CITIES VERSUS SUBURBS: THE POST 2000 DYNAMICS OF POPULATION AND EMPLOYMENT IN U.S. METRO AREAS OF U.S. BANARJEE, Soumendra * CHATTERJEE, Boishampayan

Abstract. This paper gives a descriptive mapping of the population and employment changes and the characteristics of these changes between central cities and suburbs of U.S. metropolitan areas, post 2000. The key findings of this study are: population centralization happened between 2005 and 2010. However, between 2002 and 2007, job growth was happening in the suburbs; newly formed central cities contributed much toward the rise in population of central cities; population centralization on average involved more whites, college students, young professionals, and non-whites, respectively. On the other hand, non-white population increased in the suburbs; with a shift in the demographic distribution of population between central cities and suburbs, urban revival tapered down by the end of 2015. As employment responds to this, policies should be suitably directed to accommodate these changes.

Keywords: Population, Employment, Centralization, Central city, Metropolitan area JEL classification: R1, J1

1. Introduction

Population and employment movement in urban America is something which has drawn attention among researchers from time to time. Particularly, population and employment shifts in metropolitan areas have defined the changes in urban equilibria in terms of growth of cities and urban area. Almost the first half of the twentieth century was a period when population and employment concentrated in central cities, until the process of decentralization begun primariliy from 1950 onwards. From then, U.S. metropolitan areas got gradually characterized by suburbanized population and employment. By 2000, this process of suburbanization shifted the urban equilibrium to a point where people both lived and worked in the suburbs. However, the pace of this population and employment movement gradually tapered down by the end of the twentieth century. Post 2000, the dynamics of population and employment within metro areas has been taking a different course. First, recent studies point out that on average, both cities and suburbs grew more slowly in the 2000s than the 1990s (Alan Berube, 2011). Second, in recent years, cities have been growing comparatively faster than the suburbs. This brings in place the discussion on the possibility of population and employment centralization and whether this urban revival be persistent in years to come. In this light, this paper attempts to do a descriptive mapping of the population and employment changes that took place in U.S. metropolitan areas post 2000. The objective of this study is to provide a big picture of population and employment movement between central cities and suburbs in metropolitan areas between 2000 and 2015, with particular focus on the characteristics of such movements. This study would thus serve as a premise for further research on identifying the factors that has driven the changes in population and employment characteristics in central city and suburbs in recent past years.

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2. Background and Motivation

U.S. metropolitan areas has historically been characterized by suburbanized population and employment. With the development of highway construction, people were able to move to their preferred locations and the process of suburbanization picked up. 1960s and 1970s were years of significant population loss for central cities in U.S. metropolitan areas. In 1950, 57% of MSA residents were located in the central cities. In 1970, the share was 43% while in 1990 it was 37% (Mieszkowski and Mills 1993). Aggregate population of central cities in the United States declined by 17% despite a population growth of 72% in the metropolitan statistical areas (MSA) as a whole between 1950 and 1990 (Baum-Snow, 2007). Although with lesser speed, the process of population suburbanization continued to shape the residential distribution of population within a metropolitan area (Frey, 2012)

On the other hand, along with population, employment decentralized as well. In 1950, 70% of MSA jobs were located in the central cities. In 1970, the share was 55% while in 1990 it was 45% (Mieszkowski and Mills 1993). Employment also got decentralized with jobs such as manufacturing, wholesale, retail locating in the suburbs. Gordon and Richardson (1996) estimated that between 1976 and 1986, most of the job growth in the urban peripheries of consolidated metropolitan statistical areas (CMSA) has been in the manufacturing, wholesale, retail and service industries. By 2000, people both lived and worked in the suburbs. The median employee worked eight miles from the city center and the median resident lived nine miles from the city center. (Glaeser and Kahn, 2001).

Population suburbanization also shaped up the racial residential distribution in U.S. metropolitan areas, with primarily whites migrating to suburbs (Massey and Denton, 1988). Till 2000, majority of the white population lived in the suburbs, while mostly Black non-Hispanic population lived in urban core of metropolitan areas. (Gardner, 2016). However, after 2000, a gradual change in the racial residential profiling is observed with increase in immigrants and non-whites, particularly Hispanic population, moving into the suburbs (Frey et al 2009). Recent trends in population suburbanization suggest that major racial groups such as whites, blacks, Asians, and Hispanics are becoming more suburbanized (Massey and Tannen, 2018). At the same time, studies report that suburbs of metropolitan areas are getting poorer, contrary to what we have seen in population suburbanization in U.S. metro areas. (Kneebone and Garr, 2010). If employment opportunities, particularly unskilled jobs, locate in suburbs, then it is likely that unskilled laborers will suburbanize as well.

In recent years, tales of urban revival in American cities have become commonplace, and widely relayed by the popular press. Indeed post 2000, a clear pattern of suburbanization was not visible. Between 2000 and 2010, metro areas experienced steady increase in population growth in both primary cities and suburbs, although the growth was greater in the latter than the former. However, between 2010 and 2013, central city population growth picked up and surpassed that of the suburbs. In particular, large cities grew at a much higher pace during 2010-2013 than before 2010. (Frey, 2014) Again most recent census data reveal a resurgence of suburbanization in the last few years. (Frey 2018). With all these roller coaster, it can be said that post 2000, population suburbanization in U.S. metropolitan areas is a mixed, with some degree of urban revival, which is in contrast

with the suburbanization era of the last century as documented by Glaeser and Kahn (2004); Baum-Snow (2007); Boustan (2010) and others.

Couture and Handbury (2015) find that although an average American is still suburbanizing, American cities have experienced large increases in young professionals near their central business districts over the last decade. They find that preferences for consumption amenities - such as retail, entertainment, and service establishments explain this location decision of the young and college-educated adults. As far as the racial distribution is concerned, analysing data from the decennial censuses Frey (2011) finds that whites' share of population in central cities have been persistently declining between 1990 and 2010. Among the minority group, Hispanics outnumber blacks and represent the largest minority group in major American cities. As per the 2010 census data, in large metro areas, more than half of all minority groups, including blacks, now reside in the suburbs (Frey, 2011).

The picture of urban America seems a bit diverse after 2000. Do we see a reverse of suburbanization with central cities gaining more population than suburbs in metro areas? Is a similar pattern observed in case of employment distribution as well? Are old central cities attracting population and employment or it is the contribution of newly formed central cities? Do we observe a different pattern in the distribution of population by age, education, race in central cities and suburbs post 2000? What is the contribution of different industries in the employment growth of central cities and suburbs? The theme of this paper is to provide a descriptive analysis of these central questions and provide a big picture of the "suburbanization vs urban revival" story. For that we look into the data between 2000 and 2015 to see if there is any noticeable change in the pattern of population and employment movement in U.S. metro areas.

3. Methodology and Data

The data for this study is drawn from two sources. Population and related demographic data is obtained from U.S. Census Bureau American Community Survey (ACS) 5 year data. Employment data by industry is obtained from U.S. Census Bureau Economic Census (EC). From both the sources, data is obtained at the place and metropolitan area level. For ACS, the sample period is 2005, 2010, 2015 while for EC it is 2002, 2007, and 2012. Place level data is used to map the central cities of metropolitan areas. Central cities are census defined principle cities of metropolitan areas. Suburbs of metropolitan areas pertain to the portion of the metropolitan area's population that lies outside the boundaries of the central cities. Population data is described using two geographical definitions of central cities and MSAs- (1) constant geography and (2) contemporaneous geography. For constant geography measures, we use consolidated metropolitan statistical area 2000 definition of central city and MSAs as defined by Office of Management and Budget (OMB). To create the constant geography central city data, we use the place level data to map the central cities of metro areas that correspond to the central cities of metro areas as per 2000 OMB definition. The data is then aggregated to generate measures of population for central city for each metropolitan area. Similarly, 2000 definition of metropolitan area was mapped with contemporaneous definitions to create the constant geography population data by considering the MSAs pertaining to 2000 definition. For contemporaneous geography of MSAs, we use census definition of core based statistical areas and their principal cities of respective years. Metropolitan area delineations of Census 2000 and recent years is

obtained from Census Bureau's delineation files. We use data on various population demographics and employment by industry to derive estimates of central city, suburb, and metro area. Population estimates include measures related to total population, population across race, education, and age. Employment estimates are obtained for industries using 2-digit North American Industry Classification System (NAICS). These estimates allow us to characterize the recent changes in population and employment in metro areas and see whether there exist any discernable pattern in population and employment movement.

4. Findings

4.1. Is U.S. population centralizing?

US urban population has been increasing steadily. Table 1 shows the total urban and central city population for 2005, 2010 and 2015. Urban population is defined as the sum of population in census defined metropolitan and micropolitan areas in 2005, 2010, and 2015, respectively. Urban population as a percentage of total population was 87.5 percent in 2005, which increased to 93.8 percent in 2015, a growth of about 7.2 percent. On the other hand, central city population as a percentage of urban population grew by 10.27 percent. Out of the increase in total urban population between 2005 and 2015, about 53 percent was in central cities. All this indicate that there has been a tendency of urban population to centralize. Central cities have been gaining population with newly formed central cities contributing toward that increase.

Year	U.S. population ¹	Urban population ²	Central city population ³	Central city percentage ⁴	New central city population
2005	288.38	252.31	79.11	31.35	
2010	303.97	285.00	99.08	34.77	2.38
2015	316.52	297.08	102.70	34.57	2.37

Table 1. Total urban and central city population in United States

1. Population in millions. 2. Urban population is defined as the sum of population in census defined metropolitan and micropolitan areas in 2005, 2010, and 2015, respectively. 3. Central city population is defined as sum of population in census defined principal cities of metropolitan areas in 2005, 2010, and 2015, respectively. 4. Central city population relative to urban population.

To see whether there is evidence of population centralization, we look into Table 2. Table 2 shows total population of MSAs, central cities and suburbs for 2005, 2010, and 2015 for both constant and contemporaneous geographies. Both MSA and central city population has increased, which is an indication of population centralization. For both constant and contemporaneous geographies, central city population growth has been about 9 percent on average. However, the growth in population between 2005 and 2010 has been greater than between 2010 and 2015 for both the geography definitions. The speed of population increase in central cities is also greater than that of MSAs, as indicated by an increase in the central city population share from 0.36 to 0.39 for the constant geography definition. For the contemporaneous geography, if we do not restrict ourselves only to the common MSAs across years, average population growth of central cities is 14.4 percent. In fact, as per census defined central cities of metro areas, 46 new central cities were added between 2005 and 2010 and 2015. These newly formed central cities added 4.75 million population to the urban core. The

growth of suburb population during 2005 and 2010 and 2010 and 2015 averaged out to 4 percent, much lesser than the average population growth of central cities.

Year	MSA population ¹		Centra popula	Central city Central city population ² population percentage ³		l city ation tage ³	Suburb pop	oulation ⁴
	Cons geo	Cont geo	Cons geo	Cont geo	Cons geo	Čont geo	Cons geo	Cont geo
2005	202.3	198.1	73.4	72.0	36.3	36.3	128.7	126.8
2010	214.2	209.9	83.3	82.1	38.9	39.1	130.2	127.6
2015	225.2	222.7	87.2	85.2	38.7	38.2	138.3	137.8

Table 2. Total population estimates for MSA, central city, and suburb

1. 172 (194) common MSAs in case of constant (contemporaneous) geography. 2. Population in millions.3. Central city population relative to MSA population. 4. Difference between MSA and central city population.

Next we do a regional comparison of population changes in MSAs and central cities. Figure 1 shows the percentage changes in MSA and central city population across census defined regions. Population changes are computed between 2005 and 2010, and 2010 and 2015 using 2000 definition of MSA and central city geography. Region wise also there is evidence of population centralization with both MSA and central city population increasing for all the regions between 2005-2010 and 2010-2015. The general trend observed from Figure 1 is that between 2005 and 2010, greater proportion of the population growth in MSAs were in the central cities for all the regions. Among the regions, the speed of centralization has relatively been greater in Midwest and Northeast. The scenario is different during 2010-2015. Although, all the regions continue to show some signs of centralization, the speed is comparatively slower. Unlike the previous decade, on average MSA population growth is greater than that of central cities, except for west. Thus overall population centralization is evident across regions, although in varying degrees. Immigrant population rose significantly during the last decade and a half in metropolitan areas (Wilson and Singer 2011). This regional disparity may partly be attributed to differences in the increase in immigrant population across regions. The pace of centralization, however, slowed down for all the regions.



Figure 1A. Regional MSA and central city population change trend in 2005-2010

Source: Elaboration on data from ACS database, 2005, 2010.



Figure 1B. Regional MSA and central city population change trend in 2010-2015

Source: Elaboration on data from ACS database, 2010, 2015.

U.S. metropolitan areas thus exhibit some degree of population centralization, particularly during the period of 2005 to 2010. This precedence of central cities over suburbs in population increase is unlike to what happened in previous decades. As this phenomenon is visibly less towards the end of 2015, it hints that this might be a temporary phase occurring due to reasons such as influx of immigrants in metro area central cities and the housing market crisis. In addition, we cannot say whether it's a "reversal of suburbanization", as along with rise in central city population, we see increase in suburban population as well, only at a slower pace.

4.2. Whose urban revival is this?

4.2.1. Population distribution by age and educational attainment

Next, we turn in to see the demography of the population which is contributing to the change in the disposition of population in central cities and suburbs of metropolitan areas. Table 3 shows the percentage of population of a particular age group in central city of total MSA population of that age group. A clear pattern emerges that between 2005 and 2010, central city population share out of MSA population share increased for all the age categories while between 2010 and 2015, it remained more or less same. Overall, population in central cities increased across all age groups. In addition, we can say that between 2005 and 2010, there has been a fair degree of population centralization across ages as the increase in central city population is significantly higher than that of MSA (See Appendix Table A1). As we can see from Table 3, the distribution of population across age groups are gradually becoming even between central cities and suburbs. More than 40 percent of the population are residing in central cities for all the age groups. In particular, young college students and working professionals (age groups 15-24 and 25-39, respectively) have the highest representation in central cities, almost close to 50 percent. This is in contrast with the earlier demographic distribution of urban America where considerably greater proportion of middle-aged working population with families live in the suburbs.

Next we look into the distribution of population between central city and suburb in terms of education attainment. Between 2005 and 2010, population in central cities has increased for all the education categories. In 2010, out of total MSA population with up to high school degree, about 41 percent were residing in central cities. For people with college and higher education degrees, this percentage was 45 and 47, respectively. Although the estimates changed marginally between 2010 and 2015, we can see that almost half of the population

with college and higher degree is residing in central city of a metropolitan area. The average percentage growth of population for all education category has been relatively greater in central cities than in MSAs (see Appendix Table A2).

		The second se	
Age category	2005	2010	2015
0-5	43.3 (18.9)	46.1 (17.4)	45.6 (17.2)
5-14	39.4 (17.8)	42.4 (17.1)	41.6 (16. 9)
15-24	44.2 (18.8)	50.6 (18.5)	49.0 (18.4)
25-39	43.7 (18.1)	47.6 (17.4)	47.1 (17.2)
40-54	38.2(17.7)	41.5 (16.8)	40.5 (16.7)
55-64	37.8 (18.1)	41.0 (16.7)	40.0 (16.8)
65+	40.4 (18.7)	42.8 (17.4)	40.5 (17.5)

Table 3. Central city population out of MSA population by age group¹

1. Mean percentage (Standard deviations).

Table 4. (Central city	population	out of MSA	population h	ov educational leve	1 ¹
I able li v	contrar city	population	out of more	population t	y cuucutional icre	

Education category	2005	2010	2015
High school	37.2 (17.7)	40.8 (17.0)	39.3 (17.0)
Bachelors	42.3 (20.3)	45.3 (19.5)	44.2 (19.1)
Graduate, rofessional	44.3 (21.2)	47.2 (21.0)	46.6 (20.8)

1. Mean percentage (Standard deviations).

Overall, between 2005 and 2010, central cities have attracted more population than suburbs across all age and education groups, particularly for college students and working professionals. By 2015, although this phenomenon subsided, central city and suburbs on average hold almost equal percentage of MSA population across age and education categories. By 2015, about 47 percent population between age 15 to 39 and about 45 percent of population with college and higher education degrees were residing in central cites. **4.2.2. Racial composition of population in central city and suburbs**

Table 5 shows the racial distribution of population within the central city and suburb. Only 105 MSAs are used as data on population of Hispanic origin was limited. For 2005, 58 percent of MSA population were white, followed by Hispanic, Black and Asian with 14, 12 and 4 percent respectively. Within 5 years, share of Hispanic and Asian population out of total MSA population increased by 31 and 32 percent respectively, while white and black population share increased by 20 and 22 percent. Within 2005 and 2015, among the non-whites, Hispanic population on average rose by 30.3 percent, which is more than double the increase in black population in an MSA. For all the three years, we see Hispanic population outnumbering black.

Geography	MSA			(Central city		Suburb		
Year	2005	2010	2015	2005	2010	2015	2005	2010	2015
Total	162.6	171.9	182.8	61.4	69.0	71.6	101.2	103.0	111.2
White	114.9	120.0	127.5	35.7	41.1	42.8	79.2	78.8	84.7
Hispanic	28.5	32.5	37.2	13.1	16.2	17.9	15.4	16.3	19.3
Black	23.1	24.6	26.4	13.2	14.1	14.5	9.9	10.5	12.0
American Indian	1.0	1.0	1.1	0.4	0.5	0.5	0.5	0.6	0.6
Asian	8.8	10.1	11.8	4.3	5.1	6.0	4.5	5.0	6.0
Native Hawaii	0.2	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.2

Table 5. Total population by race for MSA, central city, and suburb¹

1. Contemporaneous geography. 2. Population are in Million

Out of nearly 70 percent of the population in these 105 MSAs are white, about 33 percent lives in the central city in 2015. This percentage has been more or less same for the previous two years. For all the years, percentage of non-whites in MSAs residing in central cities is around 50 percent. Again, out of its total population in the central city, non-white proportion was 50.7 percent. This increased to 52.6 and 54.2 percentages respectively in years 2010 and 2015. The percentages of white population out of total central city population were 58.2 for 2005 and about 59.7 in 2010 and 2015. Thus, although we see a relatively higher proportion of whites out of total white population in an MSA are residing in the suburbs, the racial distribution of population between whites and non-whites between central cities and suburbs are more equitable. 2005 to 2010 was an era of growing population in central city, which is reflected in most of the racial groups. By 2015, however, we see a reversal of this trend. Suburbs started picking up on population growth faster than central cities. For instance, the average rise in population in suburbs has been 13.72 percent, almost double than that of central city. Historically, the process of population suburbanization has entailed a racial residential classification-mostly whites in the suburbs and non-whites in the central cities. In our sample period, the data suggests that the distribution of population by race across city and suburb has become more equitable. Presence of non-whites is growing in suburbs, particularly after 2010.

Figure 2A shows race wise distribution of population growth between central city and suburbs out of total MSA population growth. Out of total population growth in an MSA, more than 80 percent was in central city. This is reflected in an increase in population across races as well. For all the races, the average contribution of population growth in central city has been greater than that of the suburbs between 2005 and 2010. Out of total MSA population growth, central city population growth has been maximum for White, Hispanic, Asian and American Indian. For instance, out of total Hispanic population growth in MSA, about 78 percent growth happened in central cities. Similarly, for the other races, central city registered a relatively higher population growth as compared to the suburbs. In fact, suburban population growth has been negative for whites.



Figure 2A. Central city and suburb population growth by race: 2005-2010

Source: Elaboration on data from ACS database, 2005, 2010.

However, between 2010 and 2015, the picture is different as suburbs overtake central cities in growth numbers as we can see from Figure 2B. Central city population growth was much lesser, only 24 percent of total population growth in MSA. Similarly, 2010-2015

period saw an influx of population in suburbs for all the racial groups. For example, about 80 percent of the total growth in black population in MSA was in suburb. Between 2005 and 2010, this growth was relatively equi-proportional between central city and suburb. White population, which had a negative suburb growth between 2005 and 2010, observed a growth of 4.9 percent, about 78 percent of total growth in white population.



Figure 2B. Central city and suburb population growth by race: 2010-2015

Source: Elaboration on data from ACS database, 2010, 2015.

From Figure 3A and 3B, in the Appendix, what we can see is that white and Hispanic population has largely contributed in the population growth of central city and suburb. For instance, between 2005 and 2010, the population growth of central city was primarily driven by whites and Hispanics. Although population growth in the suburbs was much lesser than that of the central city, Hispanic made up substantial part of that growth. The contribution of white and Hispanic population was the maximum.

The same is true between 2010 and 2015. Hispanic and whites outweighed other races in the population growth in both central city and suburbs. Among other races, black had a fair amount of growth in both central city (2005-2010) and suburb (2010-2015). The overall observation from the Figure is that we do not see white as a dominant racial group residing in suburbs. Over years it is seen that non-whites also are locating themselves in the suburbs, increasing the possibility of a more equitable racial residential distribution in an MSA.

4.3 Evidence of urban revival of employment?

We now turn to the employment side of urban America. Table 6 presents total industry employment of entire U.S., urban area, and central city for 2002, 2007, and 2012. Total urban employment, measured as sum of total employment in metropolitan and micropolitan areas, has been steadily increasing between 2002 and 2012. The urban share of total employment increased by 1.5 percent between 2002 and 2007, and by 2.2 percent between 2007 and 2012. However, central city employment did not pick up that growth. In fact, the share of central city employment out of total urban employment declined by 38.7 percent on average between 2002 and 2012. Suburban employment on the other hand grew on an average of 95 percent between 2002 and 2012. Thus, overall urban industry employment witnessed some degree of employment decentralization during 2002 and 2012.

	Table 6. Total urban and central city employment in United States									
Year	ear U.S. Urban Central city emp									
	employment ¹	employment ²								
2002	109.17	69.63	53.7							
2007	115.82	75.01	35.2							
2012	112.19	74.26	35.5							

1. Employment in millions.2. Urban employment is defined as the sum of employment in census defined metropolitan and micropolitan areas in 2002, 2007, and 2012, respectively. 3. Central city employment is defined as sum of employment in census defined principal cities of metropolitan areas in 2002, 2007, and 2012, respectively.

Table 7 shows the employment totals for MSA, central city, and suburb for 323 MSAs common to all years for 2002, 2007 and 2012. A clear pattern emerges from the numbers. 2002-2007 was a period of job growth followed by a stagnant phase during 2007 to 2012. The job growth during the first of the sample period happened in the suburbs. In fact, an indication of employment decentralization is observed as we see an increase in total MSA and suburban employment, while a decline in central city employment. The magnitude of this change was also big. The proportion of central city employment out of total MSA employment fell by 39 percent, while that for suburbs increased by 170 percent. Suburbs contribution to total employment growth was 35.53 percent, while central city contribution was -27.99 percent, leading to a net growth of MSA employment by 7.54 percent. Period of 2007 to 2012 was stagnant in terms of job growth. This is in contrast with what is observed in case of population growth. Central city population grew consistently between 2005 and 2015, indicating some degree of centralization. Thus, we see a fall in central city total employment between 2002 and 2007 while a rise in central city total population between 2005 and 2010. The period of 2007 to 2012 in overall job stagnation may be partly attributed to 2008 recession. Overall, comparing the population and employment growth in MSAs, we see signs of population centralization and employment suburbanization. Americans on average tend to live in central cities and work in suburbs. However, more light can be thrown on this once we look into the characteristics of employment growth in MSA.

Year	MSA	Central city	Suburb
2002	66.0	53.7	12.3
2007	71.0	35.2	35.8
2012	70.6	35.5	35.5

Table 7. Total MSA, central city and suburb employment current definition for 2002, 2007, 2012¹

1. In million.

At the regional level, we can see that all four regions on average experienced loss of central city employment between 2002 and 2007 in Figure 4A. On the other hand, MSA employment in all four regions increased, indicating a rise in suburban employment. The changes in MSA and central city employment has not been uniform across regions. For instance, the loss of central city employment was comparatively lower in south and west than in Midwest and Northeast, while gain in MSA employment was relatively more. In the context of employment decentralization, we may say Southern and Western regions experienced suburban job growth between 2002 and 2007. The same cannot be said for the Northeast and Midwest regions as although we see significant fall in central city employment, gain in total MSA employment has been minimal. Thus, the data indicates

that between 2002 and 2007 on average we observe a redistribution of employment from central city to the suburbs of MSAs across regions, although with different degrees.

2007 to 2012 gives a different picture of employment in MSAs across regions in Figure 4B. First central city employment loss has been much lesser. In fact for northeast and south it grew. In Midwest and West, both central city and MSA employment fell. This is in contrast with what we have seen during 2002 and 2007. Unlike 2002-2007 period, none of the regions show signs of job suburbanization. The growth of jobs in suburbs that was visible stagnated by the end of 2012. 2007-2012 may be a period of overall job stagnation in the country, which is reflected in minimal growth of employment across all four regions, be it central city or suburb.

Table 8 shows the trend in MSA, central city and suburb employment for Manufacturing, Wholesale, Retail and Services sectors. 2002-2007 provides an evidence of employment decentralization.

Year	Geography	Total	Manufacturing	Wholesale	Retail	Services
2002	Metropolitan	66.0	9.9	4.6	10.9	40.6
	Central city	53.7	7.5	3.7	8.6	33.9
	Suburb	12.3	2.5	0.9	2.3	6.7
2007	Metropolitan	71.0	9.1	4.9	11.6	45.4
	Central city	35.2	3.6	1.8	5.1	24.7
	Suburb	35.8	5.5	3.1	6.5	20.7
2012	Metropolitan	70.6	7.7	4.6	11.2	47.2
	Central city	35.1	3.0	1.7	4.9	25.5
	Suburb	35.5	4.8	2.9	6.3	21.6

Table 8. Employment by industry¹

1. In million.

The share of suburban employment out of total MSA employment increased by about 2.7 times and central city employment declined by 1.6 times between 2002 and 2007. At the sectoral level also, all the four major industrial sectors-manufacturing, wholesale, retail and services have experienced a substantial increase in employment in the suburbs while central city employment decreased. For instance, in case of the wholesale industry, despite a 6 percent rise in MSA employment, central city employment declined by about 51 percent between 2002 and 2007. On the other hand, suburban employment grew by about 245 percent. Similar trend is observed for Retail and Service industries as well. Only for manufacturing, despite a growth of suburban employment, we see overall 8 percent fall in MSA employment. Thus, the descriptives so far indicate toward suburbanization of employment during 2002 to 2007. 2007-2012 period gives a different picture altogether. First as compared to the 2002- 2007 period, the degree of change in MSA, central city and suburb employment is much lesser. Second, except for services, employment in MSA, central city and suburb declined for wholesale, retail and manufacturing. In the service sector employment increased by 3.84 percent in MSA, 3.24 in central city 4.56 percent in suburbs, which doesn't indicate job decentralization. Thus between 2007 and 2012, total employment growth was stagnant with no major distributional changes between central cities and suburbs across industries.

Figure 5A, in the Appendix, shows the contribution of industries (2-digit NAICS) in the growth of MSA employment for central city and suburb. Between 2002 and 2007, all the

sectors are showing a rise in suburban employment and a fall in central city employment. MSA employment has also increased for all industrial sector, except manufacturing and information services. This growth in MSA employment is largely contributed by suburban employment. For instance, among the service sector industries, educational growth is among the highest, which is 24.4 percent. This growth figure is characterized by a 47.6 percent growth in suburban employment while a 23.19 percent decline in central city employment. Similarly, employment growth in wholesale and retail trade in suburbs has also overcompensated the fall in employment in central city. Both of the industries registered a positive MSA employment growth of 5.91 and 6.71 percent. In both the cases, suburb employment grew by 47.48 and 38.84 percent respectively. 2002-2007 may thus be characterized as a period of employment decentralization for all industries.

Figure 5B, in the Appendix, shows the contribution of employment growth by 2-digit NAICS code for central city and suburb in total MSA employment growth between 2007 and 2012. The picture is quite different from the employment growth of the previous five years. Total MSA employment has been declining for industries, except for some service industries such as professional, educational, health, arts and accommodation. Educational industry recorded a maximum growth of about 18 percent at the MSA level, out of which central city employment grew by 10.98 percent and suburb employment grew by 6.92. Except health care, for all the service sector industries which had positive MSA employment growth, central city's contribution was relatively more than suburbs. Thus unlike 2002-2007, the relative contribution of central city in total MSA employment growth was greater than suburbs. This is in contrast with what we observe in the previous five years growth pattern, which was more suburb centric. In fact, for industries such as manufacturing and real estate, fall in suburban employment contributed to about 54 and 57 percent respectively in the total decline in MSA employment for these industries. Overall, the period of 2007 to 2012 was in general a period of employment loss, may be due to job loss aftermath the 2008 financial crisis. It can't be said a priori that it was a period of reversal of job suburbanization. Although central city job loss was relatively less than that of suburbs, there is no evidence of industries as such where we observe an increase in overall MSA employment, but a decline in suburban employment.

Figures 6A and 6B, in the Appendix, show the contribution of industries to employment growth within a suburb and central city of MSA. As we can see, 2002-2007 was a period of employment growth for suburbs while central city observed a decline in employment.

Within the suburbs, the contributions of manufacturing, wholesale, retail and service sector in total employment growth were 24.69, 17.80, 34.36 and 113.90 percent respectively. The key drivers of the service sector employment growth were health, accommodation, administrative and professional services. 2007-12 was a period of employment loss for both suburb and central city.

Positive growth were registered for service sector industries such as health care, accommodation, professional and educational services, although at a lesser degree as compared to 2002-2007 period. Out of these industries, health care's contribution was maximum- 1.60 percent for central city and 2.49 percent for suburb. For other sectors the degree of the change in employment (be it positive or negative) across industries is comparatively more in central cities than in suburbs.

4.4 Population and employment suburbanization/urbanization

Table 9A panel 1 lists the top ten MSAs according to central city population and employment changes between 2005 to 2010 and 2002 to 2007 respectively. 40 percent MSAs are from south and west in top 10 with maximum change in population. For employment, the distribution is dispersed with 40 percent MSAs on average in Midwest experiencing significant central city employment changes, followed by 30 percent from south, 20 and 10 percent from north east and 10 west. All the top ten MSAs are exhibiting gain in central city population but loss in central city employment. This is counterfactual to what we observe in the shift of urban equilibria as explained by "people follow jobs" or "jobs follow people" hypotheses. This is also true for many of the MSAs with least population and employment changes. One more thing to notice is that only 20 percent of top ten MSAs are common in both population and employment change. This indicates that it is not generally true that MSAs observing maximum population movement between 2005 and 2010 also experienced major employment changes.

	FAINEL 1: 10p 10 MSAs with population and employment change									
	Pop	ulation c	hange 2005-2010	Employment change 2002-2007						
	Region	State	MSA	Region	State	MSA				
1	South	DC	Washington-Arlington-	Northeast	NJ	New York-Northern				
			Alexandria			New Jersey-Long Island				
2	West	AZ	Phoenix-Mesa-Glendale	Midwest	IL	Chicago-Naperville-Joliet				
3	West	CA	San Francisco-Oakland-	South	DE	Philadelphia-Camden-				
			Fremont			Wilmington				
4	Northeast	MA	Boston-Cambridge-	Northeast	MA	Boston-Cambridge-Quincy				
			Quincy							
5	South	ΤX	Houston-Sugar Land-	Midwest	MN	Minneapolis-St. Paul-				
			Baytown			Bloomington				
6	South	NC	Charlotte-Gastonia-	Midwest	MO	St. Louis				
			Rock Hill							
7	West	WA	Seattle-Tacoma-	South	FL	Miami-Fort Lauderdale-				
			Bellevue			Pompano Beach				
8	West	CA	San Jose-Sunnyvale-	West	CA	San Francisco-Oakland-				
			Santa Clara			Fremont				
9	Midwest	MN	Minneapolis-St. Paul-	Midwest	OH	Cleveland-Elyria-Mentor				
			Bloomington							
10	South	ΤX	McAllen-Edinburg-	South	GA	Atlanta-Sandy Springs-				
			Mission			Marietta				

 Table 9A. Top and Bottom ten MSAs according to population and employment change

Table 9A panel 2 shows the population and employment changes for 2010-2015 and 2007-2012 respectively. The picture is different from the earlier period changes. 40 percent of the MSAs with highest population and employment changes are from western and southern regions. Unlike the previous year changes, 80 percent of the top ten MSAs are common in the list of MSAs with maximum population and employment changes. Also for all the common MSAs, we see that population and employment changes are moving in the same direction. This means MSAs with population centralization also experienced a gain in central city employment while MSAs with loss in central city population observed job decentralization. However only two MSAs (Phoenix-Mesa-Scottsdale and Providence-Warwick) recorded a decline in population and employment levels while others have shown centralization.

	PANEL 2: Top 10 MSAs with population and employment change										
Population change 2010-2015				Employment change 2007-2012							
	Region	State	MSA	Region State		MSA					
1	Northeast	NJ	New York-Newark-	Northeast	NJ	New York-Newark-					
			Jersey City			Jersey City					
2	West	NV	Las Vegas-Henderson-	West	WA	Seattle-Tacoma-					
			Paradise			Bellevue					
3	Northeast	MA	Providence-Warwick	West	AZ	Phoenix-Mesa-					
						Scottsdale					
4	West	CO	Denver-Aurora-	South	GA	Atlanta-Sandy Springs-					
			Lakewood			Roswell					
5	West	WA	Seattle-Tacoma-	South	TX	Houston-The					
			Bellevue			Woodlands-Sugar Land					
6	South	ΤX	Houston-The Woodlands	Northeast	MA	Providence-Warwick					
			- Sugar Land								
7	South	DC	Washington-Arlington-	South	DC	Washington-Arlington-					
			Alexandria			Alexandria					
8	South	GA	Atlanta-Sandy Springs-	South	FL	Tampa-St. Petersburg-					
			Roswell			Clearwater					
9	South	ΤX	San Antonio-New	West NV Reno		Reno					
			Braunfels								
10	West	AZ	Phoenix-Mesa-	West	CO	Denver-Aurora-					
			Scottsdale			Lakewood					

 Table 9A Top and Bottom ten MSAs according to population and employment change

Table 9B. Central city population and employment changes of top and bottom ten MSAs

Top 10 MSAs 2005 population wise

State	MSA	Central city	Central city		
		population change	employment change		
		2005-2010	2002-2007		
MA	Boston-Cambridge-Quincy	289984	-1071963		
MI	Detroit-Warren-Livonia	113005	-693986		
GA	Atlanta-Sandy Springs-Marietta	67026	-427678		
DC	Washington-Arlington-Alexandria	367059	51453		
TX	Houston-Sugar Land-Baytown	245517	-79647		
FL	Miami-Fort Lauderdale-Miami Beach	203512	-513079		
DE	Philadelphia-Camden-Wilmington	112334	-1110474		
TX	Dallas-Fort Worth-Arlington	188178	-433827		
IL	Chicago-Naperville-Joliet	188774	-1720066		
NJ	New York-Northern New Jersey-Long Island	153017	-2981804		
	Top 10 MSAs 2010 pop	oulation wise			
State	MSA	Central city	Central city		
		population change	employment change		
		2010-2015	2007-2012		
MI	Detroit-Warren-Livonia	-71993	-17180		
MA	Boston-Cambridge-Quincy	-79656	-37010		
GA	Atlanta-Sandy Springs-Marietta	202491	102207		
DC	Washington-Arlington-Alexandria	209607	76665		

Doston Camorage Quincy	19050	57010
Atlanta-Sandy Springs-Marietta	202491	102207
Washington-Arlington-Alexandria	209607	76665
Miami-Fort Lauderdale-Pompano Beach	60	1048
Houston-Sugar Land-Baytown	228310	99230
Philadelphia-Camden-Wilmington	49091	15801
Dallas-Fort Worth-Arlington	12065	-72992
Chicago-Joliet-Naperville	-119708	-33208
New York-Northern New Jersey-Long Island	670947	260465

FL TX DE TX IL NJ Table 9B enlists the top ten MSAs by population and their level of central city employment and population changes. The changes are shown for 2005-2010 and 2010-2015 for central city population and 2002-2007 and 2007-12 for central city employment. For years 2005-2010 and 2002-2007, all the top 10 MSAs show population centralization. However, central city employment for all the top ten MSAs fell, barring Washington-Arlington-Alexandria metro area. MSAs with least population also showed a similar trend. MSAs in the top ten by population are showing greater movement in employment on average than population. For top ten MSAs, there was an average increase in central city population of about 15.5 percent, while employment declined by almost three times more, averaging about 42.2 percent.

Comparing Tables 9A and B it can be said that it is not necessary that population movement is greater in larger MSAs. Among MSAs which are in the top 10 according to population changes, only three MSAs (Boston, Wahsington, and Houston) appear in the top ten list of MSAs by population. However, six of the large MSAs by population are in the top ten list of MSAs with significant central city employment decline.

Between 2010-2015 and 2007-2012, the average percentage change in central city population and employment have been relatively slower than the earlier years. Also the direction on movement on average where in the same direction. Between 2010-2015 and 2007-2012, both population and employment in top ten MSAs on average experienced centralization. Also, unlike the previous years, for top ten MSAs by population, average percent change in population has been greater than that of employment.

5. Summary and Discussion

Decentralization of population and employment has lost its momentum after 2000. In fact, data from 2005 to 2015 indicate evidence of some degree of population centralization. However, the speed of centralization was lesser after 2010 than in the initial years. Although population in existing central cities (as per OMB 2000 definition of principal cities in MSAs) has grown, new central cities formed between 2005 and 2015 contributed much toward the growth of population in metropolitan areas. If we look at the entire time frame between 2005 and 2015, we can see two episodes of population movement. Between 2005 and 2010, central city population grew rapidly, while suburban population growth was stagnant. Post 2010, central city population grew, but at a lesser rate while suburban population growth picked up. Putting it all together, after 2005, we see some form of convergence in the difference created in population residing in central cities and suburbs due to years of suburbanization, making the distribution more equal. The question that arises here is that whether this transition is short-lived or we are seeing a long run shift in the urban equilibria? It may be that 2007 to 2009 recession triggered a short term revival of central city population, which is reflected in the population explosion of central city till 2010. However, data also reveals that central city population continued to grow with new (and presumably low density) central cities attracted considerable population. If this is a continuing phenomenon, then the push and pull factors of urbanization have to be looked into.

One outcome of population suburbanization was racial residential segregation of population between central cities and suburbs in an MSA. Whites predominantly moved to the suburbs while non-whites remained in the cities. This demarcation happened on the

basis of factors which are directly or indirectly related to race. Given that population of central cities and suburbs have converged in the recent years, it is important to see how far the demographic distribution has changed. As we see from the data, racial distribution has been more equitable between 2005 and 2010. Unlike the era of suburbanization, a significant portion of the increase in central city population constituted whites, particularly between 2005 and 2010. In fact, Hispanic also contributed largely to the growth of central city population. On the other hand, between 2010 and 2015 suburb population grew faster than central cities, with black and Hispanic population rising considerably. Overall, the data indicates a fair degree of racial assimilation, which is in contrast with what happened prior to 2000. However, this big picture should be interpreted a bit carefully. It may happen that whites are attracted to the new central cities as compared to the denser and matured suburbs. In fact, white population continue to grow in these suburbs, then it is possible that racial polarization continues. Given that recent literature voices about suburbs getting poorer, this possibility cannot be neglected.

If we look into the employment side, we see that although urban employment increased steadily between 2002 and 2012, the share of central city employment out of total urban employment declined by about 6.1 percent. Overall, suburb is the winner in job growth during this time period. In particular, between 2002 and 2007, employment in manufacturing, wholesale, retail and services increased for suburbs. The period of 2007 to 2012 was a general employment loss for industries in metro areas. However, employment in some service industries such as professional, educational, health, arts and accommodation continued to grow in suburbs. Central cities also recorded a positive growth of employment in these industries. In fact, except health care, for all the service sector industries which had positive MSA employment growth, central city's contribution was relatively more than suburbs. For instance, educational industry recorded a maximum growth of about 18 percent at the MSA level, out of which central city employment grew by 10.98 percent.

If we now map the two time periods considered in this study, we can curve out a pattern in the population and employment movements in MSAs. 2005-2010 was an era of general population increase in central cities. What is noticeable is that newer central cities attracted primarily young, college students, and young professionals. On the employment side, suburbs attracted employment, particularly during the period of 2002 to 2007. This arrangement might give an indication that people are preferring to live in newer and less dense central cities than matured suburbs. If these central cities offer better amenities and are well networked with the existing suburbs where job growth is happening, then this settlement pattern may exist for a longer period of time. On the other hand, the post 2007 employment scenario indicate recession, lack of jobs and mortgage meltdown may have caused the central city population to rise. More recent data may throw light on whether centralization of population is a short lived phenomenon or not.

Whatever may be the case, changes in population and employment leads to some degree of assimilation or dissimilation of population on the basis of demography. In our case, we see that the percentage of non-white population in the suburbs has been increasing. This may lead to integration of races if white population retains itself in the suburbs. This is not very evident during 2005 to 2010, as we see white population growth in central city and non-white population growth in suburbs. So it looks like racial residential segregation continued during this period, with a shift of white population in cities and non-white to suburbs. This continued to be the case till 2015, although we see relatively more rise in white population in the suburbs. Both push and pull factors may be at work for this distribution to emerge. The spur in non-white population growth may be due to employment opportunities opening up in manufacturing, wholesale and retail industries in the suburbs. It would be interesting to see how much non-white employment happened in this course, as it may throw some light on non-white unemployment arising due to spatial mismatch. On the other hand, white and non-white segregation may happen if newer central cities attract relatively more white population for their amenities and less congestion.

The aim of this study was to give a big picture of the population and employment dynamics in U.S. metro areas. Increased centralization or suburbanization of population and employment and their characteristics would be captured if we see above average representation of metro areas in this context. Our analysis reveals three primary things. First population centralization between 2005 and 2010. Almost during the same time period and after, job growth was happening in the suburbs. So on average we observe population centralization and job suburbanization in our sample period. Second, polarization of population on the basis of race may still be there but might have taken a different form, with non-whites living in the suburbs and whites in cities. Third, there is a discontinuity in the pace of urban revival of population, as it tapered down by the end of 2015. Thus whether the urban revival is short-lived or not, more recent data will be able to tell.

The objective of this paper has been relatively modest. We aim to deliver a descriptive mapping of the population and employment changes, along with the characteristics of these changes between central cities and suburbs, which had a significant role in the structural transformation of the metropolitan areas post 2000 till 2015. This description is a necessary step to further research on the causes underlying the main trends outlined here. A few limitations of this study should be mentioned. First, the processes of population and employment movement is heterogeneous across metro areas. The degree of suburbanization or centralization is specific to the characteristics of metro areas such as size, age, existing population level and its characteristics, level of public good provision etc. For that, we may see varying degree and direction of population and employment movement across metro areas. It is therefore also necessary to take a look of these processes at a disaggregated level. Second, the delineation of suburb and central city is important while measuring the degree of suburbanization. The construction of central city area in an MSA may be based on disaggregated level data such as census tracts. Third, geographical areas such as exurbs, and micropolitan areas also contribute to urban growth, which is something that should be explored further.

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Annex on line at the journal Website: http://www.usc.es/economet/eaat.htm

Appendix



Figure 3A. Growth of population by race within central city and suburb: 2005-2010

Figure 3B. Growth of population by race within central city and suburb: 2010-2015



Source: Elaboration on data from ACS database, 2010, 2015.



Figure 4A. Changes in central city and MSA employment across regions 2002-2007

Source: Elaboration on data from EC database, 2002, 2007.

Figure 4B. Changes in central city and MSA employment across regions 2007-2012



Source: Elaboration on data from EC database, 2007, 2012.



Figure 5A. Central city and suburb employment growth by industry: 2002-2007

Source: Elaboration on data from EC database, 2002, 2007.

Figure 5B. Central city and suburb employment growth by industry: 2007-2012



Source: Elaboration on data from EC database, 2007, 2012.



Figure 6A. Growth of employment by industry within central city and suburb: 2002-2007

Figure 6B. Growth of employment by industry within central city and suburb: 2007-2012



Source: Elaboration on data from EC database, 2007, 2012.

A1. ropulation growth across age group										
Age category	Geography	2005-2010	2010-2015	2005-2015						
0-5	Central city	15.0	0.5	15.0						
		(42.3)	(12.4)	(42.8)						
	MSA	1.8	1.2	3.0						
		(6.8)	(9.5)	(12.2)						
5-14	Central city	18.3	2.2	20.6						
		(50.7)	(13.0)	(54.8)						
	MSA	3.1	3.9	7.4						
		(6.0)	(10.6)	(14.3)						
15-24	Central city	40.8	0.0	40.6						
		(46.1)	(9.3)	(47.5)						
	MSA	15.1	3.4	19.1						
		(12.4)	(8.3)	(15.9)						
25-39	Central city	18.2	5.1	24.0						
		(32.4)	(10.5)	(35.7)						
	MSA	3.7	5.8	9.9						
		(6.5)	(9.6)	(13.6)						
40-54	Central city	18.6	-3.0	15.0						
		(37.0)	(12.2)	(39.1)						
	MSA	2.6	-0.6	2.1						
		(5.0)	(9.9)	(12.3)						
55-64	Central city	35.3	14.9	55.0						
		(45.0)	(12.4)	(53.9)						
	MSA	16.3	17.8	37.0						
		(6.5)	(11.9)	(15.6)						
65+	Central city	27.6	11.2	41.5						
		(41.9)	(14.4)	(49.4)						
[Γ	MSA	12.7	18.4	33.7						
		(4.9)	(12.9)	(17.2)						

A1. Population growth across age group¹

1. Mean (Standard deviations) of 194 observations.

A2. Population growth across education group ¹							
Age category	Geography	2005-	2010-	2005-			
		2010	2015	2015			
High school	Central city	23.2	0.2	22.8			
_	_	(43.7)	(13.6)	(46.5)			
	MSA	4.8	4.1	9.2			
		(5.8)	(11.8)	(14.0)			
Bachelors	Central city	26.0	9.9	37.9			
		(47.2)	(12.8)	(51.7)			
	MSA	9.0	12.3	22.4			
		(6.9)	(9.1)	(12.8)			
Graduate, professional	Central city	30.3	15.5	49.9			
		(73.6)	(15.2)	(84.0)			
	MSA	10.6	16.9	29.3			
		(8.4)	(10.3)	(14.5)			

1. Mean (Standard deviations) of 194 observations.