



# Educational Attainment and Recovery from Recessions Across Metropolitan Areas

Bryan Bezold

Metropolitan area business cycles vary considerably in both magnitude and duration. Some metro areas recover rapidly from downturns, some take longer, and some never recover. Because recent recessions have involved employment changes at the North American Industrial Classification System (NAICS) supersector level that were both cyclical and structural, part of a metro area's recovery from a recession may include the process of workers adapting to new jobs in other industries. If worker adaptation is part of the recovery process, then metro areas with higher educational levels might be able to recover more quickly from recessions. This hypothesis is tested with multiple regression models of the 1990 and 2001 recessions. There is a significant and negative link between college attainment and the time it took for metropolitan areas to recover from the 2001 recession, but not from the 1990 recession. (JEL A10, J24)

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**M**etropolitan areas experience economic contractions in much the same way that the broader U.S. economy does. However, because economies of metropolitan statistical areas (MSAs) differ in their demographics and other economic characteristics, they are natural subjects to use to test for relationships between structural economic characteristics and economic performance during business cycles. In this paper I use a panel of the 50 largest MSAs in the United States to test for a relationship between the share of each MSA's population over 25 years of age with a college degree and the time in months it takes for that MSA to recover from a recession. In each case, employment is used to define the beginning and end of a recession and the time interval for recovery. The relationship between college attainment and recovery length is being tested because, as the structure of the U.S. economy changes, the process of recovery from recession may depend on the ability of workers to adapt to new jobs at different firms or in different industries. If more-

educated workers are more adaptable, and more-adaptable workers are better at learning new skills at new jobs, then there may be a relationship between the level of education in an MSA and the time it takes for that MSA to recover from a recession.

During the 2001 recession, as with most recessions, the United States and most major MSAs experienced an overall decline in nonfarm employment, a recovery to the previous peak employment level, and then continued expansion. Nonfarm employment declined from a peak of 132.5 million in February 2001 to a trough of 129.8 million in August 2003. Employment expanded at an average monthly rate of 151,000 between September 2003 and February 2005, when the United States first exceeded its prior peak level of employment. Between March 2005 and January 2007, average monthly job gains accelerated to slightly over 200,000 per month.

At the same time, however, some industries (as defined by North American Industrial

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Bryan Bezold is chief economist at the St. Louis Regional Chamber and Growth Association.

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Classification System [NAICS] supersectors) declined and did not recover. U.S. manufacturing employment, for example, declined from slightly more than 17 million in March 2001 to 14 million in January 2007. Employment in the information sector also appeared to have permanently declined from a pre-recession peak of 3.7 million to 3.0 million in January 2007. This phenomenon was also observable in most MSAs. Approximately 3.7 million workers, or 2.8 percent of total peak employment, appear to have been permanently dislocated from their previous industries.

Compare this with the 1990 recession. Overall, the U.S. experienced an employment peak, trough, and recovery. Nonfarm payroll employment peaked at 109.8 million in June 1990, fell to a trough of 180.2 million in May 1991, and recovered to the previous peak level in February 1993. As with the 2001 recession, manufacturing employment began to decline before overall nonfarm employment began to decline. Manufacturing employment declined by 7.3 percent, or 1.3 million jobs, from a peak of 18.0 million in March 1989 to a trough of 16.7 million in August 1993. Manufacturing-sector employment did not fully recover to its pre-1990 recession peak, but did rise to roughly 98 percent of its peak before beginning to decline again in March 1998.

The structural adjustment that the United States and most major MSAs experienced during the 1990 recession and recovery process was thus smaller than in the 2001 recession. The total number of manufacturing workers permanently displaced—the difference between manufacturing employment at its pre-1990 recession peak and its relative peak in March 1998—was 423,000. That was much smaller than the 3 million workers who were permanently displaced from the manufacturing sector after the 2001 recession.

It is thus the case that the U.S. economy experienced a full recovery from the 2001 recession in terms of employment, but some industries, specifically information and manufacturing, did not. The 1990 recession was also characterized by this phenomenon, but to a much smaller extent, in the manufacturing sector. Because overall nonfarm employment in both cases recovered to and grew past its previous peak, workers in those perma-

nently affected sectors either went to work in new sectors or left the labor force and were replaced by new entrants. This phenomenon likely took place at the firm level as well, with workers dislocated by the closing of firms finding work at different firms either within or outside of that industry.

That would suggest that economies, whether at the national or subnational level, recover from downturns in employment because workers are able to adapt whatever skills they may have to new firms or new industries. Once an economy makes this adjustment, its firms become more productive and it resumes a pre-recession pace of expansion. Note that in the cases of both the 1990 and 2001 recessions, average monthly nonfarm employment gains accelerated after the level of employment reached its pre-recession peak. The implication here is that the business cycle has three phases: *contraction*, during which many firms either go out of business or shed workers; *recovery*, when workers adjusted their skills to new firms or even industries; and *expansion*, when the economy has reorganized and can grow at a slightly higher rate.

If the sorting of workers from old firms to new ones and old industries to new ones is a factor in the recovery of an economy to its prior peak employment level, then it is logical to wonder if the adaptability of workers, their ability to learn new skills so that they can work in different firms or industries, would affect the time it takes for an economy to recover from a contraction.

At this point it is important to note that the National Bureau of Economic Research (NBER), the official chronicler of business cycles in the United States, characterizes recession only in terms of contraction and expansion. There is no distinction, in the NBER view, between recovery and expansion; any period of growth, prior to or after exceeding a pre-recession peak, is considered expansion. This paper's characterization of the business cycle as one with three phases, contraction, recovery, and expansion, represents a view different from the one commonly used by economists.

Many researchers, notably Owyang, Piger, and Wall (2005), have described business cycles at the state level with a two-phase model, expansion and contraction, rather than a three-phase model. Owyang et al. (2007) also have observed that a dif-

ferent set of variables is associated with economic performance during the expansion and contraction phases and that human capital measured by college attainment is correlated with MSA and state performance during growth phases.

Other research is broadly supportive of a correlation between human capital, measured by educational attainment, and measures of MSA growth. Glaeser and Saiz (2003) found a connection between growth and skills measured by college attainment for MSAs that were declining, but not for MSAs that were growing: Having a skilled workforce was more important to MSAs that were not experiencing in-migration than to those that did have higher rates of in-migration. Further, Glaeser and Saiz (2003) also concluded that “rustbelt” MSAs with higher skill levels would be more likely to adjust to structural economic changes due to declining manufacturing employment than MSAs with lower skill levels.

Silvia (2006) observed that the transition of the U.S. economy from a purely domestic labor market to one influenced by both national and international factors would have a number of results, including reduced demand for manufacturing workers but increased demand for college-educated workers. Silvia (2006) also noted that skill accumulation for workers will be a lifelong process in the face of structural economic change.

Because other research confirms correlation between college attainment and economic growth, and also suggests a link between skilled workers and the ability of MSAs to adapt, then one would expect that MSAs with higher skill levels should recover more quickly from recessions that involve structural and not just cyclical economic changes. This paper tests the hypothesis that increased worker adaptability, measured by college attainment levels, is correlated with faster recoveries from recessions. After a contraction in employment, workers that are permanently displaced from their firms or industries will need to be able to adapt to new firms or industries; also, prospective employers must believe that the workers will be able to adapt to new environments for overall MSA employment to recover from a contraction. Better-educated workers should be more able to adjust to new jobs in new industries, so MSAs with a greater

share of educated workers should need less time to re-sort workers into jobs in new firms and industries.

## METHODOLOGY

The models in this paper use multiple regression analysis to test for a relationship between (i) the length of time it takes for an MSA economy to recover from its employment trough following a recession and reach a level at or above the pre-recession peak and (ii) the level of college attainment for both the 2001 and 1990 recessions. College attainment from the 1990 and 2000 U.S. Census surveys were used as a proxy for the general level of workers’ adaptability. The length of time in months for an MSA to recover from a post-recession employment trough and reach a level at or above the pre-recession peak was used as the dependent variable. This number was calculated through the inspection of seasonally adjusted nonfarm employment data for each MSA. Once the initial peak, trough, and next peak were identified, then the length of recovery was the number of months between the trough and the next month that nonfarm employment rose permanently above the level of the pre-recession peak. In many cases, the employment data did not have a smooth curve, but a volatile one. In these cases, the employment level occasionally spiked to a level above the pre-recession peak during the recovery period, but then dropped back below it. In those instances, the recovery was not considered complete until seasonally adjusted employment permanently exceeded the pre-recession peak. This is one of several sources of uncertainty in the model.

The independent variables for each MSA in the model were the share of adults over the age of 25 with a college degree, the share of employment in manufacturing and information at that pre-recession peak, and the magnitude (percentage) of each employment decline.

The share of adults with a college degree was the variable being tested; the other independent variables were included as controls. The magnitude of the decline in employment was included because the greater the number of dislocated workers, the

**Table 1****Descriptive Statistics for the Sample of 34 MSAs During the 2001 Recession**

Variable	Median	Range	Standard deviation
Percent decline in employment, peak to trough	-0.025	0.053	0.014
Share of employment in manufacturing at pre-recession peak	0.101	0.135	0.035
Share of employment in information at pre-recession peak	0.028	0.044	0.012
Share of adults over 25 with a BA or BS	0.264	0.229	0.047
Recovery length, trough to prior peak level, in months	23.5	35	10.2
	Minimum	Mode	Maximum
Date of pre-recession employment peak	March 2000	December 2000	September 2001
Date of employment trough	October 2001	March 2003	June 2003
Date of recovery to pre-recession peak employment level	August 2002	April 2005	February 2007

**Table 2****Descriptive Statistics for the Sample of 44 MSAs During the 1990 Recession**

Variable	Median	Range	Standard deviation
Percent decline in employment, peak to trough	-0.021	0.139	0.027
Share of employment in manufacturing at pre-recession peak	0.135	0.277	0.052
Share of adults over 25 with a BA or BS	0.209	0.263	0.045
Recovery length, trough to prior peak level, in months	16.5	70	17.5
	Minimum	Mode	Maximum
Date of pre-recession employment peak	January 1990	August 1990	September 1991
Date of employment trough	December 1990	April 1991	January 1996
Date of recovery to pre-recession peak employment level	May 1991	January 1992	July 2000

longer it would take to completely sort all of the dislocated workers into new jobs. Because the 2001 recession was concentrated in the manufacturing and information NAICS supersectors, the share of an MSA's employment in those two sectors would likely affect the length of time it took to recover from a recession; more workers in affected sectors would presumably increase the number of workers who have to be sorted into other firms or industries. The inclusion of these two variables on the right-hand side of the equation reflected an assumption that the 2001 recession was an exogenous shock to the manufacturing and information sectors in each MSA.

In the case of the 1990 recession, the share of employment in the information sector was not included because the information sector fully recovered from the 1990 recession and therefore did not produce permanently displaced workers; it was assumed that the decline in manufacturing was the exogenous shock to MSA economies. Table 1 contains descriptive statistics for the model of the 2001 recession variables; Table 2 contains descriptive statistics for the model of the 1990 recession.

More simply put, the control variables are selected to see whether two MSAs that had different college attainment levels but the same magnitude

of contraction, and an equal share of employment in sectors most subject to the exogenous shock, would experience recoveries of different lengths.

The analysis initially began with the 50 largest MSAs in the United States. The eventual model of the 2001 recession, however, is based on just 34 of them: 12 of the 50 largest MSA had not fully recovered from the 2001 recession by January of 2007 and 4 MSAs did not experience any employment contraction during the 2001 recession. Those 16 were excluded from the model.

For the 1990 recession, there were similar limitations. The Los Angeles MSA never recovered from the 1990 recession, and five other MSAs did not experience a significant decline in overall nonfarm employment. A total of six MSAs were thus excluded from the 1990 recession model.

Of the 12 MSAs that had not yet recovered from the 2001 recession, seven had college attainment above the U.S. average (24.4 percent) and five had college attainment below the U.S. average. Similarly, of the four MSAs that did not experience an employment contraction, two had college attainment above the U.S. average and two below. The MSAs that experienced neither recovery nor recession were distributed across the range of college attainment, which raises an initial concern about the proposed link between college attainment and recovery lengths. In the case of the 1990 recession, the only MSA not to fully recover was Los Angeles, which had college attainment below the U.S. average in 1990. Three MSAs with above-average attainment, however—San Francisco, San Jose, and San Diego—had the longest recovery times. So, in both the 1990 and 2001 recession models, there were some clear outliers that could not be included in the model and that did not exhibit the proposed relationship between college attainment and faster recoveries.

## RESULTS FOR THE MODELS OF THE 2001 RECESSION

Results of the regression models for the 2001 recession are listed in Tables 3 through 5. Each of the independent variables is significant at the 10 percent but not the 5 percent levels, and the model

explains approximately 30 percent of the variation of the recovery length. The coefficient for college attainment,  $-60.5$ , implies that if the magnitude of the decline in employment and the shares of employment in manufacturing and information are held constant, a one-standard-deviation increase in college attainment, which is 4.7 percentage points, would decrease the length of a recovery by 2.8 months. That is roughly one-quarter of the standard deviation of the recovery length.

Based on the results of the initial model, there is an observed correlation between recovery length and college attainment, but it is not of optimal significance. It is also not a large correlation and is part of a model that leaves most of the variation in recovery length unexplained.

These results leave two possibilities: The first is that there is not a significant relationship between college attainment and recovery time, either because there isn't really a correlation between adaptability and recovery or because college attainment isn't a good measure of adaptability. The second is that such a relationship does exist and would be better observed with some modifications to the original model. A number of modifications were thus attempted.

As mentioned here previously, the monthly employment data used to identify peaks and troughs for each MSA were volatile and the volatility contributed to the possibility that turning points might be misidentified. To correct for this potential error, the monthly data were compressed to quarterly frequency. The same analysis was repeated with the same variables, transformed from months to quarters. The results, however, did not change: After that transformation, the coefficients for three of the four independent variables—college attainment, share of employment in the information sector, and share of employment in the manufacturing sector—were no longer significant at even the 10 percent level. With quarterly rather than monthly data, the difference between each MSA's contraction and recovery became smaller, whereas the difference between each MSA's control variables remained constant. The adjusted  $R^2$  of the model fell from 0.30 with the monthly data to 0.18 with the quarterly data.

Another obvious idea to further test the hypoth-

**Table 3****Results of Initial Regression Model of 2001 Recession ( $n = 34$ )**

Variable	Coefficient	<i>t</i> -statistic
Constant	15.3	1.5
Percent decline in employment (peak to trough)	-217.8	-1.8*
Share of employment in manufacturing at peak	87.1	1.9*
Share of employment in information at peak	276.3	1.8*
College attainment	-60.5	-1.7*
<b>Model statistics</b>		
<i>F</i> -statistic		4.6**
Adjusted $R^2$		0.30

NOTE: \* $p < 0.10$ , \*\* $p < 0.05$ .**Table 4****Results of Model of 2001 Recession with Dichotomized College Attainment Based on U.S. Average ( $n = 34$ )**

Variable	Coefficient	<i>t</i> -statistic
Constant	3.8	0.6
Share of employment in manufacturing at peak	126.2	2.9**
Share of employment in information at peak	365.6	3.0*
College attainment exceeds U.S. average (1 or 0)	-7.9	-2.5**
<b>Model statistics</b>		
<i>F</i> -statistic		6.1**
Adjusted $R^2$		0.32

NOTE: \* $p < 0.10$ , \*\* $p < 0.05$ .**Table 5****Results of Model of 2001 Recession with Dichotomized College Attainment Based on Sample Median ( $n = 34$ )**

Variable	Coefficient	<i>t</i> -statistic
Constant	1.0	0.2
Share of employment in manufacturing at peak	120.2	2.8**
Share of employment in information at peak	419.4	3.2**
College attainment exceeds sample median (1 or 0)	-7.3	-2.3**
<b>Model statistics</b>		
<i>F</i> -statistic		5.6**
Adjusted $R^2$		0.29

NOTE: \* $p < 0.10$ , \*\* $p < 0.05$ .

esis is to expand the sample size. Five additional MSAs were added to the sample: Raleigh-Cary, North Carolina; Tucson, Arizona; Tulsa, Oklahoma; Albany-Schenectady-Troy, New York; and Honolulu, Hawaii. These MSAs were included because they were the next-largest U.S. MSAs that experienced both a contraction and recovery. When these five MSAs were added to the model, however, the level of college attainment was not significantly correlated with recovery length. As described here previously, the fact that this model correction did not change the results could mean that the tested relationship between college attainment and recovery length does not exist. It is also possible that the five MSAs added to the sample were not large enough for the reorganizing of workers to be a part of the recovery process. The average peak employment of the five MSAs added to the sample was 413,000, compared with an average of 1.4 million for the other sample of 34 MSAs. Thus, the five MSAs added to the sample may not be large enough to have the perceived job opportunities necessary to convince dislocated workers to remain in the area and look for a new job.

Another possibility is (i) that there is some threshold of adaptability necessary for workers in an MSA to reorganize and (ii) that being much above that threshold is not particularly helpful to the process of economic recovery. To test for that result, the college attainment variable was dichotomized into a dummy variable that reflected college attainment above the U.S. average. The results of this model were slightly better than the original model. With college attainment coded as a 1 if it was above the 2000 U.S. average (24.4 percent), the coefficient was  $-7.9$ , significant at the 5 percent level. In this model, however, the variable reflecting the percent decline in peak-to-trough employment was no longer significant at the 10 percent level and was removed from the model. Given that fact, the results of this model suggest that, after controlling for shares of employment in manufacturing and information, an MSA that had college attainment in the year 2000 that exceeded the U.S. average would recover to its pre-recession peak employment level almost 8 months faster than an MSA with below-average college attainment. Alter-

natively, having college attainment above the U.S. average shortens recovery length in this sample by about three-quarters of one standard deviation.

In our sample, 23 of the 34 MSAs (about two-thirds) had college attainment that exceeded the U.S. average. It is also generally true that MSAs tend to have higher college attainment than rural areas do, so comparing MSAs with the U.S. average may not be appropriate. The model was run a final time with the dummy recoded to reflect 1 if that MSA had college attainment greater than the sample median. In the case of the 2001 recession model with 34 MSAs, the variable for college attainment above the sample median was significant at the 5 percent level, as were the manufacturing and information sector employment controls.

## RESULTS FOR THE MODELS OF THE 1990 RECESSION

For the 1990 recession, the same methodology was applied, except that the share of employment in the information sector was not used as a control variable. The results of these regressions are in Tables 6 through 8. For the initial model, the level of college attainment was not significantly correlated with shorter recovery times. The model was repeated with a dichotomized variable reflecting college attainment above the U.S. average in 1990 or above the sample mean (both of which were coded as 1). Neither of the dichotomized variables was significantly correlated. The share of employment in manufacturing was also not significantly correlated with recovery from the 1990 recession.

## CONCLUSIONS

These results suggest that, after controlling for the magnitude of peak-to-trough decline in employment in manufacturing and information, there is a negative relationship between some measures of college attainment and the length of time measured in months that it takes for a large MSA to recover from a post-recession employment trough to its previous peak employment level for the 2001 recession. This is not the case for the 1990 recession. The level of significance of the relationship between

**Table 6****Results of Initial Model of 1990 Recession ( $n = 44$ )**

Variable	Coefficient	<i>t</i> -statistic
Constant	20.5	1.89*
Percent decline in employment (peak to trough)	-508.28	-6.98**
Share of employment in manufacturing at peak	-48.23	-1.29
College attainment	-34.32	-0.817
<b>Model statistics</b>		
<i>F</i> -statistic		17.21**
Adjusted $R^2$		0.53

NOTE: \* $p < 0.10$ , \*\* $p < 0.05$ .**Table 7****Results of Model of 1990 Recession with Dichotomized College Attainment Based on U.S. Average ( $n = 44$ )**

Variable	Coefficient	<i>t</i> -statistic
Constant	8.82	2.65**
Percent decline in employment (peak to trough)	-470.17	-7.05**
College attainment exceeds U.S. average (1 or 0)	-3.01	-0.814
<b>Model statistics</b>		
<i>F</i> -statistic		25.85**
Adjusted $R^2$		0.53

NOTE: \* $p < 0.10$ , \*\* $p < 0.05$ .**Table 8****Results of Model of 1990 Recession with Dichotomized College Attainment Based on Sample Mean ( $n = 44$ )**

Variable	Coefficient	<i>t</i> -statistic
Constant	8.26	2.56**
Percent decline in employment (peak to trough)	-467.22	-6.99**
College attainment exceeds sample median (1 or 0)	-2.10	-0.57
<b>Model statistics</b>		
<i>F</i> -statistic		24.49**
Adjusted $R^2$		0.52

NOTE: \* $p < 0.10$ , \*\* $p < 0.05$ .



the level of college attainment and recovery length is not optimal, but the relationship reaches the 5 percent level of significance when college attainment is dichotomized into a dummy variable reflecting above-average college attainment. The model results do not change when smaller MSAs are added to the sample or when the data are compressed from monthly frequency to quarterly frequency.

There are a number of reasons to view these results with some skepticism. The first is that the relationship is significant when observing the 2001 recession, but not the 1990 recession. There are a few things worth noting about the model for the 1990 recession in spite of the fact that there is not a significant relationship between recovery times and college attainments. One is that the sizes of the coefficients for the college attainment variables are all smaller in the 1990 model than in the 2001 model. So, even if the relationship between college attainment and recovery time was significant in the model of the 1990 recession, it would still be weaker than that observed in the model of the 2001 recession. Another interesting characteristic of the 1990 model, again setting aside the question of significance, is that even with a smaller number of right-hand-side variables, the  $R^2$  is much higher for the models of the 1990 recession than the models for the 2001 recession. In fact, a simple equation in which recovery length after the 1990 recession is associated with only a constant term and an MSA's percent decline in employment explains more than half of the variation in recovery time. These differences suggest that the 1990 and 2001 recessions were distinct from one another.

Another reason for skepticism is that that 12 of the 50 largest MSAs experienced a contraction but have not yet recovered from the 2001 recession; and some of these, most notably Boston, San Francisco, and San Diego, have relatively high college attainment. It is also true that some areas with high college attainment—such as San Diego, San Francisco, and San Jose—were among the slowest to recover from the 1990 recession. On the other hand, some areas with low college attainment—such as Detroit and Cleveland—still had not recovered from the 2001 recession by the beginning of 2007. The inclusion of those MSAs might

have improved the relationship between college attainment and recovery length.

It is also true that the independent variable in this model, college attainment, may not be the best proxy for worker adaptability. The fact that adding more observations to the sample did not improve the results is another source of uncertainty. Further research, such as an examination of these same MSAs during previous contractions and recoveries, or perhaps with a more refined measure of worker adaptability than simple college attainment, is thus necessary.

The fact that the relationship between college attainment and recovery length was significant for the 2001 recession but not for the 1990 recession could alternatively be seen to support, rather than contradict, the proposed relationship between college attainment as a measure of worker adaptability and faster recovery from recessions. The period of weak employment growth following the 1990 recession has commonly been referred to as a “jobless recovery” that differed from past recessions. The recovery from the 2001 recession was similar in that there was also a weak employment recovery, but different in that the apparently permanent decline in manufacturing suggests that a structural, and not just cyclical, change took place in the U.S. economy after the 2001 recession. After the 2001 recession, a larger number of workers needed to adapt themselves to new industries and firms, so it was more important for MSAs to have more adaptable and skilled workers to recover from the 2001 recession as compared with the 1990 recession. The fact that the relationship between educational attainment and recovery was stronger for the 2001 recession than for the 1990 recession provides some empirical support for the proposition that the 1990 and 2001 recessions were different from one another.

This finding is also consistent with previous research that has established a correlation between skills and growth and the ability of MSAs to adjust to structural change (Glaeser and Saiz, 2003). That, in turn, suggests that education and adaptability are more important to economic recovery when recessions have a larger component of structural change as opposed to a larger component of cyclical change. If observers such as Silvia (2006) are correct,

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and globalization will drive both continued structural changes in the U.S. economy and increased demand for educated workers, then future economic recoveries may be more influenced by educational attainment than those in the past.

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