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University Cities: Centers of Reinvention

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This report examines the factors behind the growth of six "University Cities" into prosperous, high-amenity urban centers. The findings presented here provide evidence that University Cities used their stocks of human capital more effectively than did other similarly sized cities with research universities. Through their ability to adapt to technological change, University Cities have thrived historically and, more recently, have proven resilient to the Great Recession.

Introduction

Cities with more educated populations tend to have lower crime, higher wages, and better health, among other positive outcomes.[1] The most educated cities are a magnet for businesses looking for skilled labor forces. In September, 2017, Amazon released information stating that the company would be searching for an urban location for its second headquarters with the requirement that the future site have a "strong university system."[2] A well-educated city with a large university in its central core will likely end up winning the bid. Beyond the obvious benefits of an educated population, such as the increased labor productivity sought by companies like Amazon, education is a crucial factor in the growth of urban areas.

Human capital, economists' term for the knowledge, skills, and ideas of workers, is now widely recognized as a key ingredient in the well-being of cities. Over a decade ago, MIT economist Ed Glaeser linked human capital to the population growth of cities and metropolitan areas. Glaeser's seminal work entitled, "The Rise of the Skilled City," found that cities and metropolitan areas with larger initial "stocks" of human capital grew faster in subsequent decades.[3]

Recent work by Scott Shapiro of Lexington-Fayette Urban County Government and Arnie Stromberg of the University of Kentucky has uncovered a group of "University Cities" that, in addition to enjoying high levels of human capital, also have a combination of amenities that have proved elusive for the majority of municipalities.[4] The six "University Cities" (Ann Arbor, MI; Durham-Chapel Hill, NC; Fort Collins, CO; Lexington, KY; Lincoln, NE; and Madison, WI) all have a large, high research productivity "R1" university in their urban centers and boast low levels of violent crime, high real wages, low cost of living, and high levels of arts and culture. With 115 universities classified as R1 universities today, a natural question is: What fueled the rise of these particular six cities to University City status?

Based on an examination of data from the U.S. Census Bureau's Decennial Census, the present report

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Table 1: *Descriptive Statistics, Decennial Census Data*

	Pop. > 1 mil.		Pop. < 1 mil.		Pop. < 1 mil. with R1		University Cities	
	(N = 9)		(N = 395)		(N = 85)		(N = 6)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Population, 1970 (thousands)	2321	2297	87	103	182	215	112	45
Population growth, 1970-2010	0.32	0.63	2.78	5.28	0.55	0.88	1.11	0.85
R1 university present	0.78	0.44	0.00	NA	1.00	NA	1.00	NA
Share with B.A. or more (age 25+), 1970	0.11	0.04	0.12	0.06	0.25	0.16	0.26	0.12
Share high school dropouts (age 25+), 1970	0.48	0.09	0.42	0.12	0.36	0.16	0.32	0.13
Share foreign born, 1970	0.08	0.05	0.05	0.05	0.06	0.06	0.03	0.02
Share workers in manufacturing, 1970	0.24	0.06	0.23	0.11	0.16	0.09	0.13	0.03
Share workers in trade, 1970	0.21	0.02	0.22	0.04	0.19	0.04	0.18	0.03
Share workers in professional services, 1970	0.17	0.02	0.18	0.05	0.34	0.15	0.37	0.10
Unemployment rate, 1970	0.05	0.01	0.05	0.02	0.04	0.01	0.04	0.01
Median family income, 1970 (2010 thousands)	56	2	57	11	55	10	56	10
Median home value, 1970 (2010 thousands)	106	31	106	35	113	36	111	26
University graduation rate, 1984	0.40	0.09	NA	NA	0.42	0.09	0.44	0.09
Average January temperature, 1961-1990	42	14	40	14	36	12	26	7
Poverty rate, 1970	0.14	0.01	0.11	0.07	0.14	0.05	0.13	0.04

finds that University Cities are not only places with larger amounts of human capital, but also places where human capital has been used more advantageously than in other, similar cities. The analysis presented in this report demonstrates that from 1970 to 2010, University Cities grew faster than other, similarly sized cities with R1 universities because they were able to adapt their economies to technological change –a process of "reinvention." Additional data from the American Community Survey reveals that during the Great Recession, University Cities used their human capital to mitigate the severity of the housing crisis while experiencing disproportionately larger shifts in terms of industry employment shares.

Reinvention

In addition to examining the direction of causality between human capital and population growth, Glaeser's "The Rise of the Skilled City" tested several hypotheses regarding the actual mechanism by which human capital affects population growth. One of his hypotheses was the idea that cities, in order to thrive, must "reinvent" their economies in order to adapt to technological progress. To test this view, Glaeser analyzed cities in two groups: those with colder climates and those with warmer climates. Cities with colder climates were historically more often subject to negative shocks and less likely to see high rates of immigration than cities with warmer climates –two characteristics that make survival and growth a matter of frequent "reinvention."[5] Among the colder cities, Glaeser found a much stronger impact of human capital on population growth from 1980 to 2000 than among cities with warmer climates. Glaeser's findings indicate that human capital leads to city growth by allowing cities to reinvent themselves.

Historical Growth

The decades spanning the years 1970 to 2010 saw a rise in the population of cities in the United States. Among the fastest growing urban areas over this time period were University Cities. Table 1 tabulates Decennial Census data over the 1970-2010 time period into four distinct groups: larger cities, smaller cities, smaller cities with R1 universities, and University Cities. University Cities experienced population growth rates that were more than double that of similarly sized cities with R1 universities and more than triple that of the largest cities. The group of smaller cities without R1 universities grew more on average than University Cities, but with significantly more variation in the rate of growth as evidenced by the high standard deviation.

By two separate measures –the share of the population over 25 years of age with at least B.A. degrees and the share of that age group failing to complete high school –University Cities ranked the highest for human capital, the critical input into city growth.[1] Along most other dimensions, University Cities tended to have demographics similar to other, smaller cities with universities –with the exception of their climates: University Cities were 10 degrees colder on average in January than the smaller city-R1 university group. This is a large difference in climate that, in light of Glaeser's findings, suggests that human capital may have been more effective for increasing population growth in University Cities relative to other similarly sized cities with R1 universities.

Figures 1 and 2 display the estimated relationship between human capital and city population growth for non-University Cities and University Cities respectively. The data display the results of regressions

Figure 1: *City Growth and Human Capital, Non-University Cities*

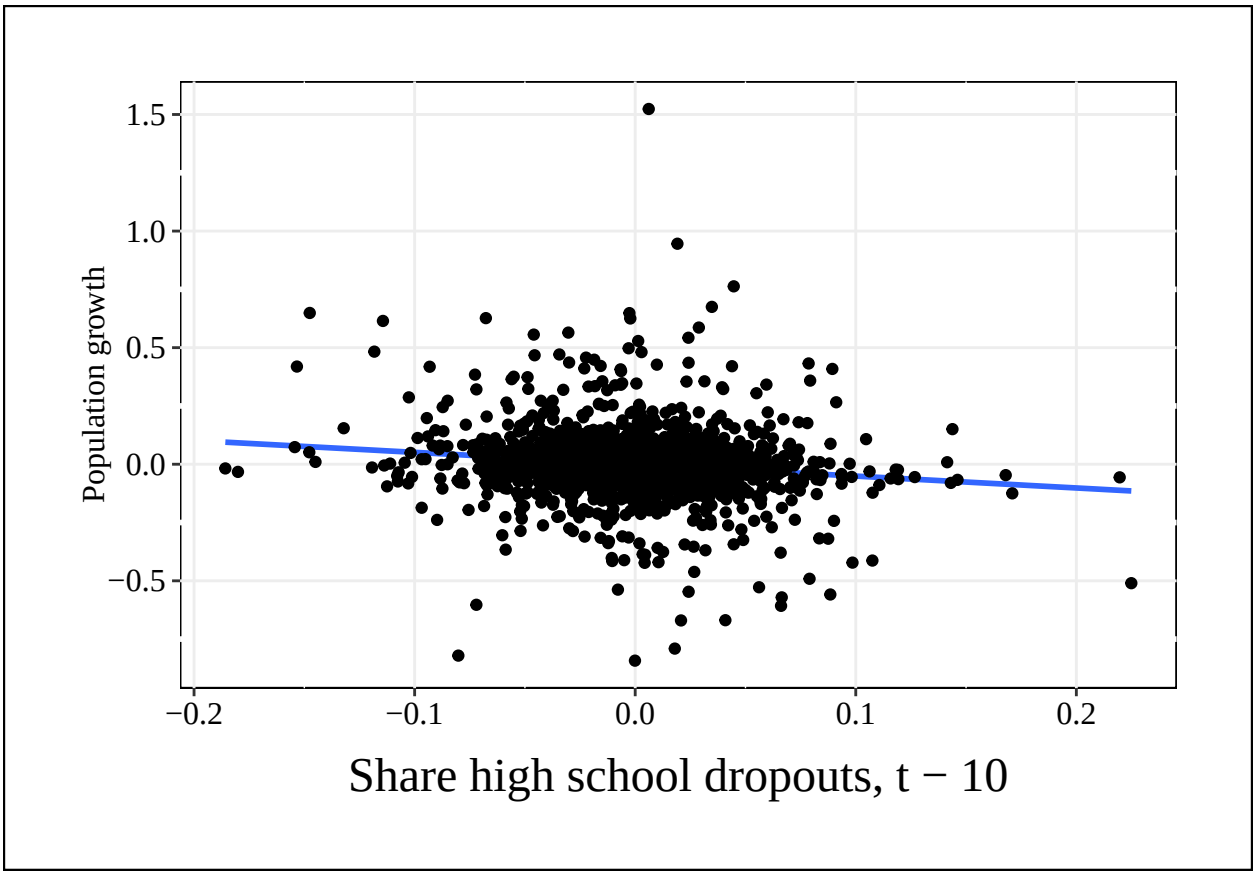


Figure 1 plots the relationship between the 10 year change in population growth and the share of high school drop outs after controlling for the log of the population, unemployment rate, share of manufacturing employment, and decade and city fixed effects. See Table 2 for regression estimates.

that model population growth in each decade as a function of human capital at the start of the corresponding prior decade and several confounding variables, including the log of city population, the unemployment rate, and the share of employment from manufacturing (all of which were measured at the start of the decade as well). Additionally, decade and city fixed effects are included in order to control for static differences between cities and macroeconomic trends that affected all cities in the same way over time.

For both groups of cities, the relationships are negative, since a greater share of high school dropouts indicates a lower level of human capital. The resulting human capital-growth relationship is much larger in magnitude (more negative) for University Cities, indicating that human capital had more of an impact on growth for University Cities relative to non-University Cities. The regression coefficients are displayed in Table 2. In short, this finding indicates that the impact of human capital on growth was stronger for University Cities than all other cities, holding constant other factors, and points to University Cities growing by reinventing themselves.

Diversification

If University Cities have had to repeatedly reinvent their economies over the past several decades, one likely outcome of this process would be movement toward more diversified economies. Table 3 displays the median industry employment share by city group over the years where the Census data are comparable: 1970-1990.[2] During this time period, cities without R1 universities saw their economies become less diverse: the median industry employment share increased by 12 percent for the largest cities and by 22 percent for smaller cities without R1 universities, whereas the small city-with R1 university group saw decreases in their median employment shares of 7 percent. University Cities, however, saw the largest decreases in their median industry employment share: a decrease of 13 percent from 1970 to 1990, indicating that their economies diversified at a faster rate than did non-University Cities.

The Great Recession

The evidence described above suggests that, historically, University Cities grew by reinventing themselves in the

Figure 2: *City Growth and Human Capital, University Cities*

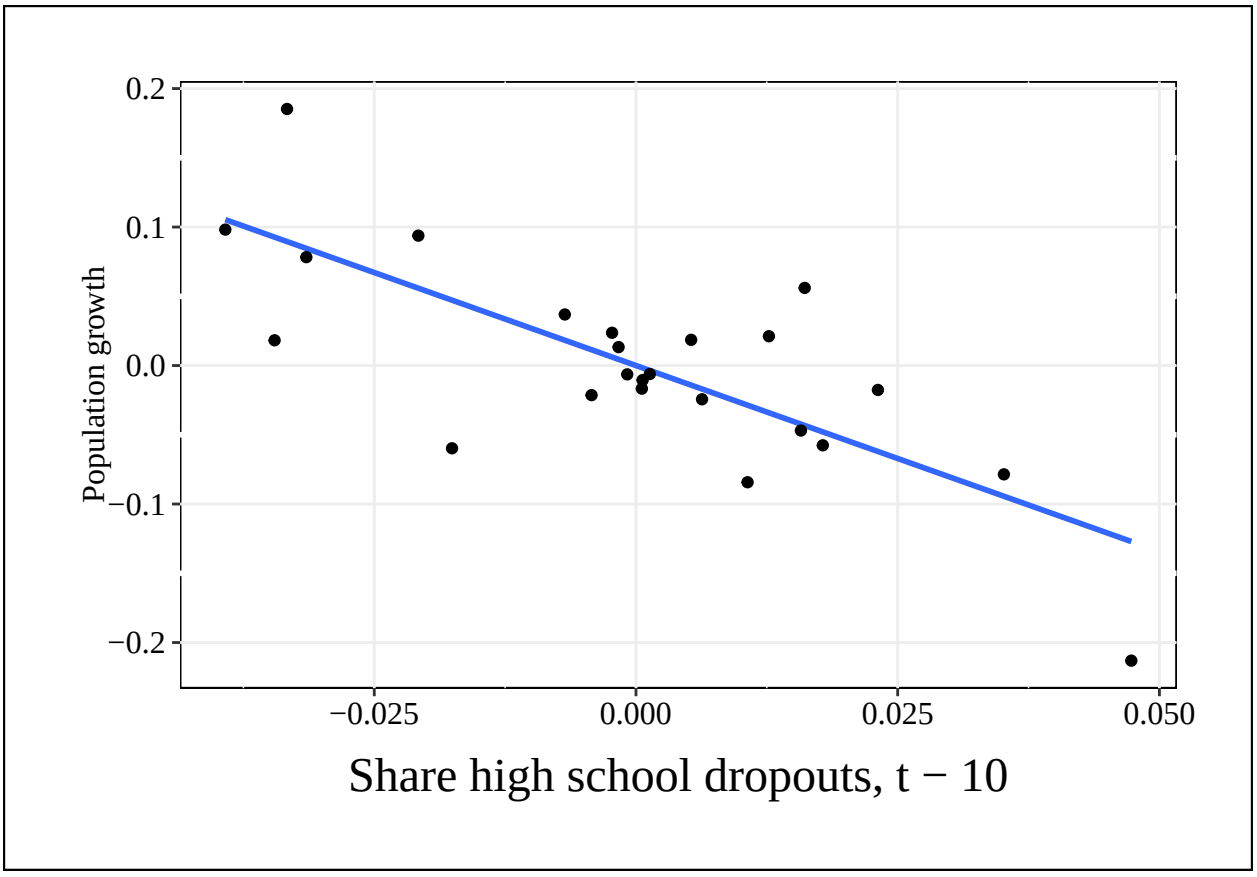


Figure 2 plots the relationship between the 10 year change in population growth and the share of high school drop outs after controlling for the log of the population, unemployment rate, share of manufacturing employment, and decade and city fixed effects. See Table 2 for regression estimates.

Table 2: *The Impact of Human Capital on Growth in Non-University Cities and University Cities*

	Dependent variable:	
	Population growth	
	(Non-UC)	(UC)
Share high school dropouts, t - 10	−0.509***	−2.685***
	(0.122)	(0.890)
Log pop., t - 10	−0.423***	−0.927***
	(0.025)	(0.222)
Unemployment rate, t - 10	−0.166	1.736
	(0.206)	(4.518)
Share manufacturing, t - 10	0.641***	3.862***
	(0.131)	(1.207)
City fixed effects	Yes	Yes
Decade fixed effects	Yes	Yes
Observations	1,956	24
R^2	0.774	0.886
Note:	*p<0.1; **p<0.05; ***p<0.01	

Table 3: *Median Industry Employment Share, Decennial Census*

	Pop. > 1 mil.	Pop. < 1 mil.	Pop. < 1 mil. with R1	University Cities
1970	0.06341	0.05129	0.05395	0.05513
1980	0.0682	0.05907	0.05156	0.0515
1990	0.07106	0.06242	0.05007	0.04817
Percent change	**0.12**	**0.22**	**-0.07**	**-0.13**

face of negative shocks, leading them to develop more diverse economies. One way to test the validity of these findings is to examine University Cities' experience during the largest negative shock in recent economic history: the Great Recession. If University Cities do reinvent themselves when faced with difficult economic situations, then human capital should have had a more mitigating impact on the severity of the recession for their economies. Also, one would expect University Cities to exhibit a greater amount of fluctuation in terms of industry employment shares over the same time period.

The Housing Crash

In order to examine impact of the Great Recession on urban employment and industry, data from the Census Bureau's American Community Survey (ACS) multiyear estimates were analyzed. The ACS 2007 3-year survey was collected by the Census in 2004-2006, while the ACS 2013 3-year survey was collected between 2010 and 2012, allowing for both the "pre" recession period (ACS 2007) and the "post" recession period (ACS 2013) to be directly compared.[3]

Table 4 shows that, for the same four groups of cities examined in Table 1, University Cities fared better during the Great Recession than other cities; they experienced a smaller increase in their unemployment rates and a less severe crash in their home values. Not surprisingly, University Cities also boasted the highest level of human capital in 2007 as measured by the share of people over 25 years old without a high school degree.

To test whether human capital levels altered the severity of the Great Recession, the average ratio between the change in city unemployment rates from 2007 to 2013 and the percentage change in median home values was computed for each of the 4 city groups. Ratios that are more negative reflect a stronger impact of the Great Recession crash in home values on unemployment rates.

Figure 3 plots the relationship between this ratio and human capital in 2007 for each group of cities. Negative correlations between human capital and the unemployment/home value change ratio imply that lower levels of human capital were associated with a harsher impact of the Great Recession on unemployment.

University Cities exhibited the strongest correlation, with a slope of -0.044, nearly ten times larger in magnitude then the next closest group of cities (Pop. >1 million people). This finding implies that for University Cities, human capital had a mitigating effect on the impact of the Great Recession –an effect that was either not present at all or not present to the same degree for the other groups of cities.

Industry Change

Lastly, if University Cities did avoid the negative impacts of the Great Recession by reinventing themselves, then for a similar level of unemployment rate change from 2007 to 2013, one would expect a greater amount of total fluctuation in terms of industry employment shares.

Table 5 demonstrates that University Cities had a disproportionately larger amount of industry shifting during 2007-2013 relative to their unemployment rates. The row in Table 5 labeled "Cumulative change" shows the total absolute value of changes in terms of the industry share of employment numbers for each of the four categories of cities as in the previous tables.

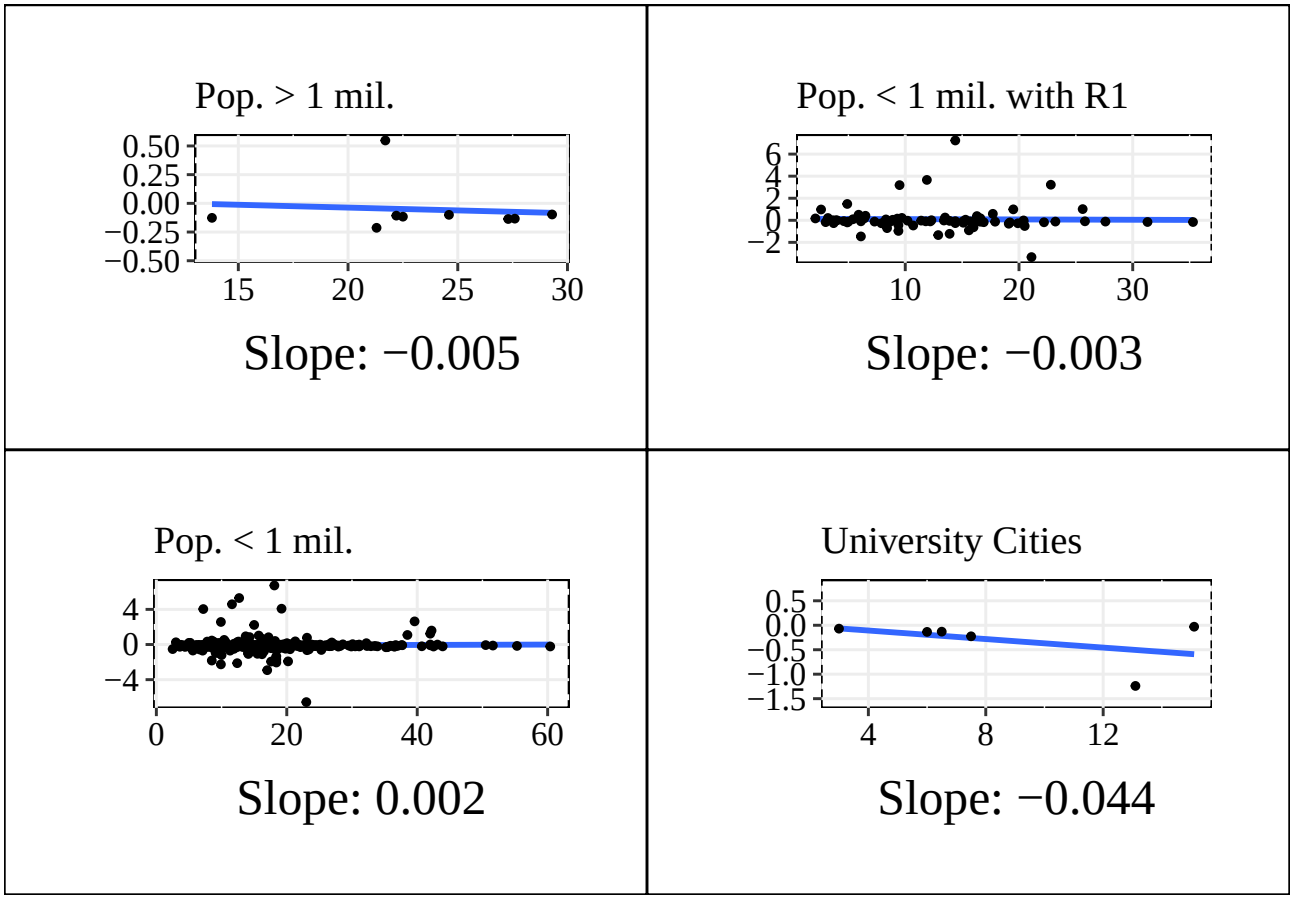
All else being equal, larger changes in unemployment rates should result in larger amounts of industry shifting. Since the numbers in Table 5 represent industry shares rather than absolute amounts, the decline of one industry must be met by an increase in other industries. For example, Table 5 shows that the largest cities saw an increase in their unemployment rates of 3 percentage points, due in part to the well-documented contraction of the construction industry that occurred as a result of the drop in housing prices. It is therefore not surprising that the largest cities had the largest unemployment rates and also the largest amount of cumulative industry employment share change.

Whereas University Cities saw the lowest increases in unemployment rates –half of the percentage point increase that small R1 cities saw –they experienced a 5.9 percent *larger* cumulative industry employment share change than did the small city-with R1 group.

Table 4: *Descriptive Statistics, ACS 3-year Estimates*

	Pop. > 1 mil.		Pop. < 1 mil.		Pop. < 1 mil. with R1		University Cities	
	(N = 9)		(N = 395)		(N = 85)		(N = 6)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Unemployment rate change, 2007 to 2013	0.03	0.02	0.03	0.03	0.02	0.02	0.01	0.01
Median home value percent change, 2007 to 2013	-0.24	0.20	-0.22	0.20	-0.11	0.14	-0.08	0.05
Share high school dropouts (age 25+), 2007	23.37	4.62	17.26	9.18	12.96	7.07	8.53	4.61
Unemployment rate, 2007	0.12	0.06	0.10	0.03	0.09	0.03	0.07	0.01

Figure 3: *Human Capital and the Impact of Falling Home Values on Unemployment*



Y axis = Ratio of change in unemployment to change in home values, X axis = Share of high school dropouts age 25+

Figure 3 plots the relationship between the ratio of the change in unemployment rates to the percentage change in median home values from 2007-2013 against the levels of human capital in 2007 as measured by the share of the population age 25+ without a high school degree for 4 groups of cities.

The high degree of industry employment share changes from 2007 to 2013 given the relatively smaller increases in unemployment rates for University Cities provides further evidence that University Cities manage recessions through the process of reinvention driven by human capital.

Conclusion

This report finds that University Cities were places that utilized human capital to a greater extent than did other cities, even cities with R1 universities. The findings presented here are consistent with those presented by Glaeser in "The Rise of the Skilled City," which indicate that policies that increase the provision of human capital are likely to encourage city growth and that the primary mechanism by which cities make use of their human capital is through the ability to adapt their economies to technological progress.

The findings presented in this report suggest that policies should allow for industries to freely rise and fall within urban areas, placing a premium on

Table 5: *Industry Share Changes, ACS 3-year Estimates from 2007 to 2013*

	Pop. > 1 mil.	Pop. < 1 mil.	Pop. < 1 mil. with R1	University Cities
Agriculture, forestry, hunting	0.00095	0.00198	0.00046	0.00176
Mining	0.00086	0.00151	0.00083	0.00132
Construction	-0.01902	-0.01717	-0.01209	-0.01135
Manufacturing	-0.00964	-0.00841	-0.00516	-0.00551
Wholesale trade	-0.00645	-0.00726	-0.00459	-0.00289
Retail trade	0.00581	0.00060	0.00112	-0.00085
Transportation, wharehousing	-0.00263	-0.00126	-0.00257	-0.00217
Utilities	0.00001	0.00039	0.00013	0.00098
Information	-0.00323	-0.00476	-0.00547	-0.00392
Finance, insurance	-0.00493	-0.00536	-0.00377	-0.00639
Real estate	-0.00270	-0.00359	-0.00330	-0.00235
Professional services	0.00567	0.00321	0.00530	0.00995
Management	-0.00039	-0.00054	-0.00040	-0.00048
Administratiions, waste	0.00281	0.00355	0.00183	-0.00089
Educational services	0.00616	0.00460	0.00333	0.00402
Health, social services	0.01813	0.01859	0.01153	0.00702
Arts, entertainment, recreation	0.00134	0.00168	0.00175	0.00073
Accommodations, food	0.00899	0.00911	0.01045	0.01316
Other services	0.00163	0.00166	0.00201	0.00208
Public administration	-0.00335	0.00147	-0.00139	-0.00422
Cumulative change	**0.10472**	**0.09669**	**0.07748**	**0.08202**
Unemployment rate change	0.03	0.03	0.02	0.01

the movement of labor and capital between industries. Economies with a diverse set of industries go hand in hand with urban adaptation to a technologically changing world.

References

[1] Steven H Woolf. “How are income and wealth linked to health and longevity?” In: *The Urban Institute* (2015).

[2] Amazon.com, Inc. *Amazon HQ2 RFP*. https://images-na.ssl-images-amazon.com/images/G/01/Anything/test/images/usa/RFP_3._V516043504_.pdf. 2017.

[3] Edward L Glaeser and Albert Saiz. *The rise of the skilled city*. Tech. rep. National Bureau of Economic Research, 2003.

[4] Scott Shapiro. *New Species of City Discovered: The University City*. https://nextcity.org/daily/entry/what-is-a-university-city-new-definition-urban-typology. 2016.

[5] Edward L. Glaeser. *Reinventing Boston: 1640-2003*. 2003.

Notes

[1] Glaeser found that, for cities, the preferred measure of human capital was the share of high school dropouts over the age of 25, whereas for larger metropolitan statistical areas, the share of the population with at least B.A. degrees was a more accurate measure of human capital. The remainder of this report utilizes share of high school dropouts as the measure of human capital.

[2] The NAIC industry codes replaced the SIC industry codes in 1997, making comparisons across 1990 and 2000 difficult.

[3] The ACS collects 1-year and 5-year estimates as well, but the former do not reach many smaller cities with R1 universities and the latter, while fully comprehensive in terms of cities covered, do not fall around the Great Recession with the correct timing.