest level of workers with Bachelors degrees or higher – had been actually adding jobs. Similarly, the educational services industry, which has one of the highest concentrations of workers with a Bachelors degree or greater, and the accommodations and food service industry are both adding jobs at a comparable rate.

Figure 5.6

Comparative Employment Levels by Industry and Education



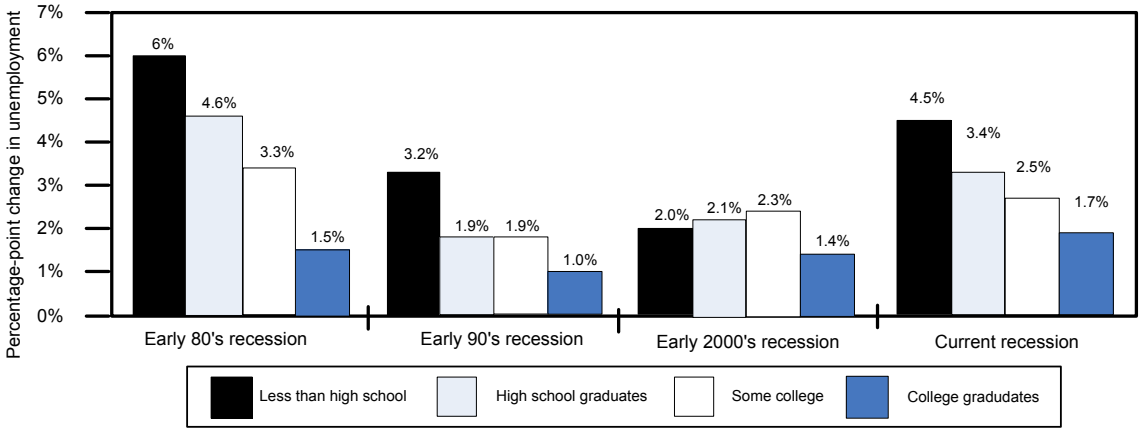
Source: BLS CES data, 2008

Although the current recession is still underway, what is the current distribution of the educational attainment rate of unemployment? Does the distribution match that of the

early 2000's recession or of previous recessions? Figure 5.7 provides the percentage point change in the unemployment rate from the employment level peak in December 2007 to the current employment level trough of January 2009 (latest data available). The shape of the percentage point change in the unemployment rate for the current recession is similar to the distribution in the early 1980's recession – there is a pronounced drop in the percentage point change in unemployment with increasing levels of education. Workers with less than a high school diploma are experiencing the highest percentage point change while workers with a Bachelors degree and above are currently experiencing the lowest percentage point increase in unemployment.

Figure 5.7

Percentage point change in unemployment rate



Source: Mishel, Bernstein, & Boushey, 2003 and Author's calculations using CPS data

When considering the industries affected by the current recession, this distribution is not surprising. In the early 1980's recession, the construction and manufacturing industries led all other industries in the decline in employment levels with a 14 percent drop for construction and a 13.5 percent drop in manufacturing. These two industries both have

relatively low concentrations of workers with a Bachelors degree and higher. Similar to the 1980's recession, these two industries are again leading the decline in the percentage of employment level declines in the current recession. Thus far, the construction industry has had a 10 percent decline in employment levels while the manufacturing industry has experienced an 8 percent decline in employment levels. Similarly, the trade, transportation, and utilities sector – also a sector with relatively low concentrations of workers with a Bachelors degree or higher – had the fourth greatest percent decline in employment levels in both the 1980's recession and the current recession. Table 5.10 compares the percent change in employment levels by industry of the 1980's recession and the current recession.

Table 5.10

Comparison of change in employment levels during 1980's and current recession

Industry	Change in Employment Level During 1980's Recession	Percent Change
Construction	-600	-14.0%
Manufacturing	-2527	-13.5%
Information	-114	-4.9%
Trade, Transportation, Utilities	-191	-1.0%
Mining	9	0.8%
Leisure and Hospitality	152	2.2%
Professional and Business Services	342	4.4%
Financial Activities	242	4.7%
Other Services	215	7.5%
Education and Health Services	564	7.7%

Industry	Change in employment level, thousands Current recession as of January 2009	Percent change
Construction	-781	-10%
Manufacturing	-1064	-8%
Professional and Business Services	-848	-5%
Trade, Transportation, Utilities	-985	-4%
Information	-105	-3%
Financial Activities	-269	-3%
Leisure and Hospitality	-266	-2%
Other Services	-44	-1%
Education and Health Services	573	3%
Mining	51	7%

Source: Author's calculations using CES data

There are also material differences between the 1980's recession and the current recession. In the 1980's recession the employment losses were concentrated in just four of the ten industries, with the other six industries showing employment level increases. The current recession, however, is much broader in terms of the industries affected. Eight of the ten industries are experiencing employment level losses. In other words, the current recession has a much more broad impact on the economy and labor market. As

a result of this broad impact, there is less concentration of employment level losses in any one particular industry and thus a wider variety of occupations.

Although no one can predict when the current recession will end or what the final educational attainment distribution of unemployment will look like, it appears as though the distribution of unemployment is indeed a function of the industries affected. If industries with low concentrations of workers with a Bachelors degree or higher are affected, then the educational attainment distribution may shift towards less educated workers. If industries with high concentrations of workers with a Bachelors degree or higher are affected, as happened in the early 2000's recession, then the educational attainment distribution may shift towards workers with higher levels of education.

Although getting more education is indeed good and necessary for a variety of reasons, in the future more education will not necessarily protect workers from economic downturns if the present types of market shocks continue. The question then is what is the probability that the industries being adversely affected by the current recession will likewise be adversely affected by future recessions? Put more precisely, which industries have prospects for future growth? What is the occupational composition of these industries? What are the educational requirements for the predominant occupations within these industries?

Forces influencing the changing educational composition of unemployment

Given that the manufacturing sector has been consistently shedding jobs over the last several decades, it comes as little surprise that this sector also shed jobs in the 2001

recession. Although the information sector had previously lost jobs in the 1980's and 1990's recessions, the losses were relatively mild. So why was the 2001 recession so different for workers in the information sector? The excessive investment in technology related businesses and the subsequent bursting of the Dot.com bubble was undoubtedly a market shock, but were there other factors influencing the educational attainment distribution of the unemployment rate?

There is no single reason why the face of unemployment changed in the 2001 recession. Once the changes in industrial and occupational composition of the employed as well as educational composition of the labor force have been accounted for, two prime suspects appear to be influencing these changes: technology and trade. The way that companies are getting work done may influence the changing face of unemployment. Technological innovation in the form of robotics, telecommunications, and software as well as trade influences such as offshoring and importing H-1B visa workers seem to play a role in the educational attainment distribution of unemployment. Technology influences the occupational and educational composition of the labor force by continuously changing the structure of work. For example, robotics in the automobile industry enables the production of more cars at lower costs with less labor. Similarly, software and telecommunications advances enable information publishing organizations to produce more content, faster, with less labor. Trade influences the occupational and educational composition of the labor force by either importing or exporting work to at least cheaper, and perhaps even better skilled labor in countries other than the United States. For example, India has grown to be a significant market for providing well-educated, low cost labor for information technology services (Friedman, 2005). Exporting work outside the

United States or importing labor from other countries has been associated with increases in unemployment domestically (Blinder, 2006).

Technological Influences

Many authors have emphasized the role of technological change in recent decades, which may interact with rising educational attainment to increase overall unemployment (Daly, Jackson, & Valletta, 2007). Technology may be used to increase a firms productivity, a measure of economic efficiency which shows how effectively economic inputs are converted into output. The U.S. economy has been able to produce more goods and services over time, not by requiring a proportional increase of labor time, but by making production more efficient. The Bureau of Labor Statistics measures productivity by comparing the amount of goods and services produced with the inputs used in production. Labor productivity then is the ratio of the output of goods and services to the labor hours devoted to the production of that output. The most commonly used labor productivity measure is output per hour of all persons (BLS, 2008). The Bureau of Labor Statistics collects detailed data on output per hour and labor costs for the U.S. business sector, the nonfarm business sector, and the manufacturing sector. Although the Bureau does not collect data for all industries, output per hour and labor costs are available for a subset of other, selected industries in the mining, utilities, wholesale and retail trade, and services sectors (BLS, 2008).

One way in which technology is used is to automate tasks that might have been performed by people. Advances in task automation enable a smaller number of workers to produce increasingly greater output without adding additional labor, or even reducing

the existing amount of labor to produce the same output. These technological advances are commonly associated with manufacturing and other industries with occupations requiring repetitive tasks and relatively lower levels of education. Technological advances are, however, becoming more broadly realized. I will compare two examples of technological influences, first in an industry with relatively low educational attainment (motor vehicles manufacturing) and the other in an industry with relatively high educational attainment (information publishing).

In order to explore the role of technology in doing work today, let us build upon the example of how cars are typically manufactured, with an emphasis on the division of labor between robots and humans. Most cars are built through an assembly line process (Rose & Schlager, 2003), with the parts going to the car instead of the car going to the parts. For most cars the body weld shop is the first stage, in which the major body panels, such as the floor, the roof and the side panels, are first welded within a frame. With the possible exception of programming the system, robots do most of this work. The next stage is coating, which cleans all the die oils and any dirt, then applies a texture to the metal for painting. The cars are painted by reciprocating beam sprayers or robots and then baked in ovens. Body framing, welding, and painting consume about two-thirds of the cars total time in assembly, but the last third is the general assembly stage, which occupies most of the human labor. The interior is first assembled in a logical order - floor carpets, windshields and door glass, heating and air conditioning, pedals, headliners, lighting, instrument panels, and steering columns. The engine is then attached to the supporting structure and the transmission and further work is done to install the exhaust pipes, drive shafts, hubs, brakes, and shock absorbers. The final

assembly stage is where the wiring is connected, fuel tank installed, radiator is installed with connecting hoses, all the fluids added, the wheels are installed and the bumpers, grille and external lights assembled. Now the car is started, tested and then shipped (Rose & Schlager, 2003). By the time the car is ready to be shipped approximately two-thirds of the work is completed by robots or other automation technology and one-third is completed by humans.

It is clear that technology has changed the way cars are built, but how have these technological changes influenced employment levels in the automobile industry? The influence may be seen in the productivity and output data for the industry. As discussed above in Chapter 3, if output grows at the same rate as productivity, there will be no change in employment levels. If the output growth rate is greater than the productivity growth rate, then employment levels grow. Conversely, if the output growth rate is less than the productivity growth rate, then employment levels decline. Table 5.11 provides the average annual productivity growth rate and average annual output growth rate for the motor vehicle manufacturing industry between 1995 and 2006.

Table 5.11

Productivity and Output Growth Rates for the Motor Vehicle Manufacturing Industry

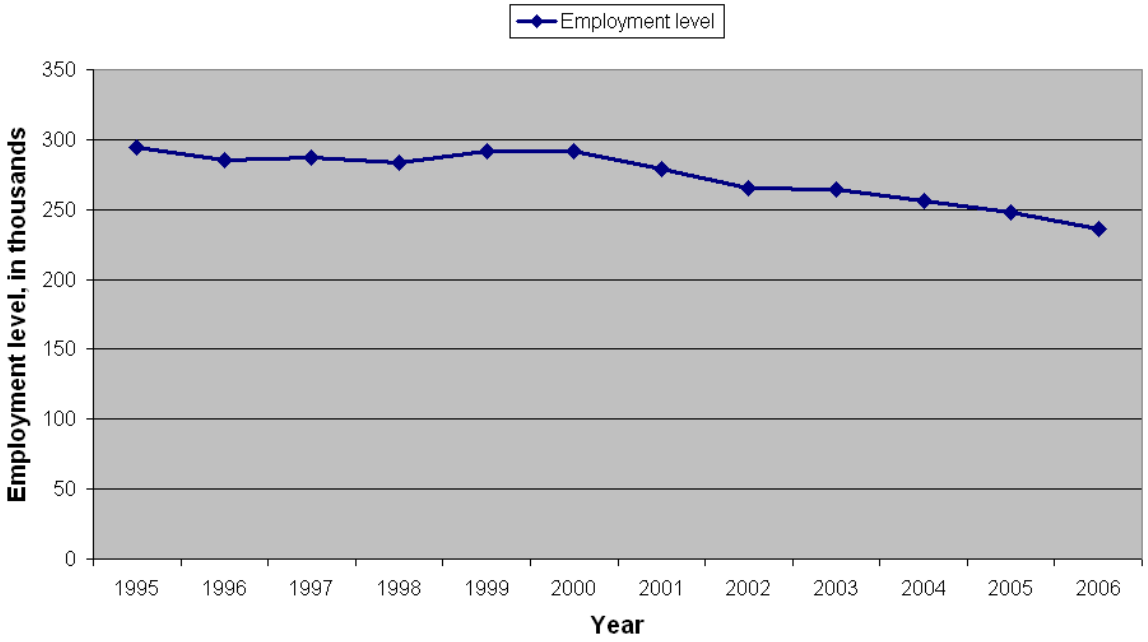
Year	Annual percent growth (decline) in productivity	Annual percent growth (decline) in output	Difference
1995	-1.6	0.9	2.5
1996	2.9	-1.3	-4.2
1997	9.9	10.9	1.0
1998	13.4	5.5	-7.9
1999	8.1	15.6	7.5
2000	-10.5	-11	-0.5
2001	0.3	-7.6	-7.9
2002	14.5	12	-2.5
2003	11.7	9.4	-2.3
2004	0.9	-1.8	-2.7
2005	4.4	0.7	-3.7
2006	10.4	2.6	-7.8
Average	5.4	3.0	-2.4

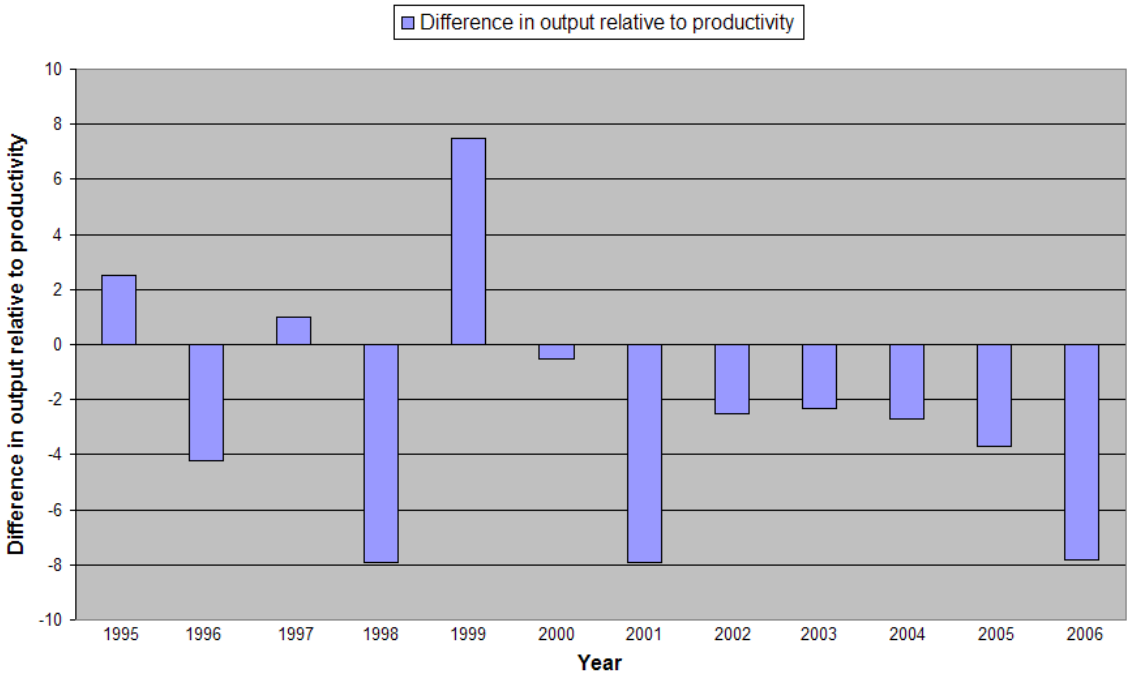
Source: Author's calculations using BLS Industry Productivity and Costs data, 2008

Between 1995 and 2006 productivity in the motor vehicles manufacturing industry increased by an average annual rate of 5.4 percent while output grew by an annual average rate of 3.0 percent. Productivity growth outpaced output by an annual average of 2.4 percent. What then happened to employment levels during this time? Figure 5.8 charts the annual employment levels in the motor vehicle manufacturing industry between 1995 and 2006 and below it the difference in productivity and output for the same year. In 1995, there were 295,000 workers in the motor vehicle manufacturing industry, by 2006, there were 237,000. Over this twelve-year period, employment levels in the industry dropped by 58,000 workers or 20 percent. Productivity grew faster than output and consequently employment declined.

Figure 5.8

Motor Vehicle Manufacturing Industry Employment Levels, in Thousands





Source: Author's calculations using BLS Industry Productivity and CES data, 2008

Has technology had a similar influence on the information publishing industry? Did the relatively high levels of educational attainment protect workers from job loss? There were indeed significant investments in technology between the 1980's recession and the 2001 recession, particularly in the latter part of the 1990's. The cost of computing technology decreased, data and telephony networks spread around the world, and there was a proliferation of new software (Friedman, 2005). Just as robots automated tasks within the manufacturing sector, technology is having a significant impact on the information publishing industry.

The information publishing industry has seen fundamental changes in recent years in how their products and services are created and provided to their customers (Madigan, 2007). For example, traditional newspapers are struggling with how to transition from print editions of their content to online versions of their content and compete with other online content providers who may have different business models compared to traditional newspapers. Software has streamlined the content creation and publishing process by making it faster and easier to write, review, and organize the content to be printed, both on paper and online (Madigan, 2007). Due to this increased ease of use, there has been a consolidation of work where reporters and editors are participating in a broader set of tasks and at a much faster pace. An important implication of this increased ease of publishing information is that hundreds if not thousands of new participants are able to provide content at very low costs. The internet has lowered the barriers of entry to the information publishing business such that even individuals are able to start their own news organizations (Madigan, 2007).

How have these technological changes influenced employment levels in the information publishing industry? As with the auto manufacturing industry, the influence may be seen in the productivity and output data. Table 5.12 provides the average annual productivity growth rate and average annual output growth rate for the publishing industry between 1995 and 2006.

Table 5.12

Productivity and Output Growth Rates for the Information, Publishing Industry

Year	Annual percent growth (decline) in productivity	Annual percent growth (decline) in output	Difference
1995	5.2	7.8	2.6
1996	7.5	9	1.5
1997	12.1	15.7	3.6
1998	16.1	18.5	2.4
1999	0.1	6.5	6.4
2000	0.7	2.5	1.8
2001	-0.4	-3.1	-2.7
2002	0.5	-4	-4.5
2003	7.8	-1.7	-9.5
2004	3.4	3.9	0.5
2005	4.4	3.9	-0.5
2006	4.5	1.8	-2.7
Average	5.2	5.1	-0.1

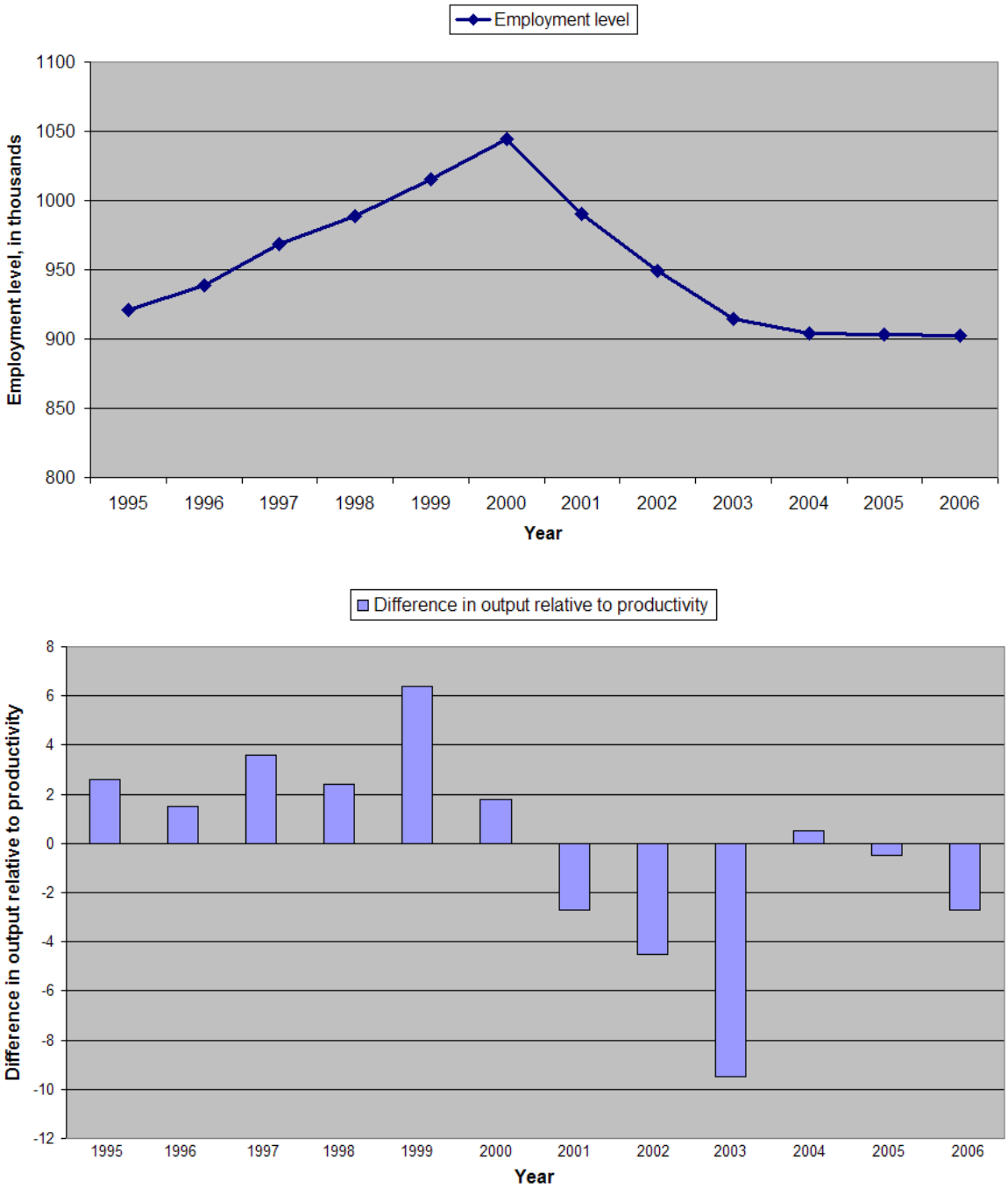
Source: Author's calculations using BLS Industry Productivity and Costs data, 2008

Between 1995 and 2006 productivity in the information publishing industry increased by an average annual rate of 5.2 percent while output grew by an annual average rate of 5.1 percent. Although the annual average for this twelve year period resulted in only a negative 0.1 percent difference in productivity versus output, what is important is that the productivity gains began outpacing output in the second half of this twelve year period. From 2001 to 2006, the industry saw much greater productivity gains than output gains.

What then happened to employment levels? Figure 5.9 charts the annual employment levels in the information publishing industry between 1995 and 2006 and below it graphs the productivity and output data for the same year.

Figure 5.9

Publishing Industry Employment Levels, in Thousands



Source: Author's calculations using BLS Industry Productivity and CES data, 2008

When output growth surpassed productivity growth between 1995 and 2000, employment levels grew. From 2001 forward, this trend reversed (with a minor exception in 2004), with productivity gains surpassing output. As productivity surpassed output, employment levels fell.

Organizations go through the effort of implementing new technology to gain a particular competitive advantage. As the examples above illustrate, technology changes work through a three-step process. First, a company must see a particular advantage that was previously impractical or inefficient without new technology. Second, the work is reorganized using technology to substitute for people in carrying out some tasks and to complement people in carrying out others. Third, the re-organization of work changed the mix of skills needed to do the job. The same three-step process characterizes almost every new application of new technology (Levy & Murnane, 2004).

Trade Influences

Another implication of broad technological improvements has been the enablement of trade in services that had previously not been subject to international marketing (Blinder, 2006). Advances in software and telecommunications have enabled companies to use labor in almost any market in the world in order to deliver these services. Researchers over the past several years have raised questions about the extent of outsourcing and offshoring in the U.S. economy and the possible impact on domestic employment outcomes and productivity measures (BLS, 2004). As discussed above, technology can have an impact on employment outcomes and productivity, but does outsourcing and offshoring also have an impact on aggregate productivity data? If so, how does one

understand what portion of productivity gains are due to technology versus outsourcing and offshoring, or other variables? In order to understand the impact, it is necessary to understand how services are traded internationally as well as the construction of productivity measures. I shall provide two examples of traded services and then outline how productivity gains in these services might be measured.

IT professionals use a variety of software tools to manage services for their customers. Applications such as Microsoft's System Center Configuration Manager enable a single IT professional to not only manage thousands of computers simultaneously, but also to do it remotely, from any location with an internet connection. The advantage to the local IT professional is that she is able to manage all the computers in her companies' environment without having to walk around to each individual computer to perform software installations and maintenance – a huge gain in productivity. At the same time, these types of tools may be used at almost any distance from the end user's computer. In fact, technical support engineers can easily be sitting on the other side of the planet from their customer's desk. This method of IT service delivery is becoming increasingly prevalent. The number of offshore IT vendors providing such services tripled from 5,000 in 2003 to 15,000 in 2005 and an increasing number of U.S. companies are making use of their services (McKinsey, 2006).

In addition to exporting jobs offshore, companies also import foreign labor to the U.S. through the H-1B and L-1 visa programs. In fact, offshoring and the visa program are closely linked (Hira, 2007). Several of the large outsourcing firms have both U.S. and ex-U.S. offices and use the H-1B and L-1 visa program to move their employees and

contractors between offices, based on project needs. The relevance of immigration and visa policy reform to the democratization of unemployment becomes most acute when companies use temporary work visa programs. There have been arguments for both raising the number of allowable H-1B visas as well as limiting its use due to corporate abuse of the program. It is worth noting that illegal immigration has played an important role in employment outcomes, particularly for the lower end of the educational attainment distribution. With nearly two-thirds of illegal aliens lacking a high school degree, most illegal immigrants to the U.S. are on the lower end of the educational attainment distribution and thus compete with legal domestic workers on the lower end of the educational attainment distribution for similar work (Camarota, 2004). What has come to light more recently, however, are the potential effects of seemingly legal work visas on the employment outcomes for workers with higher levels of educational attainment.

Established by the Immigration Act of 1990, the H-1B nonimmigrant visa program outlines the means through which U.S. employers may import skilled temporary workers from other countries. H-1B workers are admitted to the U.S. for an initial period of three years, which may be extended for an additional three years – six years in total. An H-1B nonimmigrant must have a Bachelor's degree or higher in a specific field required by the company. Typical H-1B occupations include engineers, computer programmers, and doctors. The current annual limit of H-1B visas issued is 65,000. The H-1B Visa Reform Act of 2004, however, also makes available 20,000 new H-1B visas for foreign workers with a Master's degree or higher who have graduated from a U.S. academic institution.

Similar to H-1B visas, the L-1 visa applies to aliens who work for a company with a parent, subsidiary, branch, or affiliate in the U.S. These workers come to the U.S. as intra-company transferees who are coming temporarily to perform services in either a managerial or specialized knowledge area. A key distinction, however, is that the L-1 visa program has no limit on the number of workers allowed to work in the U.S. through this program nor are there any salary restrictions.

To illustrate the current use of these visa programs, the Table 5.13 was compiled using data published by Hira (2007) and Bhambal (2007). High volume corporate consumers of visas, their respective number of H-1B and L-1 visas used, and offshore outsourcing tendencies are provided.

Table 5.13

Visa Consumption by Company

Company	# of H-1B visas '06	# of L-1 visas '06	Total Number of Alien Workers '06	Offshore outsorcing is significant business line
Infosys Technologies	4,908	294	5,202	✓
Wipro	4,402	839	5,241	✓
Microsoft	3,117	168	3,285	
Tata Consultancy Services	3,046	4887	7,933	✓
Satyam Computer Services	2,880	950	3,830	✓
Congizant Tech Solutions	2,226	3520	5,746	✓
Patni Computer Systems	1,391	440	1,831	✓
IBM	1,130	1406	2,536	✓
Oracle	1,022	176	1,198	
Larsen & Toubro Infotech	947		947	✓
HCL America	910	511	1,421	✓
Deloitte & Touche	890	256	1,146	✓
Cisco Systems	828		828	
Intel	828	392	1,220	
i-Flex Solutions	817		817	✓
Ernst & Young	774		774	✓
Tech Mahindra Americas	770		770	✓
Motorola	760		760	
MphasiS	751		751	✓
Deloitte Consulting	665	256	921	✓
Kanbay		329	329	✓
Honeywell International		320	320	
HP		316	316	✓
Accenture		291	291	✓
Caritor		231	231	✓
Schlumberger Technology		214	214	✓
Syntel		171	171	✓
Total Visas Issued	**33,062**	**15,967**	**49,029**	**41,418**

Source: Hira, 2007; Bhambal 2007

Several observations are readily apparent. More than one third (35 percent) of all H-1B visas issued in 2006 were consumed by India-based IT outsourcing firms, with approximately 27 percent of all H-1B visas consumed by only five of these companies (Infosys, Wipro, Tata, Satyam, and Cognizant). This translates into 23,048 information technology jobs potentially being lost by U.S. employees in 2006 alone. When combining the number of H-1B and L-1 visas issued to these same India-based IT outsourcing

firms, the number of potential information technology jobs lost increases to 34,489, with 27,952 of these going to the top five India-based IT outsorcing firms.

Comparing this visa usage behavior to occupational growth projections published by the BLS, offshore outsourcing is fulfilling a significant percentage of the forecasted job growth for the information technology industry. The BLS estimates that the information technology industry will add approximately 118,100 IT-related jobs per year between 2004 and 2014 including jobs such as Computer Software Engineers, Computer Systems Analysts, Network Systems and Data Communications Analysts, Database Administrators, and Computer Support Specialists (BLS, 2008). Based on the number of H-1B and L-1 visas issued to companies in 2006 who have offshore outsourcing as a significant business line, the 41,418 total visas represents 35 percent of the estimated job growth for IT-related occupations in 2006. In other words, over one third of the IT-related job growth in 2006 may have been consumed by IT offshore outsourcing.

Arguments for raising the cap come from technology companies who state that the U.S. educational system is producing an insufficient number of math and science graduates compared to countries like India and China. As a result, U.S. firms claim they cannot find enough qualified applicants to fill their human capital needs and the labor gap inhibits their competitiveness. Arguments against the program come from the view that companies in the high technology industry give jobs to H-1B visa holders that could have gone to American workers instead. An example of this argument comes from the IEEE-USA, a US organizational unit of the IEEE, which has called for the cap to remain at or below current levels, with income from the program used to train US workers that have

lost their jobs. There is also criticism regarding the management of the current system due to frequent policy violations. In the U.S. Citizenship and Immigration Services (USCIS) study *H-1B Benefit Fraud & Compliance Assessment* published in September 2008, officials reported that the overall visa program violation rate was 21 percent (Herbst, 2008). These included violations such as the visa recipient not receiving the prevailing wage, forged employment documents, actual job duties significantly different from the position description listed, and even fraudulent or non-existent businesses used as a cover to bring the visa holder into the U.S. illegally.

Also worth noting is that the IT industry, regardless of where the corporate headquarters is domiciled and core services provided, is consuming over half of all visas issued by the U.S. government. This means that all other economic sectors such as natural resources and mining, construction, most manufacturing industries, transportation, utilities, wholesale trade, retail trade, financial services, education and health services, as well as leisure and hospitality are all sharing the remaining 49 percent of visas. This suggests that the H-1B program has a disproportionate impact in the information services industry, a sector with a well-educated workforce. As such, the existence of such visa programs could affect unemployment rates among highly educated workers specialized to this industrial sector.

IT services are not the only category of well paying service jobs that are moving offshore. Although most pharmaceutical companies were late to adopt core business process outsourcing compared to other industries, the number of companies and extent of their offshoring has been growing. Two particular areas of growth in offshoring

specifically for pharmaceutical companies have been the conducting of clinical trials and commercial analytics (McKinsey, 2006). Clinical trials consume 50 to 60 percent of a new drug's development costs and had traditionally been conducted in the U.S. By broadening the base of physicians and patients to include lower-cost countries, companies can reduce their costs per patient by 40 to 60 percent and speed up recruitment by 20 to 30 percent, thus saving significant sums of money and speeding their time to market (McKinsey, 2006). For tasks associated with commercial analytics such as monitoring the effectiveness of a sales force and identifying market trends, low-cost labor markets provide pharmaceutical companies opportunities to perform more frequent and deeper levels of data analysis that would have otherwise been cost prohibitive to perform in the U.S. (McKinsey, 2006).

Given these examples of traded services, does offshoring have an impact on productivity? The following paragraphs provide an attempt at answering this question. In order to understand the impact of offshoring, it is necessary to understand historical trends in the productivity data and how productivity is measured.

In the early 1990's, labor productivity in the business sector began growing at a faster rate than the previous decade (BLS, 2004). Coming out of the 1990 to 1991 recession, the faster growth rate was not widely viewed as unusual at the time given that productivity measures tend to grow faster during the early stages of economic recovery. As the recovery matured, the rate of productivity growth did not slow down as expected. In fact, around 1995 the productivity growth rate accelerated. Some economists believed that firms were able to make use of information technology advances to introduce new

methods of production and management controls while others believed a variety of other factors were driving the accelerated productivity rates and that the higher than expected growth rates would slow down (BLS, 2004).

The trend toward higher productivity did continue, however, even through the 2001 recession. Although productivity growth slowed in 2001 compared to the previous 5 years, its growth was still faster than most previous recessions. Once into the recovery, business sector productivity growth advanced at its fastest rate since 1950 including a considerable 9.4% annual growth rate in the third quarter of 2003 (BLS, 2004).

How might have offshoring played a role in these recent productivity gains? Clues may be found in value-added output data, which measure the contribution of capital and labor to production. If a company sends the low-value production tasks outside the U.S. the business sector output for that company is lower by the amount of value-added that is no longer produced domestically. For example, if a domestic cell phone manufacturer switches from domestic to foreign suppliers for intermediate inputs such as handsets or call center services, real manufacturing sectoral output is unchanged because the real value of the cell phone is unchanged, but given that those intermediate inputs are no longer produced domestically, U.S. jobs are lost and apparent labor productivity has increased (BLS, 2004). If the company were to offshore the high-value production tasks while retaining domestic workers for the low-value tasks, then productivity would fall. However, offshoring the high-value tasks have not been a common practice.

Information technology spending fell following the 2001 recession. Based on results from the Gartner IT Spending and Staffing Survey, after two years of cutting IT budgets, companies made only modest increases to increase their budgets in 2004 (Gartner, 2004). With technology investments falling, what was fueling the faster than expected productivity growth? Although the data is insufficient to state definitively that offshoring was a primary contributor to the productivity growth, the intersection of reduced IT spending and increased offshoring seem to be more than just a coincidence.

Irrespective of where the line is drawn between the relative contributions of technology and trade to productivity gains, the subsequent influence on the educational attainment distribution of the unemployment rate may be similar. Although it is important to understand the relative contributions for purposes of policy planning, one implication seems clear – that workers in historically safe industries and occupations are now more likely to be joining the ranks of the unemployed.

I suggest that a combination of technology and trade were two important variables influencing the generating factors of unemployment in the 2001 recession. The educational composition of the labor force is at an all time high in terms of the percentage of the workforce with a Bachelors or higher degree. This shift over the years towards a more educated workforce has been driven by the industrial and occupational composition of the U.S. economy being increasingly comprised of industries and occupations that require higher levels of education. In the past, technology has enabled the automation of more routine tasks resulting in productivity gains and the need for fewer workers to do routine tasks, particularly in the manufacturing sector. International

trade had the same adverse effect on demand for domestic labor. Today, technological investments are facilitating the global outsourcing of non-routine tasks of service and information jobs which prior to the 2000's recession were not yet digitized and remotely delivered. I suggest that the combination of these factors will continue to shift the educational attainment distribution of the unemployment rate toward the more educated.

Although there may be enough evidence to indict technology and trade in the influencing of the democratization of unemployment, there is still insufficient evidence to convict. There is much debate regarding the impact of trade and technological innovation on jobs in the U.S. and more specifically, the effects of practices such as offshoring and automation. Greater insight into how these two factors influence the unemployment profile would help clarify the effects of such practices and provide insight into if and how the less desirable ramifications might be mitigated through public policy and legislation. This insight may help tailor policies such as training or retraining programs for workers who must make significant career or industry changes.

The changes induced by improvements in technology and trade must not be viewed as inherently bad. Rather, the advantages they bring should be valued and used to competitive advantage. Our efforts from a policy perspective should be focused on how to ease the transition from the current industrial and occupational composition to the future composition. In order to make this transition, unemployment insurance programs, education and training programs, and trade and immigration programs must evolve to meet the associated challenges (Blinder, 2006).

Chapter 6 – Implications for Public Policy

Given our findings that the educational profile of unemployed workers during the 2001 recession was significantly different from the educational profile of unemployed workers during previous recessions, and that this new pattern may be exhibited in future business cycles, what, if anything, should policymakers do about workforce policies for the future? This chapter outlines implications for what policymakers should and should not consider when crafting future policies. Although interfering with market forces can have adverse, unintended consequences, there is an overt need to better understand and respond to the needs of the increasing number of well-educated, unemployed workers.

As shown in the results discussed in Chapter 5, highly educated workers are likely to have higher rates of unemployment during future recessions compared to previous recessions. These findings suggest that the educational attainment distribution of unemployment may change due to the nature of the recession. If these findings represent the beginning of a long-term trend, then changes must be made to current unemployment insurance policies, re-training and education transition assistance policies, and trade and immigration policies.

Many of these existing programs are designed to assist less educated workers and either completely or partially miss the mark for addressing the needs of more educated workers. Modifications to existing programs and the creation of new programs will be needed to address the particular needs of highly educated workers who become

unemployed. For those who are cyclically unemployed we need fundamental changes to the unemployment insurance programs in order to fill a larger share of lost income, for longer periods of time. For those who become structurally unemployed, we need to refine the re-training and education assistance programs in order to provide high-level training for workers who are already well educated, with the goal of transitioning these workers to growing occupations and industries. Finally, for those highly educated workers who are adversely affected by trade and immigration, we must gain a better understanding of the nature of the job losses due to offshoring as well as modify the current H1-B visa system to both curtail abuse of the system while simultaneously meeting the needs of businesses. As part of this discussion, I will review existing programs, their strengths, and where they fall short given the results of this research.

Unemployment Insurance Policies

The role of an unemployment system is to assist workers transitioning from one job to the next. The following section will introduce the advantages and disadvantages of the current unemployment system given the evolving profile of the unemployed toward higher concentrations of well-educated workers. Two problems with the current unemployment insurance program that grow more acute for highly educated workers are the unemployment insurance income replacement rate and the duration of benefits.

Due to the tendency for workers with higher levels of education to have higher levels of earnings, there is a more substantial funding gap compared to less educated workers. Indeed, there is a well-established relationship between educational attainment and

earnings (BLS, 2008). Table 6.1 provides the median weekly earnings of workers by educational attainment in 2008. Data are 2008 annual averages for full-time wage and salary workers age 25 and over.

Table 6.1

Median weekly earnings in 2008 for full-time wage and salary workers age 25 and over

	Less than high school diploma	High school graduate	Some college	Bachelor's degree	Master's degree	Professional degree	Doctoral degree
Median weekly earnings in 2008	$ 426	$ 591	$ 691	$ 978	$ 1,228	$ 1,522	$ 1,555

Source: BLS, 2009

Although UI benefits vary greatly by state, the national average weekly benefit is $277 (U.S Department of Labor, 2007). This benefit may meet the 50 percent replacement rate of workers with less than a high school diploma and come close to a 50 percent replacement rate for workers with a high school diploma, but falls increasingly short for workers with higher levels of education. In deed, the national average replacement rate in 2006 was 35.0 percent (U.S Department of Labor, 2007).

Before detailing how to address this funding gap, let us first review the mechanics of the current unemployment insurance system. The U.S. unemployment insurance (UI) system, as well as the social security system, was established as part of the Social Security Act of 1935. The primary purpose of the program is to provide income support during a worker's spell of unemployment, in effect smoothing out income and consumption. Premiums are paid in advance through employer taxes on wages earned. Individual eligibility requires earnings and employment experience above a state-specified minimum, and entry into unemployment must be through involuntary job loss or

a specified list of “good causes” that also vary from state to state. This public policy response to the Great Depression has had few major changes in the basic structure of the program since its inception (Kletzer & Rosen, 2006).

One of the initial goals of the UI program was to replace half of a worker’s lost gross income but this goal has been far from achieved (Kletzer & Rosen, 2006). The “replacement rate” is defined as average weekly benefits as a share of average gross weekly earnings. Currently, only the state of Hawaii has achieved the initial goal of replacing half of a worker’s actual lost wages, on average. The average replacement rate for the U.S. between 1975 and 2004 has been just over one third (Kletzer & Rosen, 2006), while the replacement rate for highly educated workers is even less.

The program is financed through a combination of federal and state payroll taxes. States are required to fund regular UI benefits for their unemployed workers while the federal and state governments share the costs of financing benefits under the automatic extended benefit program. The Federal Unemployment Tax (FUTA), after credits to employers, is currently 0.8 percent on the first $7,000 of annual salary. The taxable wage base of $7,000 was set in 1983, where it has stayed since. If the taxable wage base had been indexed to inflation since the inception of the UI program, it would currently be approximately $45,000 (Kletzer & Rosen, 2006). This lack of adjustment to inflation represents a significant funding gap.

Current labor market conditions differ greatly from when the UI program was first established in 1935. What changes to the UI system might be made to meet the income

replacement rate and duration needs of highly educated, unemployed workers? The following changes to the UI system are intended to enhance the impact and efficiency of the program to better meet the needs of the changing profile of unemployment.

Feldstein (1998) outlined the model of a UI system that would address these issues. He proposed a system of Unemployment Insurance Saving Accounts (UISAs) where individuals are required to save up to 4 percent of wages in special accounts and to draw unemployment compensation from these accounts instead of taking state unemployment insurance benefits. With Feldstein's plan, if the accounts are exhausted, the government lends money to the account. Positive accounts accrue interest while negative accounts are charged interest. Positive UISA balances would be converted into retirement income or bequeathed if the individual dies before retirement age while negative account balances would be forgiven at retirement age. Money taken by an unemployed individual from a UISA with a positive balance reduces the individual's personal wealth by an equal amount. In this case, individuals fully internalize the cost of unemployment compensation (Feldstein, 1998). Given that the unemployment benefit would be a percentage of income, the benefit is inherently calibrated to earnings differentials due to higher educational attainment as well as local labor market conditions.

The critical question regarding the viability of such a program is whether accounts based on a modest savings rate of 4 percent can finance a significant share of unemployment payments or whether the concentration of unemployment among a relatively small number of individuals would result in UISA balances being systemically negative, forcing

individuals to rely on government benefits. To answer this question Feldstein used the Panel Study on Income Dynamics to simulate the UISA system over a 25-year period. His results suggested that almost all individuals would have positive UISA balances. Even among individuals who experience unemployment, most have positive account balances at the end of their unemployment spell. Although about half of the benefit dollars would go to individuals whose accounts are negative at the end of their working life, less than one third of the benefits go to individuals who also have negative account balances when unemployed. It is important to note that the cost to taxpayers for forgiving the negative balances is substantially less than half of the taxpayer cost of the current UI system, thus greatly increasing the efficiency of the UI program.

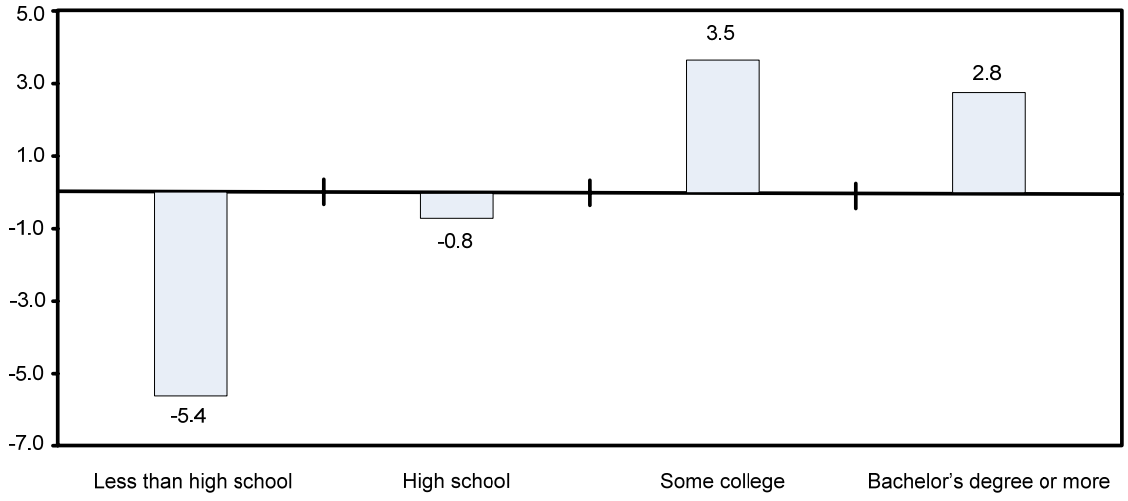
Adding to Feldstein's model, the duration of benefits should be based on the duration of labor market recessions, not a fixed, arbitrary limit. For example, the current duration of benefits usually lasts 26 weeks or approximately 6.5 months. The average duration of the last three labor market recessions, however, was 28 months. If you use the most recent labor market recession, which has thus far lasted for 15 months and is still going on, plus the previous two labor market recessions, the average duration is 21 months. Even if the current labor market recession were to end today, this leaves an unemployment compensation gap of over 14 months.

The duration of benefits should be indexed to the moving average of the duration of the last three labor market recessions. Although the duration of benefits is not exclusively a problem of higher educated workers, there are been an increasing trend toward longer spells of unemployment for well-educated workers. As previously shown in Table 3.6,

long-term unemployment has been growing for industries with higher concentrations of well-educated workers. Again, long-term unemployment is defined as occurring when unemployed workers have been seeking work for 27 weeks or more. Table 6.2 provides another perspective of this trend by showing the percentage-point change in the share of long-term unemployment by educational attainment from 2000 to 2005. The share of long-term unemployment for less educated workers is declining while the share for more educated workers is increasing.

Table 6.2

Percentage-point change in share of long-term unemployment by educational attainment, 2000-2005



Source: Mishel, Bernstein, & Allegretto, 2007

Given the need for a greater earnings replacement rate and longer duration of benefits for well-educated workers, I propose using a UISA model of unemployment insurance in which the savings target would be to replace 50 percent of workers' average weekly

earnings for the number of months of an average labor market recession. Once this target is obtained, the savings requirement could be suspended until the worker becomes unemployed again and draws on the account or the average duration of labor market recession increases. Once the worker is reemployed, the savings requirement would recommence. In other words, each worker would have a target UI fund that grows to a maximum amount based on income and length of average labor market recession.

By implementing a solution to increase the unemployment insurance income replacement rate and the duration of benefits, the two problems with the current unemployment insurance program that grow more acute for highly educated workers would be ameliorated. These changes will help ease the unique burden of highly educated workers associated with the transition from one job to the next. Easing labor transition will help address the cyclical issues associate with the peaks and troughs of the business cycle for this growing population of unemployed workers.

There are two primary arguments against such a change in the UI system. First, this proposal would shift the UI tax burden from the company to the worker. Second, introducing new taxes is politically challenging. Let us explore both of the arguments in detail.

Shifting the UI tax burden from the company to the worker is undesirable given that workers already have a substantial percentage of their gross wages taken through existing taxes. Between federal income tax, social security tax, Medicare tax, state income tax, and other various local taxes, a worker can easily give up a third or more of

their gross compensation. One could reasonably argue that the existing tax burden is excessive and adding one more item simply would not be acceptable. Freed up from having to pay UI taxes, what would companies do with the money?

Would companies pay their workers more? Companies choose from four likely options, or combinations of these options: (1) pay workers more, (2) reduce prices for customers, (3) invest it into the business, or (4) pass on the savings to shareholders in the form of increased dividends. Although it is difficult to assess if all four scenarios have an equal probability of happening, three of the four options do not result in workers receiving a direct benefit of increased wages. Workers may benefit indirectly, however, from the other three scenarios. Reduced prices for customers benefits workers through increased demand, thus job security, and in the case of consumer products, lower personal consumption costs. Investing the money into the business would benefit workers if the investments were in the form of training and development or improved physical plant. One potential down side for workers with investing back into the business is if the investments take the form of efficiency gains that ultimately result in lower labor requirements. Although this scenario is bad for the workers who lose their jobs, it is indeed good for the workers who stay with the company, the shareholders of the company, and the customers. If the savings were passed onto shareholders in the form of dividends, workers would only benefit if they were shareholders in the companies who chose this option.

Summarizing these four options from the workers perspective, by transitioning the UI tax burden to workers, they benefit directly in one scenario and may benefit in the remaining

three scenarios. The response to the concern that workers are getting a worse deal is the same as the response to the second of the two arguments against such a UI plan (introducing new taxes is politically challenging). Receiving a higher UI replacement rate for a longer period of time, receiving a payout of your UISA account when you retire, and having the potential of receiving higher wages as well as the other indirect benefits outweigh the downside of the added tax burden.

Instead of placing the UI burden on workers, why not have the same UISA plan only with companies paying the 4 percent rather than workers? This would likely result in two undesirable outcomes for workers. By increasing the cost of labor, companies would have less incentive to higher more workers, potentially increasing unemployment. Companies are also likely to shift the increased cost from wages paid to workers to the UI payments, thus decreasing workers total compensation.

After weighing the advantages and disadvantages of such a UI program, I argue the benefits to workers outweigh the downside effects. Furthermore, companies also benefit from this UI program through lower labor costs. These combined benefits not only address the particular needs of well-educated unemployed workers, but also benefits the workforce and economy as a whole.

Re-training and Educational Transition Policies

For highly educated workers who become structurally unemployed, simply going back to school for more education might not be the right answer. Additional schooling in an

occupation or industry in decline has a lower probability of improving future employment outcomes. Instead, specific training relevant to a new occupation or industry may be necessary. Let us use computer programmers as an example.

The vast majority of computer programmers are well educated. According to O*NET, over 70 percent of computer programmers report having a Bachelors degree or more. This occupation is also well compensated, with median 2007 wages of $32.73 an hour or $68,080 annually. In this role, they convert project specifications and statements of problems and procedures to detailed logical flow charts for coding into computer language. In doing so, they may develop and write computer programs to store, locate, and retrieve specific documents, data, and information. Sample job titles include Programmer Analyst, Computer Programmer, and Software Developer (O*NET, 2008).

If a computer programmer becomes unemployed, going back to school to learn more about computer programming might not be the best use of time and resources. BLS projects that computer programmers will experience a 4.1 percent decline in employment levels between 2006 and 2016. The employment level of computer programmers is estimated to drop from 435 thousand jobs down to 417 thousand jobs, a decline of 18 thousand jobs. Although they are well educated and well paid, long term employment prospects are not all that positive. What then, should a computer programmer do?

Although retraining and education are involved, moving from computer programming to another computer-related occupation that is projected to grow is one option. One such

alternative computer-related occupation would be software engineering for applications. According to O*NET, a majority of computer software engineers for applications also report having a Bachelors degree (85 percent), but have a different skill set and focus with computers. They develop, create, and modify general computer applications software or specialized utility programs. In doing so, they analyze user needs and develop software solutions and design software or customize software for client use with the aim of optimizing operational efficiency. In this role, they may analyze and design databases within an application area, working individually or coordinating development as part of a team. Sample job titles include Software Engineer, Application Integration Engineer, Software Architect, and Business Systems Analyst. Computer software engineers for applications are also well compensated with median wages in 2007 of $39.97 and hour or $83,130 annually. Unlike computer programmers, future prospects for software engineers are more positive, with employment growth much faster than average (21% or higher). Employment levels for software engineers in 2006 was approximately 507,000 and is forecasted to grow by approximately 300,000 jobs from 2006 to 2016 (O*NET, 2008).

A computer programmer who submits his resume for a software engineering job does not have a high chance of success with out some sort of bridge in education or experience. Making the switch from computer programming to software engineering requires targeted re-training in the areas particular to software engineering. Simply “more education” is an ineffective response on behalf of policymakers as well as individual workers, especially for workers who already have a good deal of schooling. The answer lies in understanding the occupational needs of industries and helping the

labor force align to meet those needs. The U.S. has historically turned to its educational system to prepare people to earn a living (Levy & Murnane, 2004). Once students leave high school or college, however, other mechanisms must be in place to support the ongoing development of the necessary skills and knowledge to be successful in a changing labor market.

There are existing programs at the federal and state level that provide a good starting point to address the re-training and education needs of highly educated workers. Although material changes are required for some and better data on the efficacy of others are needed, there is an opportunity to align the existing programs to meet the changing needs of their more educated customers. Three such programs are the Workforce Investment Act, the High Growth Job Training Initiative, and the Massachusetts Workforce Training Fund.

Workforce Investment Act of 1998

The Workforce Investment Act of 1998 (WIA) provides the framework for a national workforce preparation and employment system designed to meet both the needs of businesses and the needs of workers. The legislation is intended to provide training and employment programs that are easily accessible to workers and based on local labor market needs, particularly demand-side influences from area businesses. The intent is to empower the consumer of these services to have the flexibility to choose the programs and service providers that best meet their needs. Accountability is driven by requiring training providers to report on key success criteria relating to the subsequent placement and earnings of their customers. Before detailing how WIA should change to meet the

needs of unemployed, highly educated workers, let us first review the elements of the existing program.

There are five elements to the WIA that outline how the legislation is implemented. The heart of the legislation is contained in Title I which authorizes the new Workforce Investment system. This title provides for the establishment of state workforce investment boards and the One-Stop delivery system. Provisions of the act promote individual responsibility through the use of “Individual Training Accounts” which allows adult customers to obtain the training they determine best for them. The WIA provides appropriations for the funding of the program.

Enforcement of accountability is done through monitoring metrics of the service providers such as the rates of entry into unsubsidized employment, job retention, and post-placement earnings. Titles II through V of the legislation either reauthorizes previous legislation or makes linkages between previous legislation. Title II reauthorizes Adult Education and Literacy programs. Title III amends the Wagner-Peyser Act of 1933 that founded a national system of public employment offices, known as the Employment Service. The act was amended by the WIA to make the Employment Service part of the One-Stop services delivery system. Title IV reauthorizes the Rehabilitation Act programs and links these programs to state and local workforce development systems. Finally, Title V outlines provisions including authority for state unified plans related to several workforce development programs, incentive grants for states, and transition provisions.

The foundation of WIA is well structured and is an encouraging step towards improved workforce development. With an increasing number of well-educated, unemployed workers, however, the program requires updating to better meet the needs of the current and future workforce. In light of the fact that there are an increasing number of unemployed workers with higher levels of educational attainment there are two recommended amendments to the WIA: (1) update the core services provided, and (2) open access for all unemployed workers.

Three of the seven core services of the WIA are irrelevant to workers with higher levels of educational attainment. Under the “Getting Skills and Education” core services of the One Stop delivery system, preparing for a High School Equivalency (GED) exam, improving reading writing and math skills, and improve English skills (ESL) are irrelevant to workers with a Bachelor’s or Master’s degree. The other four categories of this core service – learning new job skills, improving current job skills, learn how to start your own business, and getting information about schools and training programs – are potentially relevant to workers with a Bachelors or Masters degree, depending on the individual needs of the customer.

In addition to these basic services, alternative core services for workers with higher levels of educational attainment should be to emphasize new ways the person could apply their existing skills to new occupations or industries as well as augmenting their existing skills to more easily transfer to a new occupation or industry. Both of these objectives could be achieved through updating core services to provide more advanced training opportunities – not just the basics. For example, encourage partnerships with

existing corporate sponsored skill development programs. Two such programs are offered by Oracle through their Oracle Workforce Development Program and Cisco through their Networking Academy and Critical Infrastructure Support Group. Software application management, data base administration, and network administration are high demand skills required by high growth industries of the economy. The programs of both corporations are designed to collaborate with academic institutions and government agencies to narrow the high technology skills gap. As I will discuss further below, these are the skills in which companies are stating they cannot find domestic talent and must resort to offshoring or using visas. By demonstrating success with such programs, other companies in private industry will be encouraged to supply comparable training based on their needs. By allowing private companies to volunteer for such programs, taxpayers benefit by avoiding increased taxes for state or local governments to create such programs.

Another opportunity for improvement to align WIA to the changing profile of unemployed workers is to allow all unemployed workers to use the system, not just the less compensated workers. Given the correlation between income and educational attainment, the WIA will under serve workers with higher educational attainments. By de-prioritizing middle-income workers, the act is limiting service access to an increasing percentage of the workforce. An argument against such a change is that doing so could “crowd out” the workers with lower levels of education. In other words, given the limited resources available through WIA, by increasing the number of participants, there would be proportionally fewer resources for workers with lower earnings. Although this is a valid concern, as the educational attainment of the workforce continues to grow, the

current structure of the WIA program will become increasingly less relevant to the workforce. Increasing WIA funding and restructuring programs will be necessary to keep pace with the changing needs of the constituents it serves.

As the educational attainment of the workforce continues to grow and the educational attainment of the unemployed continues to shift higher, we will need innovative approaches to achieving better alignment between the supply and demand within the labor market. Two good examples of such innovative approaches are the High Growth Job Training Initiative and the Massachusetts Workforce Training Fund. Maintaining, expanding, and monitoring these programs will be important as the number of well-educated, unemployed workers continues to rise.

High Growth Job Training Initiative

In 2003 the U.S. Department of Labor's Employment & Training Administration (ETA) rolled out the High Growth Job Training Initiative. This innovative program seeks to engage business, academia, and the workforce investment system in order to develop solutions to the workforce challenges of high growth industries. As discussed above in Chapter 4 – Methodology, the initiative targets education and skills development resources toward helping workers gain the skills they need to build careers in these high growth industries. Many of the occupations in these high growth industries require a Bachelor's degree or above as well as occupational or industry specific training or experience. This program provides an opportunity for highly educated workers to not only use their existing investment in education, but expand upon their investment in new ways.

The ETA followed a three-phase process to identify workforce challenges, prioritize solutions, and demonstrate results within the high growth industries. The first phase is information gathering where the ETA compiles information about the industry and its current workforce needs. As part of the information gathering the ETA conducts an industry survey, identifies workforce and industry leaders, then conducts discussion forums with industry executives. The second phase is Research and Analysis where the ETA conducts Workforce Development Forums, develops solutions, and compiles findings. The Workforce Development Forums entail bringing together representatives from a cross-section of the industry, the workforce system, and educational institutions to validate the industry challenges identified during the executive forums, brainstorm solutions, propose models for addressing the challenges, and prioritize key solutions that will address the workforce issues of the industry. The third phase is Implementation during which the ETA funds a series of projects that model the most promising solutions identified during the Workforce Solutions Forum. I will focus on one of the fourteen identified industries in order to describe how this initiative helps address the needs of an increasingly well-educated population of unemployed workers.

The biotechnology industry is devoted to the application of molecular and cellular processes to solve problems, conduct research, and create goods and services. Contrary to other industries, biotechnology is defined not by the products it produces but by the technologies it employs during production. The High Growth Job Training Initiative helps the biotechnology industry by promoting workforce quality, enhanced productivity, and economic competitiveness. This is being done by improving recruitment and

retention as well as developing skill competencies and training specific to the biotechnology industry.

The Department of Labor has forecast that the biotechnology industry will add an estimated 562,000 jobs between 2004 and 2014. In order to fill these jobs successfully, the industry must attract and retain workers with the appropriate skills. Based on challenges identified by the biotechnology industry, the U.S. Department of Labor has made a series of investments totaling more than $17 million in partnerships between businesses, community colleges, Workforce Investment Boards, and others to address the industry's workforce needs. Examples of solutions include: (1) creating, promoting, and supporting a system for portable, life long learning accounts for workers, and (2) creating a national media campaign to raise awareness of the career opportunities in the industry and provide better alignment of labor supply and demand.

The biotechnology industry has a high concentration of occupations that require higher levels of educational attainment (Sum & Khatiwada, 2007). By attracting well-educated underemployed or unemployed workers from other industries as well as continuing to develop talent within the biotechnology industry, the High Growth Job Training Initiative helps to channel the appropriate quality and quantity of talent into economically and socially beneficial careers. Through close collaboration between government, industry, and academic institutions, the effects associated with the democratization of unemployment may actually be used as a competitive advantage. As the percentage of the workforce with higher levels of educational attainment continues to increase, there will be opportunities for these better-educated workers to transition to high growth

industries thus reducing unemployment and closing the talent gap for these industries. The High Growth initiative provides a good starting point. More rigorous evaluation of the program is necessary, however, to understand its true effectiveness and long-term benefit. Considering the needs of industries and the need of well-educated, unemployed workers, the program show great promise.

Although federal participation in such education programs is important, it is equally important for states to develop programs specific to their needs. States such as California and Massachusetts have put in place working models of such programs. I will illustrate how such state level programs may be useful by outlining the key points of the Massachusetts Workforce Training Fund.

Massachusetts Workforce Training Fund

Enacted into law in July 1998, the Massachusetts Workforce Training Fund (WTF) is intended to provide resources to Massachusetts businesses and workers in order to train current and newly hired employees. Indeed, on-the-job training has been shown to be an effective way to improve the skills of workers. WTF is financed entirely by Massachusetts employers through a surcharge of $8.40 per employee as part of their overall unemployment insurance contribution. Businesses may apply for matching grants of up to $250,000 from the state to help pay for training incumbent, Massachusetts-based employees and up to $1 million in certain cases. Businesses may also receive grants of up to $2,000 per employee to train new employees who were previously unemployed, with a maximum subsidy of $30,000 per company, per year.

The WTF helps address the issue of an increasing number of well-educated unemployed workers in two ways. First, the program helps to keep employees skills relevant to the needs of businesses. Unlike the current WIA guidelines, the program does not de-prioritize workers with existing higher levels of educational attainment. The matching grants encourage businesses to invest in their existing employees, thus improving their productivity and reducing the need for using alternative measures such as offshoring the work or importing talent through the H-1B program. Second, the program encourages businesses to invest in retraining currently unemployed workers. This subsidy reduces the business' risk associated with hiring someone who might not have come from the same industry or occupational background. Granted neither of these two benefits is exclusive to highly educated workers, but unlike the current WIA, it does not discriminate against workers with higher levels of education, rather this program will help workers of all educational attainments transition between industries and occupations.

These benefits are readily apparent in a case study published in the WTF 2007 Annual Report. Working closely with EMC Corporation, headquartered in Hopkinton, Massachusetts, the WTF invested $676,000 to retrain over 500 Massachusetts-based employees. As the market for their products continues to evolve, EMC has had to shift its focus from hardware related products such as storage systems to software related products such as user-friendly applications to help manage data. As a result, EMC needed to reduce the size of its workforce associated with hardware engineering and increase the size of its workforce associated with software engineering. Although both occupations require higher levels of educational attainment, the practical skill sets associated with the two occupations are sufficiently different that you cannot simply

interchange one with the other, much like the example earlier in this chapter comparing computer programmers and software engineers. According to O*NET (2008), 70 percent or more of computer hardware engineers and computer software engineers have a Bachelor's degree or greater.

EMC had several options as to how this workforce transformation could have been made. It could have outsourced or offshored the work to another labor market such as India or China that had the software engineering skills readily available. It could have also imported software engineers via the H-1B program. What EMC chose to do, however, was to invest in its existing employees. The $676,000 invested by the WTF helped retrain the hardware engineers in software engineering development tools, methods, and techniques. In doing so, the Massachusetts labor market not only averted the unemployment of over 500 highly educated workers it also resulted in an estimated 200 net new jobs due to the fact that EMC's software engineering work remained in Massachusetts and has continued to grow.

The Massachusetts WTF is a good reference model for other states. Programs such as the WTF should be encouraged nationally for each state to make such investments in their workforces. As the educational attainment of the workforce continues to grow and the educational attainment of the unemployed continues to shift higher, we will need such innovative approaches to achieving better alignment between occupational supply and demand within the labor market. Although the EMC case study provides a starting point for assessing the impact of the program, more rigorous assessment must be done

over a longer period of time and in other states in order to measure the broader effectiveness of the program.

Improved education and training is required to address the changing needs of the unemployed as a result of the democratization of unemployment. The job market is changing fast and improving our educational system is a slow and difficult process. Although it is an imperfect tool, it is still an effective tool to prepare the workforce for a rapidly changing labor market (Levy & Murnane, 2004). As we work to make improvements in our education and training programs is it also important to couple these advances with improvements in our tax-and-transfer programs to assist with making subsequent labor market transitions.

Trade and Immigration Policies

Trade an immigration policies influence the occupational and educational composition of the labor force by either importing labor from or exporting work to locations with at least cheaper and perhaps even better skilled labor compared to the U.S. The only material difference between the two is where the work is being performed - offshore in another country through trade policy or in the U.S. through immigration policy. As discussed in Chapter 3 – Hypotheses, India and other countries have grown to be significant markets for providing well-educated, low cost labor for information technology services (Friedman, 2005).

When considering changes to U.S. immigration practices, it is important to avoid xenophobic social policy. Instead, the U.S. should acknowledge the shortage of a particular skill and come up with new ways of meeting the labor needs of businesses. In fact, it is important to reinforce social openness so that any given labor market – the U.S. or otherwise – is viewed as an attractive destination for the world's best talent. It is not uncommon for private corporations to engage in similar practices such as "poaching" key talent from their competitors. The U.S. will benefit from having the smartest most talented people want to live here. With these guiding principles in mind, there are four key policy areas to consider when accounting for the effects of trade and immigration on an increasingly well-educated population of unemployed workers: (1) improve the data that the government collects associated with offshoring, (2) improve enforcement of compliance with visa usage, (3) improve the safety net for workers unemployed by trade in previously untraded, services industries, and (4) transitional education and re-training for workers.

First, policy initiatives must focus on improving the data that the government collects associated with offshoring. Improvements are needed to better understand specifically which services and jobs go overseas and thus the effect on the educational attainment distribution of the unemployment rate. Current offshoring data is too generic and collected too infrequently to make definitive correlations between specific jobs and offshoring practices. The Bureau of Economic Analysis and the Bureau of Labor Statistics should significantly expand and refine their data collection methods in the services sectors, to better measure the extent of services activity moving offshore and the subsequent effect on U.S. employment, wages, and productivity (Litan & Brainard,

2004). Expanded and improved data may then be used to gain better insight into the effects of and solutions to the effects of offshoring.

Government agency surveys include little information on services embedded in goods trade and do not track small-scale job separations due to trade. Of the services data that do exist, there are inconsistencies between U.S. and other country data due to a lack of an international classification system. Further disaggregation and detail of data by country and industry would allow us to determine, for example, whether activities within multinational corporations are migrating to low-wage countries and what professions are actually being affected by offshoring. Furthermore, integration of existing data sets, such as occupation data from the BLS and foreign direct investment data from the Bureau of Economic Analysis, would provide additional insights.

A recent workshop held by the Brookings Institution revealed important insights into the data collected by government agencies. For instance, although the Bureau of Economic Analysis data on “business, professional, and technical” services – a sector with a high concentration of highly educated workers – show rapid growth in imports through 2002 (the last year available) and they show a growing trade surplus over the same period, U.S. data on imports from India in this category show virtually no growth between 2000 and 2002. One would expect India to represent a meaningful percentage of these services imports. Moreover, according to Charles Schultze of Brookings, U.S. government reports on business, professional, and technical services imports from India ($209 million in 2002) are much smaller than the corresponding Indian statistics, which show exports more than doubling from $1.6 billion in 2000 and 2001 to $3.4 billion in

2002 and 2003. Furthermore, these estimates exclude contract services performed onsite in the United States, but managed remotely.

The second area for policy improvement pertains to the usage of and compliance to the H-1B and L-1 visa programs. As discussed in Chapter 3 – Hypotheses, the contention around the H-1B and L-1 visa programs is between two competing views. On one side, businesses claim that there is a shortage of qualified workers in the U.S., which hampers their competitiveness. On the other side, workers and labor organizations claim that abuse of the program results in increased U.S. unemployment and wage depression. Proponents of either scenario may in fact be able to hold up examples that support their respective claims. The resolutions to this problem have thus far fallen short. Simply applying further restrictions on the use of visas would only encourage increased offshoring and potentially hamper competitiveness. Conversely, liberalizing the use of visas could further impede U.S. workers transitioning to those higher skilled occupations as well as depress wages if the increase in the supply of labor outpaces demand.

To move toward a more rational H1-B and L-1 program, several policies might be pursued. First, as far as the optimal number of visas to issue annually, the U.S. should neither increase nor decrease the current quota for the time being. Instead, existing visas granted should first be inventoried and studied in order to help determine the labor and training needs of U.S. business with the goal of making four policy improvements: (1) develop and apply a labor market test for labor availability, (2) assess compensation according to market wages, not prevailing wages, (3) enforce appropriate oversight, and

(4) generate further investments in educational programs to help close the high-end education and technical skills gap purported by businesses.

The first and most important improvement is to develop and apply a labor market test to determine local labor availability. Again, H-1B and L-1 visas are used to import highly skilled and educated workers from foreign countries in order to fill domestic labor shortages in a particular field. Although an availability test currently exists, it is neither effective nor rigorously applied. H-1B workers may be hired even though a qualified U.S. worker is available and wants the job. Furthermore, a U.S. worker can even be displaced from a job in favor of foreign workers (Hira, 2007). As far back as 1996, an Office of Inspector General's final audit report on ETA's foreign labor (OIG, 1996) found that the foreign labor certification "system is broken and needs to be fixed." The authors went on to cite numerous, specific problems including failure of the program to meet its intent of excluding foreign workers when qualified, willing U.S. workers are available and that the required labor market test is not designed to survey the labor pool available at the time the alien adjusts to permanent resident status. More recently, the U.S. Citizenship & Immigration Services (USCIS, 2008) found that 13 percent of the requests for H-1B visas were fraudulent and 7 percent contained technical violations.

The required labor market test rarely resulted in the hiring of U.S. workers over foreign labor. In fact, employers consider the labor market test to be perfunctory rather than diligent. In the OIG Overview and Assessment of Vulnerabilities in DOL's Alien Labor Certification Programs Report (OIG, 2003) researchers found little change in the DOL's administration of the programs since prior audits and reiterated that ETA's role in the

labor certification process continues to be superficial. This systematic failure may result in increased unemployment among highly educated and skilled U.S. workers.

Another area for improvement in the enforcement and compliance with visa usage pertains to the assessment of wages. An intended safeguard of the H-1B program is the requirement that an H-1B worker be paid the “prevailing wage.” This mechanism is intended to protect both U.S. workers from wage erosion as well as alien workers who may face wage discrimination. The prevailing wage guidelines are set by Congress and employer compliance is administered by the U.S Department of Justice through its foreign labor certification office. Although the regulations governing the prevailing wage appear to be reasonable in theory, in practice they are ineffective (Hira, 2007). Given the numerous loopholes, companies are able to pay below not only the prevailing wage, but also below market wages.

Hira (2007) reviewed H-1B applications of Tata Consultancy Services (TCS) and Infosys, both large Indian outsourcing firms. TCS was approved by the Department of Labor to import computer programmers at $8.22 an hour while Infosys was approved to import computer programmers at $9.15. The Bureau of Labor Statistics May 2006 National Occupational Employment and Wage Estimates report published that computer programmer’s median hourly wage was $31.50 while their average hourly wage was $33.42. By either measure, both TCS and Infosys were importing labor at one-third the U.S. labor market cost. The guidelines must be revised to provide for paying at lease local market median hourly wages. Local market wage data for 375 metropolitan statistical areas (MSAs), 34 metropolitan divisions, and over 170 nonmetropolitan areas

are readily available through the Occupational Employment Statistics (OES) program at the BLS (BLS, 2008).

There should be improved oversight of the program so that fraud and abuse may be corrected. The OIG has stated (OIG, 2003) that if the Department is to have a meaningful role in the labor certification process, it should have corresponding statutory authority, not currently available, to ensure the integrity of the process, including verifying the accuracy of information provided on labor condition applications. Even with all of the current program's shortcomings, the OIG still identified cases where employers created nonexistent jobs to help aliens obtain permanent resident status, that employers' contacts with the aliens occur long before the purported labor market test, and employers specifically tailored advertised job requirements to aliens' qualifications. The OIG again reiterated their findings in the Department's 2004 Fiscal Year Budget Request Statement for the Record, where they cited that the Department's investigations continued to identify fraud in these programs (OIG, 2004).

Once the labor market test and market wage regulations are improved, as part of the enforcement process it is important to look at the aggregate number of H-1B and L-1 visas by company. A large percentage of all U.S. H-1B visas are issued to Indian outsourcing firms. Even when looking at only five of these firms (TCS, Congizant, Wipro, Infosys, and Satyam), they represent 27 percent of all H-1B visas issued in 2006. Furthermore, after adding the L-1 visa workers these same five firms obtained, the total number of alien workers imported by these IT outsourcing firms was 27,952 (Bhambal, 2007). Although not all of these workers were computer programmers, this number

would represent 7 percent of the total estimated U.S. labor force of computer programmers (396,020). Not only did computer programmers and software engineers experience a greater relative increase in their unemployment rates, computer programmers surpassed the total unemployment rate in 2002, 2003, and 2004. When looking only at H-1B visas Tata Consulting Services or Cognizant Technology Solutions use 3,046 and 2,226 H-1B visas respectively. Although the H-1B visa program has a cap, the L-1 visa program does not. Tata and Cognizant use 4,887 and 3,520 L-1 visas for a total of 7,933 and 5,746 alien workers respectively – a much different story when only H1-B visas are assessed.

The U.S. Citizenship and Immigration Services must conduct more frequent audits and uses the information from these audits to both drive improved compliance as well as refine the measurement of labor availability at prevailing wages. This additional data will help determine if there truly is a shortage of labor or if the program is being abused. In cases where there is abuse, policymakers should limit that company's subsequent use of H-1B and L-1 visas. In cases where there is a shortage of high-end, skilled, and available labor, policymakers should use workforce development funds to help close the gap.

The third area for improvement in trade policy is to strengthen the safety net for workers dislocated by trade, using wage insurance programs. Although Congress made changes to the Trade Adjustment Assistance program in 2002, they failed to extend this program to workers in services industries. Not only does the service-producing sector represent a larger portion of the labor force, the services sectors have a higher concentration of well-

educated workers compare to the goods-producing sectors. By excluding services, a greater proportion of well-educated workers are being excluded from the program.

In response to this omission, in their 2005 publication “A Fairer Deal for America’s Workers in a new Era of Offshoring” authors Brainard, Litan, and Warren outline a compelling wage insurance program to provide a safety net against offshoring. At a cost of approximately $3.5 billion a year, their program insures earnings for displaced workers who secure reemployment at lower pay. This would provide permanently displaced full-time workers who secure reemployment with insurance on 50 percent of their earnings loss up to a cap of $10,000 a year for two years. On a per worker basis, this translates into only $25 per worker per year. Such a minimal investment would go a long way to help displaced U.S. workers get back to work more quickly and seek opportunities in new industries and occupations.

Finally, the policy improvements should incorporate mechanisms to generate funds for investment in educational programs to help workers transition to in demand occupations. As discussed at length earlier in this chapter, it is imperative to not only align the appropriate quantity of the highest quality workers to meet labor demands, it is also important to facilitate this process by investing in educational programs that meet the needs of the key constituents. One way to do this would be to apply a nominal fee for use of the visa program. The proceeds from this fee could be used to invest in the education and training programs to build the workforce sought after through the visa program. Furthermore, data from the use of H-1B and L-1 visas should be used to help guide the development of the educational and training programs. For example, many of

the companies listed as heavy visa users are IT-related companies, either IT service providers or manufacturers of IT products. Given the shortage, the additional funds generated by the visa fee could be used to re-train highly educated workers for the in demand IT occupations such as system software engineers, network administrators, and database administrators.

Policy Summary

Highly educated workers are likely to have higher rates of unemployment during future recessions compared to previous recessions. Current unemployment insurance policies, re-training and education transition assistance policies, and trade and immigration policies are currently designed to assist less educated workers and increasingly underserve the needs of more educated workers. If the educational attainment distribution of unemployment is driven by the industries affected by a particular market shock, then changes must be made to existing labor policies in order to accommodate the particular needs of highly educated workers who become unemployed. For those who are cyclically unemployed we need fundamental changes to the unemployment insurance programs in order to fill a larger share of lost income, for longer periods of time. For those who become structurally unemployed, we need to refine the re-training and education assistance programs in order to provide high-level training for workers who are already well educated, with the goal of transitioning these workers to growing occupations and industries. Finally, for those highly educated workers who are adversely affected by trade and immigration, we must gain a better understanding of the nature of

the job losses due to offshoring as well as modify the current H1-B visa system to both curtail abuse of the system while simultaneously meeting the needs of businesses.

The public policy interventions discussed above are designed to be practical responses to the democratization of unemployment. There are existing policy programs that may serve as a model and should be expanded such as the Massachusetts Workforce Training Fund and High Growth Initiative. Other programs such as the Workforce Investment Act have a good foundation, but must be refined in order to meet the needs of more educated unemployed workers. Given that interfering with market forces can have adverse, unintended consequences, it is important that policy changes be well vetted by all key stakeholders including the private businesses, academic institutions, labor organizations, and government policymakers.

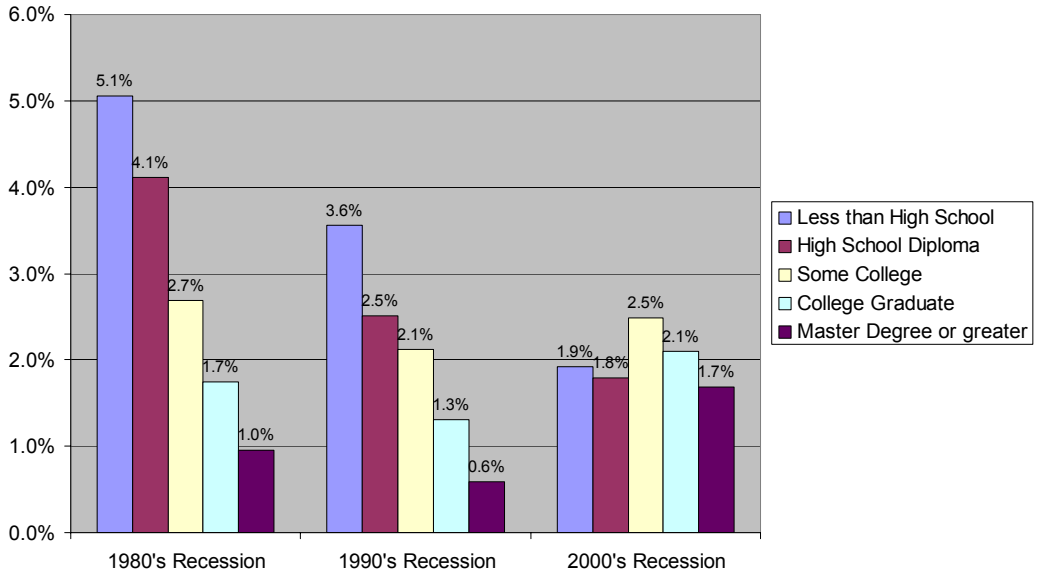
Chapter 7 – Conclusions and Future Considerations

Workers with more education have historically enjoyed greater insulation from increases in unemployment rates compared to workers with less education, especially those lacking a diploma. An analysis of 2001 data, however, indicates that the difference in unemployment rates by educational attainment is diminishing. The following graph shows the percentage point change in unemployment across educational groups over the last three labor market recessions from the employment level peak to trough.

Figure 7.1

Percentage Point Changes in Unemployment

	Less than High School	High School Diploma	Some College	College Graduate	Master Degree or greater	Average change
1980's Recession	5.1%	4.1%	2.7%	1.7%	1.0%	2.9%
1990's Recession	3.6%	2.5%	2.1%	1.3%	0.6%	2.0%
2000's Recession	1.9%	1.8%	2.5%	2.1%	1.7%	2.0%



Source: Author's calculations using BLS CPS data

This research confirmed that the leveling indeed occurred in 2001, and helped explain this change by predicting what might occur in the future and suggested policy implications if it does. Contrary to historical trends, more education no longer guarantees smaller increases in unemployment during recessions. As the industrial and occupational composition of the economy evolves, the U.S. may continue to see a leveling of unemployment by education. With the ability to forecast changes in the variables pertaining to unemployment, it is possible to hypothesize future unemployment distributions by educational profile. This understanding may be used to assist public and private policymakers in the formulation of future labor market policy as well as help workers in charting their own careers and career development.

Assessing the Trend of Unemployment

The findings of this research clearly highlight the need to monitor the trends in the unemployment profile. By better understanding the evolution of industries and their educational requirements, we will have a better understanding of future employment patterns. As the share of jobs continues to shift towards industries and occupations which require more education, an increasing percentage of people will work towards earning advanced degrees. As long as the economy can continue to create an ever larger proportion of high education and high skill jobs, as a society, this form of democratization of unemployment may be an advantageous phenomenon. Building a better understanding of these relationships is critical for U.S. long-term competitiveness in the global market.

Future Research Opportunities

There are several opportunities for future research in this area. The most important opportunity is the replication of this study after the completion of the next business cycle to help bolster the assertion that the educational attainment distribution of unemployment is driven by the industries affected. Depending on the industries most affected by the recession, the allocation of unemployment should follow suit with the occupational and thus educational composition of that particular industry. If this pattern does not continue, then the increases in unemployment should simply be allocated according to educational attainment, regardless of industry.

There are four other valuable future research opportunities: (1) expand the definition of education within the context of this research. Rather than using just educational attainment, additional insight would be gained by using an expanded definition such as the O*NET job zones to incorporate education, overall experience, and job training; (2) analyze the educational profile of underemployment and reemployment success. This will help paint a broader picture of what happens to higher educated workers during or after recessions even if they are not unemployed. As part of this research explore the extent to which companies “trade up” the educational distribution. In other words, how might better educated workers be replacing less educated workers; (3) gain a better understanding of the balance between the corporate economic efficiencies of offshoring and labor importation versus national interests of maintaining good jobs and a stable middle class; and last but not least, (4) form a better understanding of the role of information technology in the creation and destruction of jobs.

The analysis of chancing employment by educational attainment suggests that the change in the unemployment profile during the 2001 recession was not an anomaly. This phenomenon may become even more prominent in the coming years and further level the unemployment field not only between classes of workers in the U.S., but also classes of workers around the world. Insight into these mechanisms and our ability to respond appropriately will have economic implications for generations to come.

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Appendix A: Fast Growth Occupations

Occupation	Projected Growth Pace (2004-2014)	Projected Growth Employment (2004-2014)	Industries	High School or Less	Some College	College Graduate
Home Health Aides	Much Faster than Average	431,000	Health Care	61%	33%	7%
Personal and Home Care Aides	Much Faster than Average	400,000	Health Care	60%	30%	10%
Medical Assistants	Much Faster than Average	273,000	Health Care	35%	53%	11%
Computer Software Engineers, Applications	Much Faster than Average	268,000	Information Technology, Homeland Security	4%	13%	83%
Dental Assistants	Much Faster than Average	189,000	Health Care	33%	57%	10%
Computer Software Engineers, Systems Software	Much Faster than Average	180,000	Information Technology	4%	13%	83%
Network Systems and Data Communications Analysts	Much Faster than Average	153,000	Information Technology, Homeland Security	9%	31%	60%
Network and Computer Systems Administrators	Much Faster than Average	138,000	Information Technology, Homeland Security	13%	35%	51%
Dental Hygienists	Much Faster than Average	82,000	Health Care	4%	66%	30%
Physical Therapists	Much Faster than Average	72,000	Health Care	2%	8%	90%
Database Administrators	Much Faster than Average	51,000	Information Technology, Homeland Security	9%	19%	72%
Physician Assistants	Much Faster than Average	40,000	Health Care	6%	26%	69%
Physical Therapist Assistants	Much Faster than Average	36,000	Health Care	18%	52%	30%
Registered Nurses	Faster than Average	1,203,000	Health Care	2%	40%	58%
Customer Service Representatives	Faster than Average	778,000	Retail	37%	41%	22%
Nursing Aides, Orderlies, and Attendants	Faster than Average	516,000	Health Care	61%	33%	7%
Accountants and Auditors	Faster than Average	486,000	Financial Services	7%	18%	76%
Counter and Rental Clerks	Faster than Average	277,000	Hospitality, Retail	55%	30%	15%
Physicians and Surgeons	Faster than Average	212,000	Health Care	1%	2%	97%
Computer Systems Analysts	Faster than Average	208,000	Information Technology, Homeland Security	9%	25%	66%
Bill and Account Collectors	Faster than Average	184,000	Financial Services	46%	39%	15%
Computer Support Specialists	Faster than Average	183,000	Advanced Manufacturing, Energy, Financial Services, Information Technology, Nanotechnology	16%	42%	41%
Fire Fighters	Faster than Average	150,000	Homeland Security	22%	58%	20%
Computer and Information Systems Managers	Faster than Average	124,000	Information Technology, Financial Services	7%	23%	70%
Pharmacy Technicians	Faster than Average	107,000	Health Care	32%	53%	15%
Medical and Health	Faster than	105,000	Health Care	13%	27%	60%

Services Managers	Average					
Pharmacists	Faster than Average	101,000	Health Care	1%	2%	97%
Bus Drivers, Transit and Intercity	Faster than Average	83,000	Transportation	61%	33%	6%
Radiologic Technologists and Technicians	Faster than Average	76,000	Health Care	9%	68%	23%
Medical and Clinical Laboratory Technicians	Faster than Average	76,000	Biotechnology, Health Care, Nanotechnology	18%	34%	48%
Emergency Medical Technicians and Paramedics	Faster than Average	74,000	Health Care, Homeland Security	18%	65%	17%
Marketing Managers	Faster than Average	74,000	Retail	12%	22%	66%
Medical and Clinical Laboratory Technologists	Faster than Average	74,000	Biotechnology, Health Care, Nanotechnology	18%	34%	48%
Medical Records and Health Information Technicians	Faster than Average	69,000	Health Care	43%	45%	12%
Taxi Drivers and Chauffeurs	Faster than Average	64,000	Transportation	61%	25%	14%
Personal Financial Advisors	Faster than Average	61,000	Financial Services	5%	13%	82%
Rehabilitation Counselors	Faster than Average	61,000	Health Care	11%	16%	72%
Respiratory Therapists	Faster than Average	57,000	Health Care	4%	68%	28%
Highway Maintenance Workers	Faster than Average	54,000	Transportation	78%	22%	1%
Mental Health and Substance Abuse Social Workers	Faster than Average	51,000	Health Care	8%	16%	76%
Mental Health Counselors	Faster than Average	48,000	Health Care	11%	16%	72%
Medical and Public Health Social Workers	Faster than Average	48,000	Health Care	8%	16%	76%
Medical Transcriptions	Faster than Average	44,000	Health Care	35%	53%	11%
Occupational Therapists	Faster than Average	43,000	Health Care	0%	15%	85%
Construction and Building Inspectors	Faster than Average	42,000	Construction	33%	36%	31%
Massage Therapists	Faster than Average	42,000	Health Care, Hospitality	16%	51%	33%
Substance Abuse and Behavioral Disorder Counselors	Faster than Average	39,000	Health Care	11%	16%	72%
Medical Scientists, Except Epidemiologists	Faster than Average	37,000	Biotechnology, Health Care, Homeland Security, Nanotechnology	1%	1%	98%
Surgical Technologists	Faster than Average	36,000	Health Care	32%	53%	15%
First-Line Supervisors/Managers of Fire Fighting and Prevention Workers	Faster than Average	35,000	Homeland Security	14%	61%	25%
Technical Writers	Faster than Average	26,000	Advanced Manufacturing	5%	22%	73%
Environmental Engineers	Faster than Average	23,000	Construction, Energy, Geospatial Technology	7%	5%	87%
Cardiovascular Technologists and Technicians	Faster than Average	23,000	Health Care	9%	68%	23%
Tile and Marble Setters	Faster than Average	23,000	Construction	78%	19%	3%
Diagnostic Medical Sonographers	Faster than Average	23,000	Health Care	9%	68%	23%
Hazardous Materials Removal Workers	Faster than Average	22,000	Energy	69%	26%	5%

Physical Therapist Aides	Faster than Average	22,000	Health Care	18%	52%	30%
Chiropractors	Faster than Average	22,000	Health Care	0%	0%	100%
Meeting and Convention Planners	Faster than Average	19,000	Hospitality	9%	28%	63%
Survey Researchers	Faster than Average	12,000	Retail	6%	15%	79%
Actuaries	Faster than Average	12,000	Financial Services	3%	5%	92%
Occupational Therapist Assistants	Faster than Average	10,000	Health Care	8%	79%	12%
Environmental Engineering Technicians	Faster than Average	9,000	Advanced Manufacturing, Energy, Geospatial Technology, Nanotechnology	28%	54%	18%
Biochemists and Biophysicists	Faster than Average	8,000	Biotechnology, Homeland Security, Nanotechnology	1%	3%	96%
Computer and Information Scientists, Research	Faster than Average	8,000	Information Technology	9%	25%	66%
Ambulance Drivers and Attendants, Except Emergency Medical Technicians	Faster than Average	8,000	Homeland Security	44%	46%	10%
Emergency Management Specialists	Faster than Average	5,000	Homeland Security	20%	38%	42%
Biomedical Engineers	Faster than Average	5,000	Biotechnology, Nanotechnology	8%	33%	60%
Hydrologists	Faster than Average	4,000	Energy, Geospatial Technology	3%	3%	94%
Epidemiologists	Faster than Average	2,000	Homeland Security	1%	1%	98%
Average				**20%**	**32%**	**48%**

Appendix B: Average Annual Productivity Growth and Output Growth between 1995 and 2006

Sector, Industry	Average annual productivity growth between 1995 and 2006	Average annual output growth between 1995 and 2006	Difference
Professional, Scientific, and Technical Services, Architectural services	1.5	5.3	3.8
Health Care and Social Assistance, Medical and diagnostic laboratories	3.8	7.2	3.5
Transportation and Warehousing, Warehousing and storage	3.3	6.6	3.3
Professional, Scientific, and Technical Services, Engineering services	1.9	4.6	2.8
Administrative and Support and Waste Management and Remediation Services, Employment placement agencies	3.1	5.8	2.7
Real Estate and rental and leasing, Passenger car rental	0.5	2.9	2.4
Arts, Entertainment, and Recreation, Amusement and theme parks	-0.5	1.8	2.3
Accommodation and Food Services, Food services and drinking places	0.7	2.8	2.1
Information, Broadcasting (except internet)	1.6	3.4	1.8
Administrative and Support and Waste Management and Remediation Services,	2.4	4.1	1.6
Professional, Scientific, and Technical Services, Advertising agencies	2.1	3.1	1.0
Accommodation and Food Services, Traveler accommodation	1.4	2.5	0.9
Wholesale Trade	3.7	4.6	0.9
Retail Trade	4.3	4.9	0.6
Other Services (except Public Administration), Automotive repair and maintenance	1.3	1.7	0.4
Mining, All Mining	-0.9	-0.6	0.2
Real Estate and rental and leasing, Video tape and disc rental	3.6	3.8	0.2
Finance and Insurance, Commercial banking	1.8	2.0	0.2

Manufacturing, Nonmetallic mineral product manufacturing	1.7	1.9	0.1
Real Estate and rental and leasing, Truck, utility trailer, and rv (recreational vehicle) rental and leasing	6.3	6.3	0.0
Manufacturing, Beverage and tobacco product manufacturing	-0.2	-0.2	-0.1
Transportation and Warehousing, Couriers and messengers	1.2	1.1	-0.1
Information, Publishing industries (except internet)	5.2	5.1	-0.1
Manufacturing, Fabricated metal product manufacturing	1.9	1.8	-0.2
Manufacturing, Food manufacturing	1.8	1.6	-0.3
Transportation and Warehousing, Air transportation	4.0	3.7	-0.3
Transportation and Warehousing, Postal service	1.1	0.7	-0.4
Manufacturing, Wood product manufacturing	2.3	1.8	-0.4
Manufacturing, Furniture and related product manufacturing	3.0	2.3	-0.6
Manufacturing, Miscellaneous manufacturing	4.1	3.2	-0.9
Manufacturing, Transportation equipment manufacturing	3.7	2.6	-1.1
Other Services (except Public Administration), Dry cleaning and laundry services	2.0	0.7	-1.2
Manufacturing, Plastics and rubber products manufacturing	3.0	1.7	-1.3
Manufacturing, Chemical manufacturing	3.3	1.9	-1.4
Manufacturing, Machinery manufacturing	3.3	1.7	-1.5
Arts, Entertainment, and Recreation, Bowling centers	1.8	0.2	-1.6
Manufacturing, Printing and related support activities	1.7	-0.3	-2.0
Manufacturing, Petroleum and coal products manufacturing	3.3	1.2	-2.1
Utilities, Electric power generation, transmit ion	2.8	0.5	-2.3

Manufacturing, Computer and electronic product manufacturing	14.7	12.3	-2.3
Manufacturing, Textile product mills	2.4	-0.1	-2.5
Manufacturing, Primary metal manufacturing	3.0	0.4	-2.6
Utilities, Natural gas distribution	2.5	-0.1	-2.7
Administrative and Support and Waste Management and Remediation Services, Travel agencies	6.4	3.7	-2.7
Manufacturing, Paper manufacturing	2.4	-0.3	-2.8
Manufacturing, Electrical equipment, appliance, and component manufacturing	3.0	0.2	-2.8
Manufacturing, Textile mills	4.5	-3.2	-7.7
Manufacturing, Leather and allied product manufacturing	4.6	-4.6	-9.3
Manufacturing, Apparel manufacturing	2.2	-7.4	-9.6

Appendix C: Biographical Information

Name:

Mark L. Yunger

Place of birth:

Kalamazoo, MI

Education:

Doctorate, Northeastern University, expected 2009

Master of Science, Springfield College, 1997

Bachelor or Arts, Western Michigan University, 1994

Matriculated Exchange Student, Universität Tübingen, 1992

Professional experience:

Associate Director, IT, Millennium Pharmaceuticals, 2004 to present

Project Executive, Siemens Business Services, 2002 to 2004

Practice Manager, Idiom Technologies, 2000 to 2001

Business Unit Manager, Lionbridge, 1996 to 2000