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Permanently Displaced? Increasingly Disconnected?

Labor Force Participation in U.S. States and Metropolitan Areas

By Benjamin Hilgenstock and Zsóka Kóczán

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Permanently Displaced? Increasingly Disconnected? Labor Force Participation in U.S. States and Metropolitan Areas

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Abstract

The United States stands out among advanced economies with marked declines in labor force participation. National averages furthermore conceal considerable within-country heterogeneity. This paper explores regional differences to shed light on drivers of participation rates at the state and metropolitan area levels. It documents a broad-based decline, especially pronounced outside metropolitan areas. Using novel measures of local vulnerability to trade and technology it finds that metropolitan areas with higher exposures to routinization and offshoring experienced larger drops in participation in 2000-2016. Thus, areas with different occupational mixes can experience divergent labor market trajectories as a result of trade and technology.

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Keywords: Labor force participation, exposure to routinization, exposure to offshoring, technology, automation

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I. INTRODUCTION

Population growth in advanced economies is slowing, life expectancy is rising, and dependency ratios are increasing steeply (Figures 1 and 2).[1] Population aging weighs on participation rates and hence potential growth, and could undermine the sustainability of social insurance systems.[2]

However, while aging weighs on participation in most advanced economies, the United States stands out with a stark decline in participation since the late-1990s (Figure 3). The decline is particularly striking since demographic shifts were somewhat less pronounced in the United States relative to other advanced economies: population growth slowed down less, gains in life expectancy (as well as healthy life expectancy) were much more muted, and the old-age dependency ratio rose by less in the last 30 years.[3]

In many other advanced economies, the dramatic entry of prime-age women in the labor force more than offset declines in the participation of prime-age men, leading to overall gains in the participation rates of prime-age workers (see Chapter 2 of the April 2018 *World Economic Outlook* and Grigoli, Kóczán and Topalova 2017). The United States, however, experienced both an especially pronounced decline in the participation of prime-age men since at least the 1980s, and a decline in the participation of women since the late 1990s.

Furthermore, national averages conceal significant heterogeneity across states and metropolitan areas, as well as differences between urban and rural areas, or more generally between prospering hubs of innovation and progress on the one hand, and increasingly distressed and disconnected communities on the other (see e.g. Economic Innovation Group

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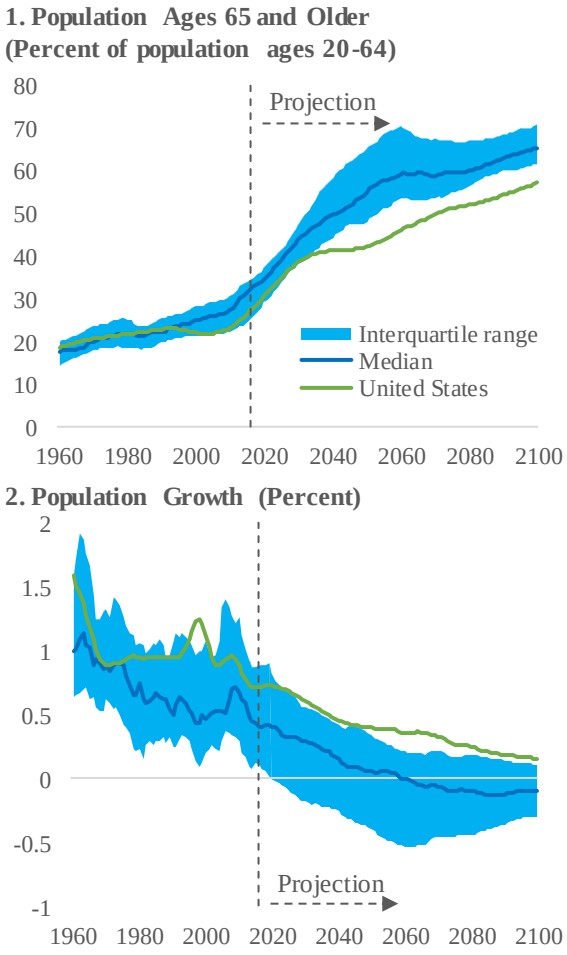
[1] Dependency ratios have been rising at least since the 1960s, and the pace of the increases accelerated in the early 2000s when the post-World War II 'baby boomer' generation started transitioning into retirement (Figure 1, panel 1). Dependency ratios are projected to increase further and reach a striking 50–60 percent in most advanced economies by the 2050s. These changes are driven both by a slowdown in population growth rates (Figure 1, panel 2) and dramatic increases in (healthy) life expectancy (Figure 2). Calculations based on United Nations population projections show that population growth rates will turn negative in 25 percent of advanced economies in the 2020s and that the median advanced economy will confront negative population growth by the late 2050s. Life expectancy at birth increased significantly between 1960 and 2016; as has healthy life expectancy for both men and women (Figure 2, panel 2).

[2] The labor force participation rate is defined in this paper as the total labor force as a percentage of total population ages 15 or older.

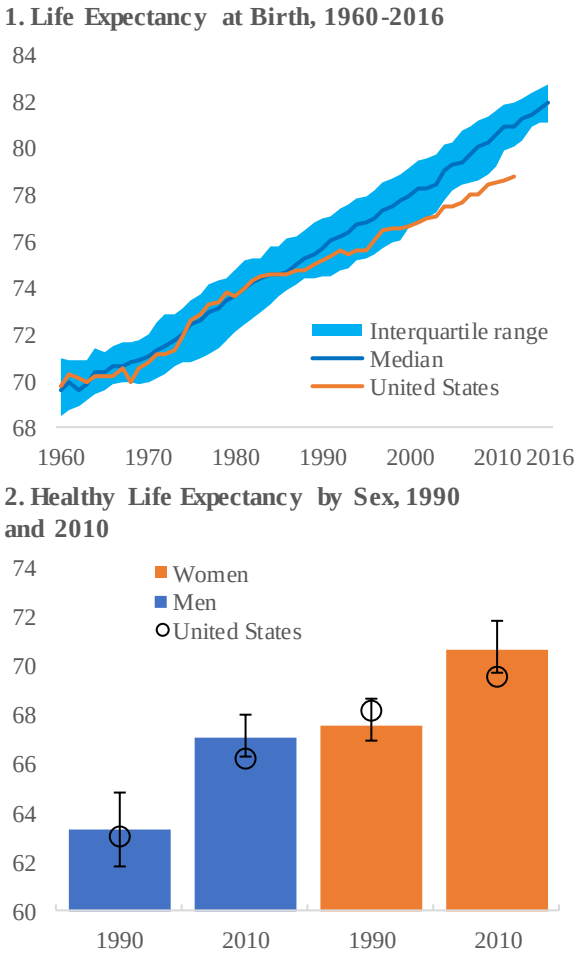
[3] The dependency ratio increased less in the United States than in 75 percent of countries and is projected to increase much less in the future as well, expected to stay more than 12 points below the median advanced economy in 2050 and more than 8 points in 2100 (Figure 1, panel 1). Life expectancy decoupled from the trend in other advanced economies starting in the mid-1980s. Life expectancy at birth was more than 2 years lower in the United States in 2012 compared to the median advanced economy (Figure 2, panel 1). The United States has also fallen behind in terms of healthy life expectancy: while it has risen for both men and women between 1990 and 2016, the United States has moved from the 75th percentile to the 25th percentile in the case of women and from the middle of the distribution to the 25th percentile in the case of men.

Figure 1. Demographic Transition in Advanced Economies, 1960-2100



Sources: United Nations; and authors' calculations.
Note: Countries included in summary statistics for advanced economies are AUS, AUT, BEL, CAN, CHE, CYP, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, GRC, HKG, IRL, ISL, ISR, ITA, JPN, KOR, LTU, LUX, LVA, MAC, MLT, NLD, NOR, NZL, PRT, SGP, SVK, SVN, SWE, and USA.

Figure 2. Changes in Life Expectancy in Advanced Economies

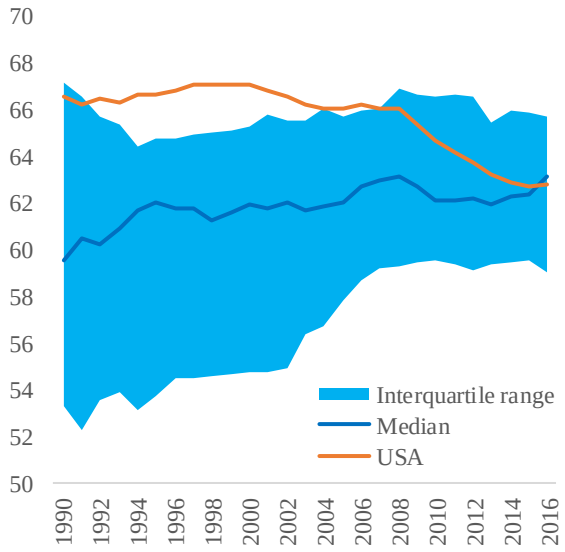


Sources: Salomon and others (2013); World Bank, World Development Indicators database; and authors' calculations.
Note: Bars show median and lines denote interquartile range. Countries included in summary statistics for advanced economies in panel 1 are AUS, AUT, BEL, CAN, CHE, CYP, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, GRC, HKG, IRL, ISL, ISR, ITA, JPN, KOR, LTU, LUX, LVA, MAC, MLT, NLD, NOR, NZL, PRT, SGP, SVK, SVN, SWE, and USA. Countries included in summary statistics in panel 2 are the same with the exception of HKG and MAC, and the addition of TWN.

2017). therein). With geographic mobility in the United States at historic lows (Ihrke 2017), the link between individual fates and those of their communities is tightening. These divergent trends in participation and the resulting polarization between thriving areas and those left behind is likely to have political economy implications as well (see also Austin, Glaeser and Summers 2018 and references

The decline in US labor force participation over the past two decades has been widely documented (see, for example, Council of Economic Advisors 2016, Eberstadt 2016, Krause and Sawhill 2017, Krueger 2017 and Abraham and Kearney 2018 for a recent review). This paper hopes to contribute to this literature by (1) examining the evolution and drivers of participation at both the state and metropolitan area levels, and (2) focusing on the roles of trade and technology, relying on novel measures of local exposure to routinization and offshoring.

Figure 3. Evolution of Labor Force Participation Rates, 1990-2016
(Percent)



Sources: Organisation for Economic Co-operation and Development; and authors' calculations.
Note: Advanced economies included are AUS, BEL, CAN, DEU, DNK, ESP, EST, FIN, FRA, GBR, GRC, IRL, ISR, ITA, JPN, KOR, LUX, NLD, NOR, NZL, PRT, and SWE. Abbreviations in the footnote use International Organization for Standardization (ISO) country codes.

The paper documents a broad-based decline in participation across states and metropolitan areas, though with especially pronounced drops outside metropolitan areas. It finds that alongside the well-documented effects of aging, trade and technology also played important roles. The aim of the empirical approach is not to precisely disentangle the relative contribution of trade versus technology—these are difficult to separate empirically since local labor markets highly exposed to routinization tend to be also highly exposed to offshorability. Rather, the paper examines the impact of each in turn and finds that lower participation in metropolitan areas is strongly associated with both exposure to routinization and to offshoring. This supports hypotheses about the role of deteriorating job opportunities for some workers as a result of technology and globalization in their increasing detachment from the workforce (in line with the findings of Abraham and Kearney 2018; Acemoglu and Autor 2011; Autor, Dorn and Hanson 2016).

The rest of the paper is structured as follows: Section II provides a brief review of the large literature on participation in the United States, Section III introduces the data used, and Section IV presents stylized facts at the state- and metropolitan area levels. Section V outlines the empirical strategy, presents regression results and illustrates the relative contributions of different factors at the metropolitan area level. Section VI concludes.

II. LITERATURE

Many hypotheses have been put forth for the puzzling decline in labor force participation in the United States. These include aging and cohort effects, cyclical forces and the severity of the Great Recession, the role of policies, as well as lower labor supply

(because of incarceration, disability and pain) and structurally lower labor demand brought on by the forces of trade and technology (especially for low- and middle-skilled).

Aging and cyclical effects are generally found to account for some, but not all of the observed decline in aggregate participation in the past decade.[4] Council of Economic Advisers (2014) examines the evolution of the labor force participation rate since 2007, which marked a demographic inflection point with the baby boomers becoming eligible for Social Security early retirement benefits, and finds that the combination of demographic changes and the drop in labor force participation that would have been expected based on historical business cycle patterns explain most but not all of the recent drop in labor force participation: aging can account for around half of the decline, and cyclical effects for about a further sixth. Hall (2014) finds that about one-third of the decline in participation between 2007 and 2013 was due to aging and the cohort effects of the baby boomers. Balakrishnan and others (2015) also document that the aging of the baby boom generation explains around half of the observed decline during 2007–13, with cyclical factors accounting for about 30–40 percent, and the rest made up of non-demographic structural factors such as increasing college enrollment and fewer students working. Fallick and Pingle (2007) and Aaronson and others (2006) zoom in on the role of cohort effects and highlight the roles of the aging of the baby-boom cohort and diminishing gains in the participation for newer cohorts of adult women.

A number of papers emphasize the key role of policies and other US-specific labor supply factors in explaining the divergence in participation rates between the United States and other advanced economies. Council of Economic Advisers (2016) points to less supportive labor market policies than in other OECD countries, such as lower spending on active labor market policies, as well as the rise in incarceration, especially affecting lower-skilled men. Blau and Kahn (2013) investigate data on participation across developed countries and find that the lack of family-friendly policies in the United States can explain roughly a quarter of the relative decline in women's participation between 1990 and 2010.

Trade and technology can also account for some of the decline in (especially lower skilled prime-age male) participation, by lowering the demand for labor. Council of Economic Advisers (2016) emphasizes the roles of technology and globalization in lowering labor demand, especially for lower-skilled. Krause and Sawhille (2017) also point to the effects of trade and technology on labor demand, especially for the lower skilled. They find that there appears to be a growing gap between the skills demanded by employers and those supplied by the labor force, and that as demand for less-skilled labor declines, the relative wages of less-skilled workers also decline. While some dislocated workers are able to

[4] Age effects capture changes due to the underlying age participation profile: prime-age workers are more likely to participate than the young and the old, hence changes in the shares of these groups will affect aggregate participation rates. Cohort effects capture shifts in these profiles due to new cohorts entering the labor force. These would include all factors associated with a particular year of birth, such as slowly changing social norms and institutions.

relocate to communities with stronger job markets, some pursue training programs to learn new skills, and some accept lower-paying positions, many leave the labor force altogether.

Geographic variation in exposures to trade and technology is examined by Autor, Dorn and Hanson (2016) and Acemoglu and Restrepo (2017). Autor, Dorn and Hanson (2016) highlight that the impacts of China's emergence are most visible in the local labor markets in which the industries exposed to foreign competition are concentrated, and show that exposed workers experience greater job churning and reduced lifetime income. Acemoglu and Restrepo (2017) analyze the local labor market effects of the increase in industrial robot usage between 1990 and 2007 and find large and robust negative effects of robots on employment and wages across commuting zones.

Several papers exploit state-level variation to examine the role of cyclical factors (Balakrishnan and others 2015, Council of Economic Advisers 2014, Erceg and Levin 2013), local labor demand shocks (Dao and others 2014), structural forces such as changing occupational composition and the rising role of services (Council of Economic Advisers 2016), and lower demand for low-skilled labor and resulting changes in the wage distribution (Council of Economic Advisers 2016).

Diverging trends in long-term inactivity across Americans regions are also highlighted in recent work by Austin, Glaeser and Summers (2018), who argue for a reconsideration of place-based policies. Regional differences in participation rates were explicitly linked to election outcomes by Brooks and others (2017a, b, c), who examine the evolution and drivers of participation rates in red and blue states in the latest election. They find that the divergence in participation rates does not appear to be related to aging, but rather to the sectoral composition of employment growth, with states skewed towards 'old economy' sectors such as manufacturing and retail experiencing 'discouraged worker effects' and hence larger declines in participation, while states with growth sectors like technology and life sciences (clustered on the coasts) have seen improvements in their participation rates.

Taking a broader perspective and examining 'distressed communities' using a measure incorporating business, education, housing, income and poverty alongside labor market indicators, Economic Innovation Group (2017) emphasizes that while some areas have experience rapid growth and seem immune to the concerns of automation and globalization, others are increasingly distressed and disconnected, diverging from the rest of the country and increasingly alienated from the benefits that these forces can bring to the economy as a whole.

This paper aims to contribute to this literature by (1) examining metropolitan areas alongside states to speak more to urban-rural differences, which to the best of our knowledge has not been previously done in this context, and (2) relying on novel measures of exposures to trade and technology for geographical regions to dig deeper into the impacts of automation and offshoring at the metropolitan area level.

III. DATA

This paper relies on data on labor force participation rates and populations from the US Bureau of Labor Statistics and the US Census Bureau, for the 50 states and roughly 290 metropolitan areas.

A metropolitan statistical area is defined by the Office of Management and Budget (OMB) as a geographical region with a relatively high population density at its core and close economic ties throughout the area. A typical metropolitan area is centered on a single large city that wields substantial influence over the region (such as Chicago or Atlanta). However, some metropolitan areas contain more than one large city with no single municipality holding a dominant position (for instance, Dallas–Fort Worth metroplex, Norfolk-Virginia Beach (Hampton Roads), Riverside–San Bernardino (Inland Empire) or Minneapolis–Saint Paul). Metropolitan statistical areas can be seen as commuting zones in that they include a contiguous area of relatively high population density as well as surrounding counties with strong social and economic ties to central counties, as measured by commuting and employment.[5]

Labor market indicators are available from 1976 at the state-level and 1990 at the metropolitan area-level. The District of Columbia is treated as a state for the purposes of this paper. Where metropolitan areas consist of areas in multiple states, such as for example New York City or Philadelphia, they are assigned to a state in line with the official metropolitan area definition by the OMB.[6]

Regressions examine the effects of aging, cyclical conditions, trade and technology. Aging and cyclical conditions are proxied using old-age dependency ratios (defined as the population age 65 and older as a percentage of the population age 15 to 64) from the US Census Bureau's American Community Survey, and real GDP growth rates from the US Bureau of Economic Analysis, respectively.

The roles of technology and trade are captured here using regions' initial exposures to routinization and offshoring. These novel measures (see Das and Hilgenstock 2018; Dao and others 2017; and Chapter 3 of the April 2017 *World Economic Outlook*) act as proxies for the initial share of jobs within a geographical unit that are at risk of being automated or offshored and thus allow for a more granular analysis of local exposures to the global forces of trade and technology. The two measures are constructed as employment-weighted averages of occupational scores for routinizability and offshorability. The routinizability scores are based

[5] Focus here is on metropolitan statistical areas, micropolitan statistical areas (not included here) are defined similarly, but are built around smaller urban clusters (at least 10,000 but less than 50,000 in population). The roughly 290 metropolitan areas analyzed in this paper accounted for 79 percent of the total US population in 2016, though with significant variation in their relative importance across states.

[6] Unfortunately, non-metropolitan area participation rates cannot be backed out from state- and metropolitan area participation rates. Explanatory variables at this level would also be difficult to construct.

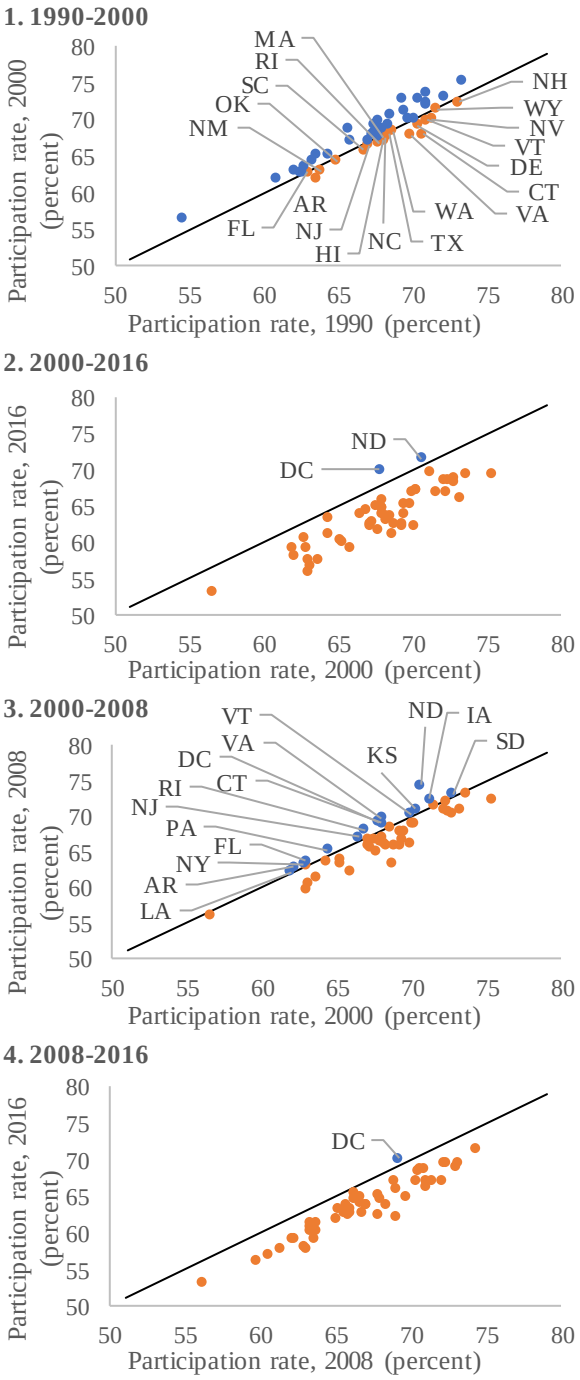
on scores from Autor and Dorn (2013). The scores measure the "routine task intensity", or how intensive an occupation is in routine tasks, for 330 occupations based on the US Department of Labor's Dictionary of Occupational Titles. The offshorability scores rely on data by Goos, Manning, and Salomons (2014) who convert the professional coders' assessment based measure in Blinder and Krueger (2014) into ISCO occupational categories. Since regional exposures to routinization and offshoring are highly correlated, they are included in the regression analysis one at a time.

Regressions also control for education, proxied by the share of population enrolled in tertiary education from the American Community Survey. All explanatory variables are constructed at the metropolitan area level.

IV. Stylized Facts

The evolution of labor force participation rates in US states shows marked breaks in 2000 and especially after the global financial crisis, with increases among a majority of states before 2000, declines in most states in the 2000–08 period and near-universal declines after 2008. Labor force participation rates rose in 32 out of 51 states between 1990 and 2000 (Figure 4, panel 1). In the period from 2000 to 2016, participation rates declined in almost all states, with the exception of the District of Columbia and North Dakota (Figure 4, panel 2). Declines were most pronounced in the Southeast (Alabama, Georgia, Kentucky, Mississippi, South Carolina) and parts of the Midwest and West (Alaska, Michigan, Nevada, Oregon). The

Figure 4. Changes in Labor Force Participation Rates, States



Sources: US Bureau of Labor Statistics; and authors' calculations.
Note: Labels in the figure use International Organization for Standardization (ISO) state codes.

decline was much smaller in the Mid-Atlantic (Maryland, New Jersey, Pennsylvania) and New England (Connecticut, Massachusetts).

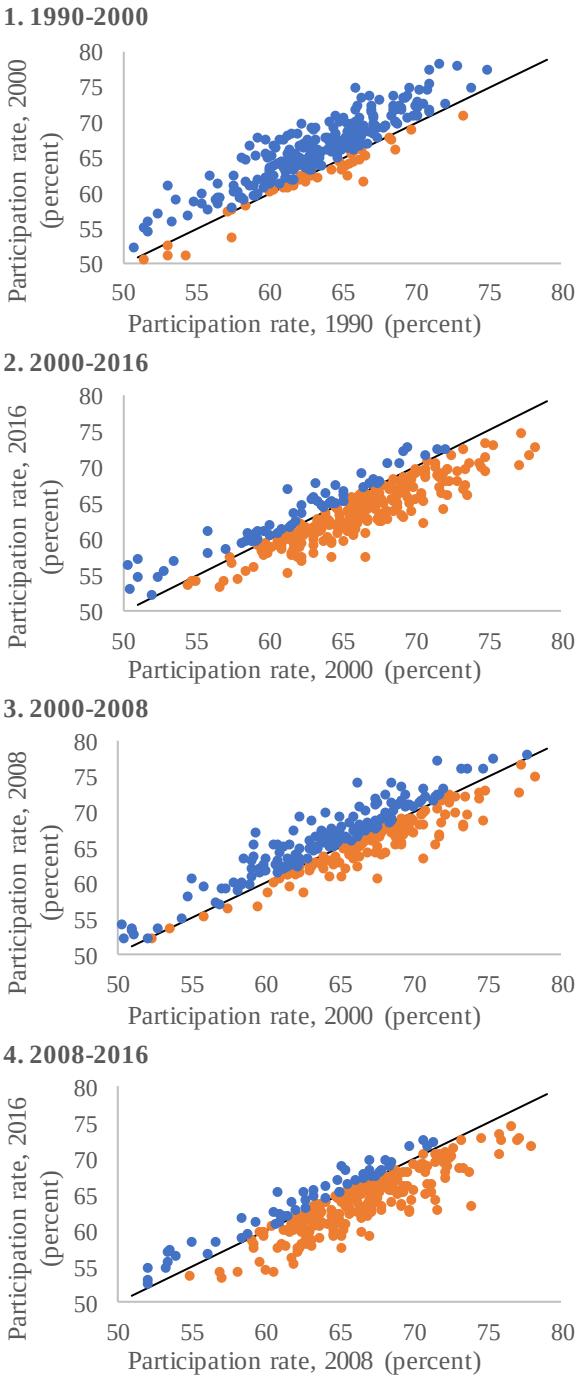
These declines became especially pronounced after the global financial crisis (Figure 4, panels 3 and 4): while participation rates rose in 15 states between 2000 and 2008, they declined in all except the District of Columbia between 2008 and 2016.

A similar, though somewhat less broad-based dynamic can be found for changes in metropolitan area labor force participation rates. While participation rates rose in 86 percent of metropolitan areas between 1990 and 2000 (Figure 5, panel 1), they declined in 78 percent between 2000 and 2016 (Figure 5, panel 2).

Again, declines became especially pronounced after the global financial crisis: participation rates still increased in over half (54 percent) of metropolitan areas between 2000 and 2008 (Figure 5, panel 3), but decreased in a large majority (81 percent) of areas between 2008 and 2016 (Figure 5, panel 4).

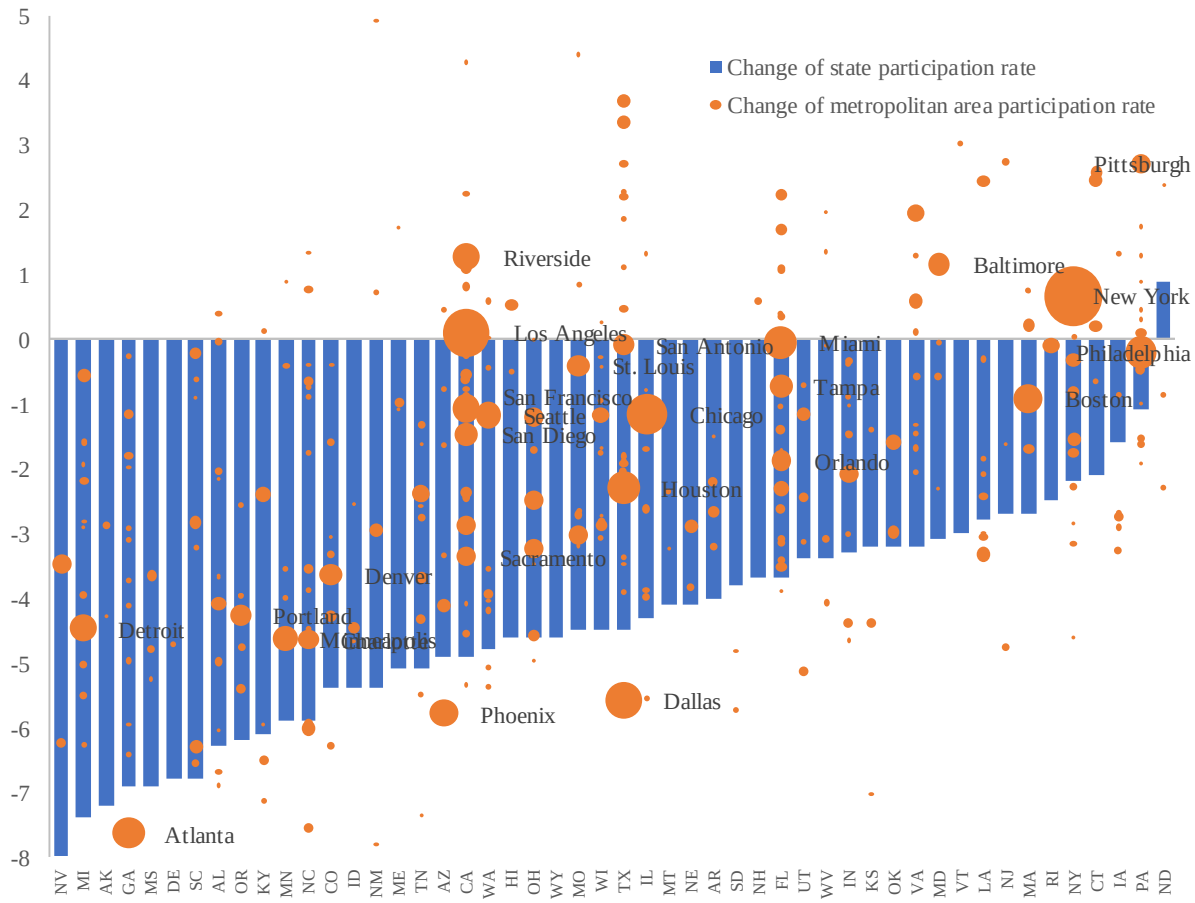
Declines were typically larger in a state as a whole than in its metropolitan areas, exacerbating urban-rural differences (in line with the findings of Weingarden 2017). Figure 6 shows that, generally, labor force participation rates between 2000 and 2016 decreased more in states than in their respective metropolitan areas. Atlanta, Dallas, and Phoenix are the only significant exceptions, possibly due to their extraordinary population growth (50 percent for Phoenix, 42 percent for both Atlanta and Dallas). Furthermore, while metropolitan areas show convergence in participation

Figure 5. Changes in Labor Force Participation Rates, Metropolitan Areas



Sources: US Bureau of Labor Statistics; US Census Bureau; and authors' calculations.
Orange markers display metropolitan areas with decreases in labor force participation.

Figure 6. Changes in Participation Rates, 2000-2016, States vs. Metropolitan Areas
(Percentage points)



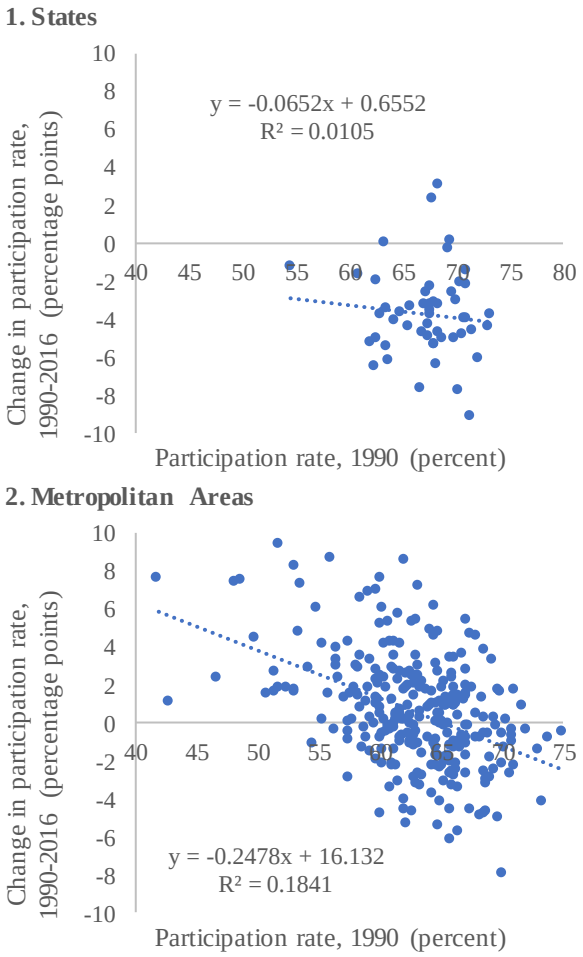
Sources: US Bureau of Labor Statistics; US Census Bureau; and authors' calculations.
Note: Marker size is based on 2016 total population.

rates, there is only very weak evidence for this at the state level (Figure 7), suggesting that non-metropolitan areas may actually be diverging. This could be the result of higher mobility between metropolitan areas than between states which consist of rural areas with lower mobility as well.[7]

Margins of adjustment—whether increases or falls in employment translated into changes in unemployment or participation—also changed after the crisis. Before 2000 employment increased on average and was matched by declines in unemployment and increases in participation. After 2000, employment declined, matched by (mostly) increasing unemployment and falling participation.

[7] Major metropolitan areas that are composed of elements of multiple states were assigned in the following way: Boston (MA), Chicago (IL), New York (NY), Philadelphia (PA). The District of Columbia was left out of the figure as it fully overlaps with the metropolitan area.

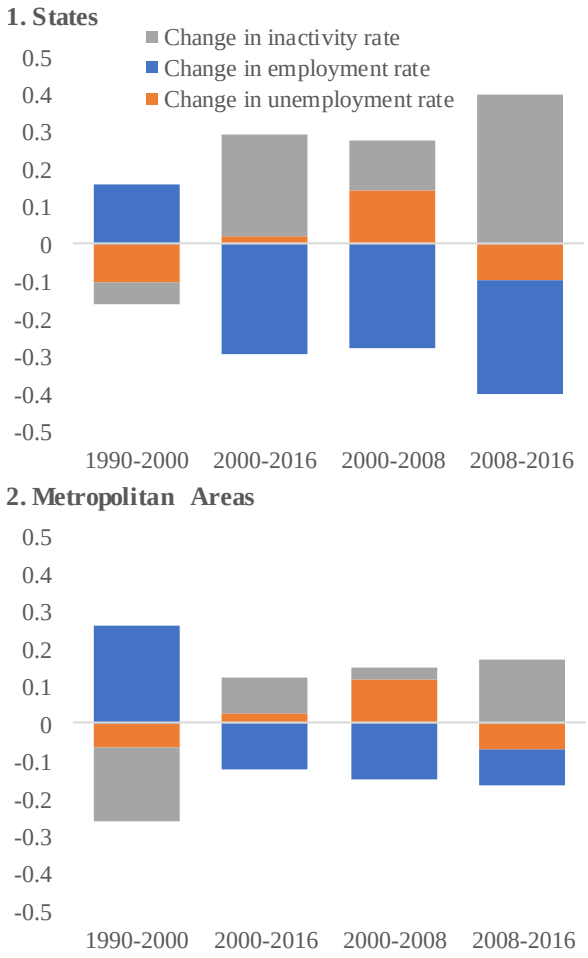
Figure 7. Convergence of Labor Force Participation Rates



Sources: US Bureau of Labor Statistics; US Census Bureau; and authors' calculations.

Figure 8. Changes in Labor Market Dynamics

(Percentage points)



Sources: US Bureau of Labor Statistics; US Census Bureau; and authors' calculations.
Note: Employment rate, unemployment rate, and inactivity rate are defined as total employment, total unemployment, and total inactive population as a percentage of total population. Figure displays population-weightes averages across states and metropolitan areas, respectively.

Although most of the decline in employment translated into rising unemployment before the crisis, after the crisis participation fell sharply. This dynamic can be observed at the level of states (Figure 8, panel 1 and Appendix Figure 1) as well as metropolitan areas (Figure 8, panel 2 and Appendix Figure 2), with the most pronounced declines in participation concentrated in the states of Nevada, Michigan, Georgia and South Carolina, and the metropolitan areas of Atlanta, Phoenix, Dallas and Detroit.

V. EMPIRICAL STRATEGY AND RESULTS

This section examines the drivers of changes in participation rates at the metropolitan area level in the post 2000 period, zooming in on some of the channels which were found to be important in the existing literature – aging, cyclical factors, trade and technology.[8] As a first step, Figure 9 shows bi-variate correlations between changes in participation rates between 2000 and 2016 and changes in dependency ratios, average real GDP growth, initial routinization and initial offshorability at the metropolitan area level. The study focuses here, and in the following empirical analysis, on metropolitan areas to leverage the larger variation in participation as well as the significantly larger number of metropolitan areas relative to states. Metropolitan areas have also been studied much less in the existing literature. Aging, and initial exposures to routinization and offshorability are significantly negatively correlated with changes in participation over this time period, as expected.

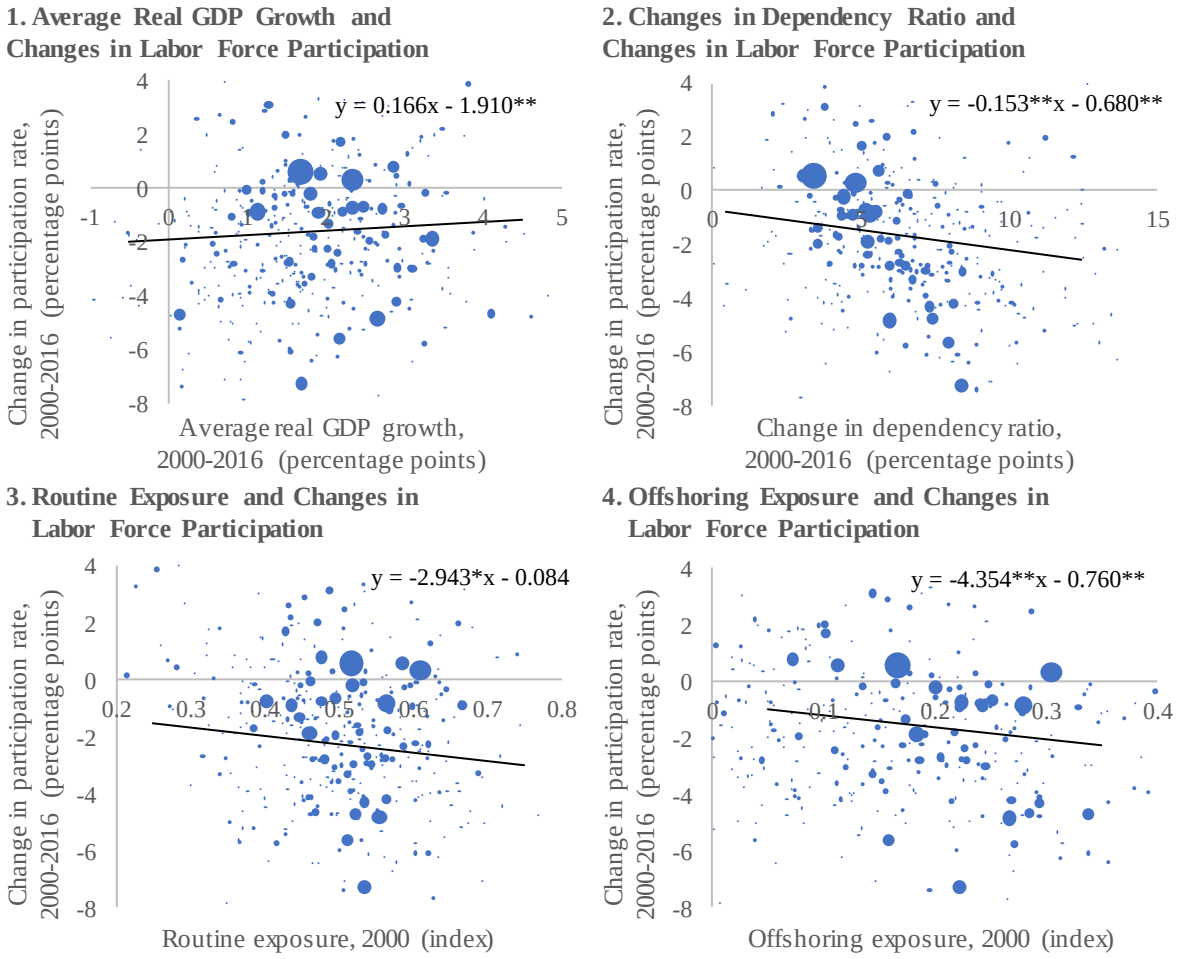
Building on these simple correlations, cross-sectional regressions at the metropolitan area level examine the association between 2000–16 changes in labor force participation rates and aging, cyclical conditions, as well as exposure to technology and trade. The following specification is estimated:

$$\Delta y_i = \beta_1 \Delta dep\ ratio_i + \beta_2 growth_i + \beta_3 \Delta educ_i + \beta_4 rout_i^0 + \beta_5 offsh_i^0 + \alpha_j$$

where Δy_i is the change in labor force participation between 2000 and 2016 in metropolitan area i. Regressions focus on long changes rather than annual data in order to allow for labor market adjustments to shocks. Thus, the estimation captures the long-term effects of shocks, such as those due to automation and trade, on participation. $\Delta dep\ ratio_i$ is the change in the old-age-dependency ratio, $growth_i$ is average real GDP growth. The roles of technology and trade are captured here using the initial exposures to routinization and offshoring ($rout_i^0$ and $offsh_i^0$) described above. Regressions also control for educational

[8] In a thorough review of the evidence, Abraham and Kearney (2018) note that labor supply factors, most notably increased participation in disability insurance programs, have played a less important role. Increases in the real value of the minimum wage and in the share of individuals with prison records have also contributed only modestly to the decline in the aggregate employment rate. They also highlight other factors such as improvements in leisure technology, changing social norms, increased drug use, growth in occupational licensing, and the costs and challenges associated with child care, however, find the evidence too preliminary to draw clear conclusions.

Figure 9. Drivers of Changes in Labor Force Participation Rates



Sources: US Bureau of Economic Analysis; US Bureau of Labor Statistics; US Census Bureau; and authors' calculations.
Note: Marker size is based on 2016 total population. Trend lines represent results of population-weighted bivariate regressions.

attainment (proxied by the change in the share of population enrolled in tertiary education, $\Delta educ_i$) and state fixed effects α_j, capturing any state-specific factors and changes that may have occurred over the period of study. Results are broadly similar when additionally controlling for initial labor force participation rates.

In line with the existing literature, the results point to significant effects of aging and cyclical conditions on labor force participation (Table 1). Labor force participation varies considerable over a person's life, rising rapidly in adolescence, flattening through the working years, and falling with age and retirement. Hence shifts in the age distribution are an important driver of movements in the aggregate participation rate: labor force participation rates were larger in metropolitan areas where the structure of the population shifted more towards individuals over the age of 65. Labor force participation declines were also larger in metropolitan areas, which experienced slower real GDP growth over this time period. This is

Table 1. Drivers of Labor Force Participation Rates in US Metropolitan Areas

Variables	(1)	(2)	(3)	(4)	(5)
Average Real GDP Growth			0.0362	0.0396*	0.0540**
			(0.0227)	(0.0227)	(0.0221)
Change in Old-Age-Dependency Ratio			-0.149***	-0.137***	-0.159***
			(0.0393)	(0.0397)	(0.0378)
Change in Postsecondary Share			0.441***	0.443***	0.370***
			(0.144)	(0.143)	(0.139)
Initial Exposure to Routinization	-2.617**			-2.342*	
	(1.133)			(1.194)	
Initial Exposure to Offshoring		-4.026***			-4.825***
		(0.914)			(0.937)
Observations	381	381	346	346	346
R^2	0.284	0.313	0.358	0.367	0.412

Source: IMF staff calculations.

Note: Standard errors are in parentheses. The dependent variable is change in labor force participation rate.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

in line with a large literature, which documents that labor force participation responds to cyclical conditions (see for example Elsby, Hobijn and Sahin 2015). The rise in unemployment during recessions may lead some workers to drop out of the labor force permanently, while diminished job prospects may also induce students to remain in school longer, or lead parents (women especially) with young children to stay at home instead of seeking jobs.[9]

However, beyond these, there are also statistically and economically meaningful effects of trade and technology. Metropolitan areas with higher initial exposures to automation and offshoring due to their occupational employment compositions see larger subsequent declines in participation rates.[10] This suggests that automation and offshoring may have permanently displaced some workers, even if their effects on the economy as a whole were beneficial, through the creation of job opportunities in other sectors or productivity gains.[11]

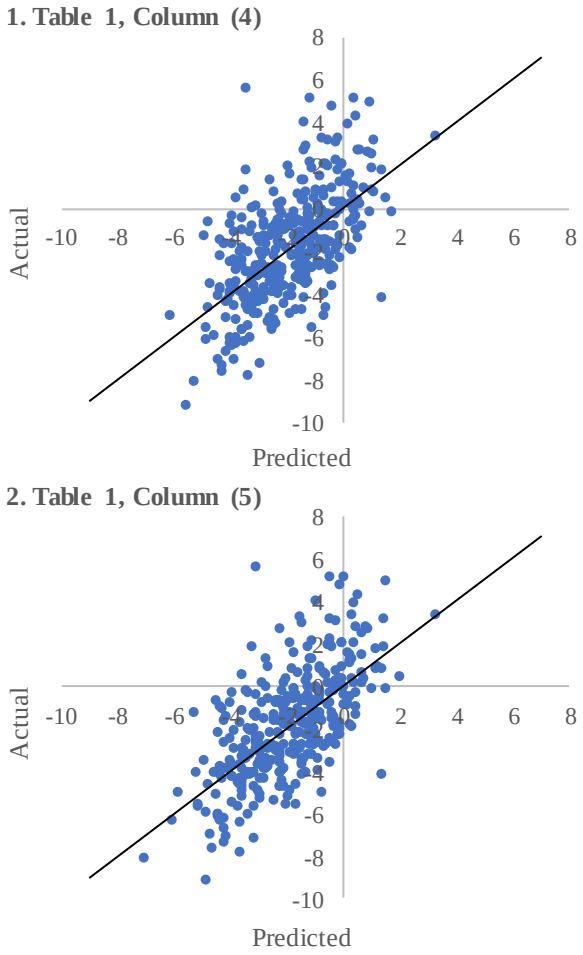
[9] Of course, GDP growth is an imperfect measure of cyclical conditions, and causality runs both ways. Unfortunately, metropolitan area level output gaps are not readily available.

[10] Charles and others (2018) rely on cross-region variation in the United States and find that the decline in manufacturing employment was a substantial cause of the decline in employment rates during the 2000s, particularly for less educated prime age workers.

[11] Autor and Salomons (2018) empirically estimate the employment and labor share impacts of productivity growth—an omnibus measure of technological change—using data on 28 industries for 18 OECD

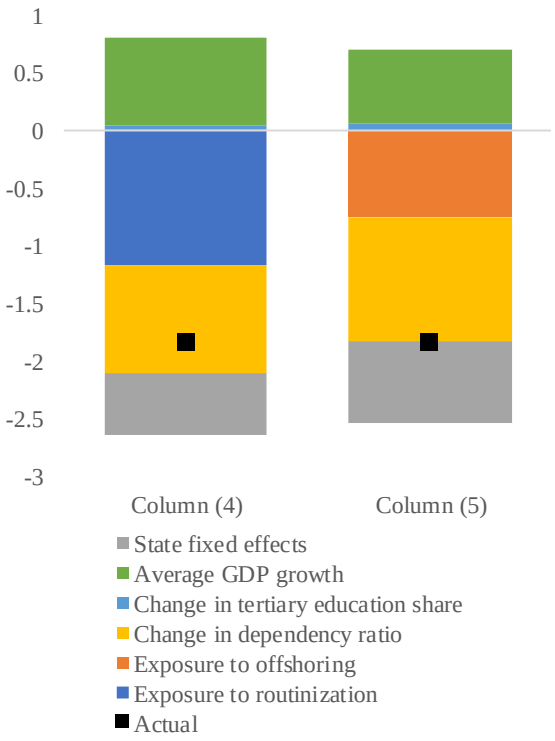
(continued…)

Figure 10. Model Fit



Source: Authors' calculations.

Figure 11. Contributions to Changes in Labor Force Participation Rates, 2000-2016
(Percentage points)



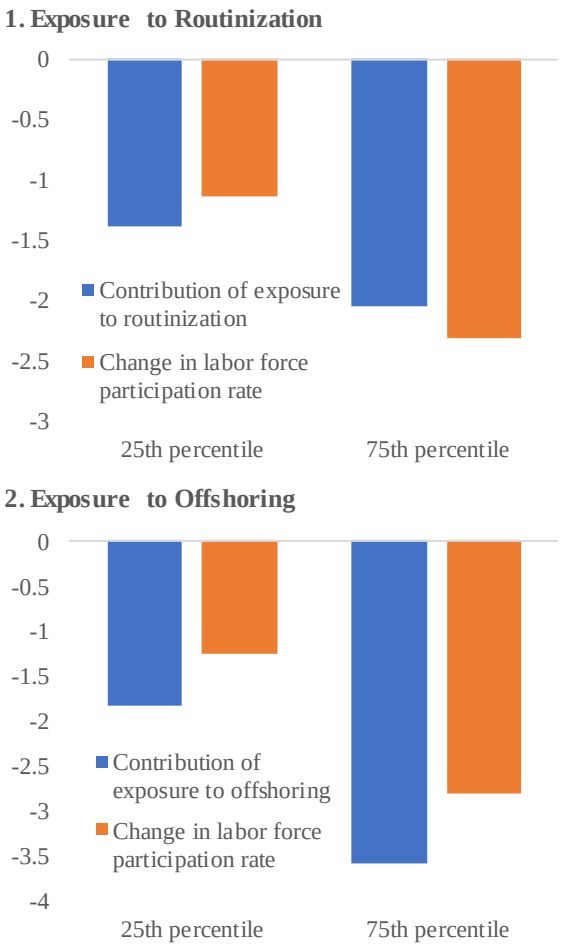
Source: Authors' calculations.

Figure 10 illustrates the fit of these regressions, and Figure 11 shows the relative contributions of each of these factors to 2000–2016 changes in participation rates (the decompositions are based on columns 4 and 5 respectively).[12] The decompositions point to significant contributions from aging: even at the metropolitan area level, the rise in dependency ratios can account for about half of the observed decline in participation rates (in line with the findings of Balakrishnan and others 2015; Council of Economic Advisers 2014; Hall 2014). Cyclical conditions would act to increase participation over this time horizon (which is longer than most of the studies noted above); however, their effect is more than offset by those of trade and technology. The novel measures of exposure to routinization and offshoring used here can explain an additional 60 and 40 percent of the decline. An additional 30 and 39 percent drag comes from

countries since 1970 and find that while automation has not been employment-displacing, it has reduced labor's share in value added.

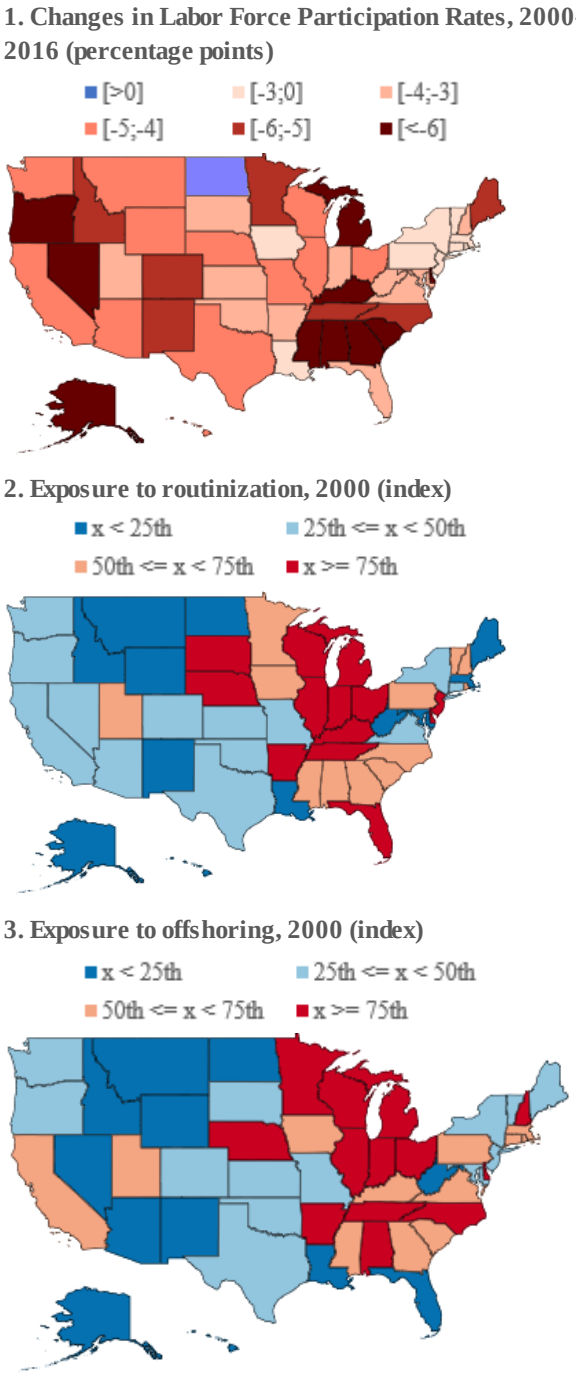
[12] As noted, due to the high correlation between initial exposures to routinization and offshorability, they are included in the regressions in turn.

Figure 12. Contributions of Exposures to Routinization and Offshoring and Changes in Labor Force Participation Rates
(Percentage points)



Source: Authors' calculations.
Note: Bars in both panels show relative contributions of exposure to routinization and to offshoring, respectively, as well as changes in labor force participation rates for metropolitan areas below the 25th percentile and above the 75th percentile of the distribution for the respective exposure measure. Simple averages across metropolitan areas are shown.

Figure 13. Exposures to Routinization and Offshoring and Changes in Labor Force Participation Rates



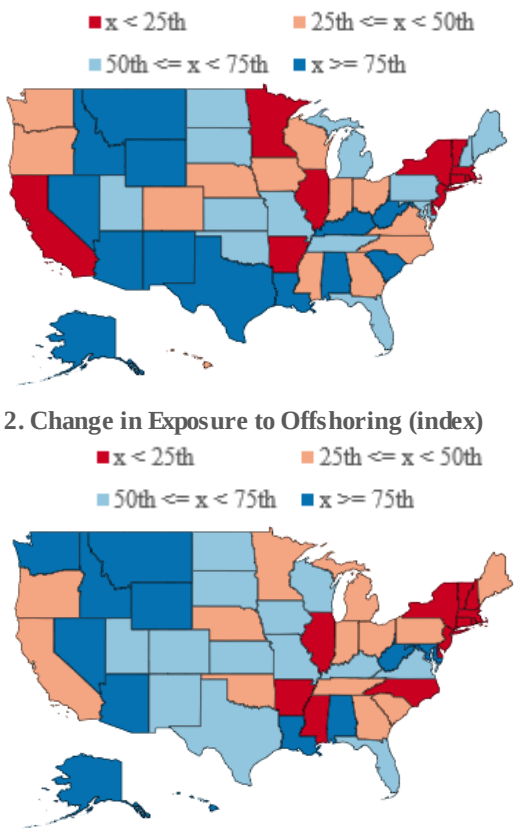
Sources: US Bureau of Labor Statistics; US Census Bureau; and authors' calculations.

the influence of state fixed effects, capturing any state-specific factors and changes that may have occurred over the period of study.

Quite strikingly, differences in initial exposures to routinization and offshoring can explain subsequent divergent participation trajectories quite well. Metropolitan areas that are highly exposed to routinization (above the

75th percentile of the distribution of initial routinization scores), including many of those known for having experienced economic distress (such as Grand Rapids, MI and Buffalo, NY) but also booming metropolitan areas (such as Los Angeles, CA and Miami, FL), experienced larger subsequent declines in participation, in line with larger negative contributions from routinizability (Figure 12, panel 1). Metropolitan areas that were relatively less exposed to routinization (below the 25th percentile), including booming cities such as Washington, DC and Boston, MA (as well as areas dominated by the agricultural industry, such as those in the California's central valley) in turn experienced participation declines that were only about half the size on average, with some seeing increases in participation.

Figure 14. Changes in Exposures to Routinization and Offshoring, 2000-2016



Sources: US Bureau of Labor Statistics; US Census Bureau; and authors' calculations.

A similar picture emerges for exposure to offshoring. Highly exposed areas (above the 75th percentile) saw declines again roughly double those in areas less exposed to offshoring (Figure 12, panel 2), with exposure to offshoring even overpredicting declines in participation. Highly exposed metropolitan areas, again, include many that have experienced economic distress, such as Detroit, MI, Cleveland, OH, and Akron, OH. However, they also include economically successful metropolitan areas such as San Francisco, CA, Minneapolis, MN, and Dallas, TX.[13]

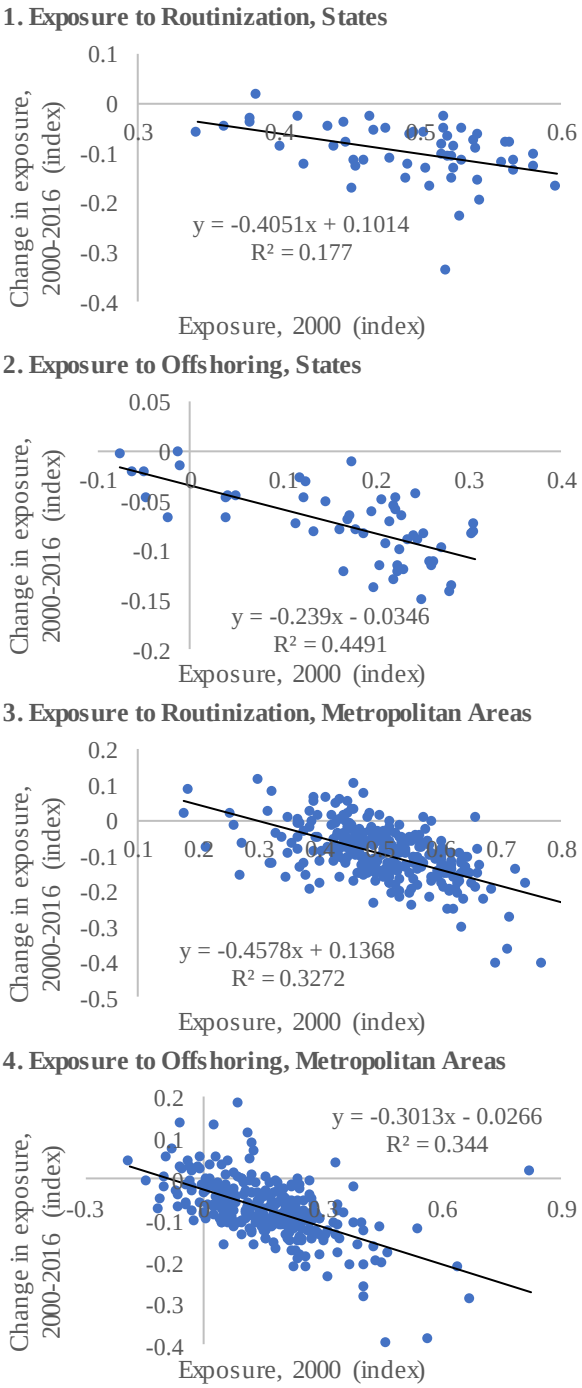
Several metropolitan areas, previously mentioned as having experienced significant economic distress, display large negative effects of both exposure to routinization and exposure to offshoring on labor force participation rates. For example, in the case of Detroit, MI, these results would suggest that exposure to routinization alone can account for a 1.2-

[13] Routinizability and offshorability are on average highly correlated (and are thus included in turn in the regressions). However, while some cities are indeed highly vulnerable on both fronts, others, such as San Jose, CA, Boston, MA, Washington, DC, Seattle, WA, Raleigh, NC, and Durham, NC, and in general areas focused on high-tech industries and education, are not as exposed to routinization, but are highly vulnerable to offshoring.

percentage point decline in labor force participation and exposure to offshoring for a 1.6-percentage point decline. Other examples include: Grand Rapids, MI (1.5, 1.9), Fort Wayne, IN (1.5, 1.9), Lancaster, PA (1.5, 1.6), Akron, OH (1.4, 1.4), Cleveland, OH (1.3, 1.4), Dayton, OH (1.3, 1.5), Youngstown, OH (1.3, 1.2), Toledo, OH (1.3, 1.2), and Allentown, PA (1.3, 1.1).

While sample sizes are unfortunately too small to examine similar regressions at the state level, Figure 13 suggests that this link can hold at the state level as well: exposures to routinization and offshoring were especially high in the Southeast and Midwest, which also exhibited the largest declines in participation as jobs became automated or offshored. Indeed, states with higher exposures to routinization and offshoring in 2000 experienced larger subsequent declines in these exposures than states that were less exposed (Figure 14, Figure 15, panels 1 and 2). This correlation between initial exposure and subsequent change holds at the metropolitan area level as well (Figure 15, panels 3 and 4).[14] The measures of routinization and offshorability are composite measures that proxy the initial occupational mix of a metropolitan area, hence the vulnerability to, rather than the actual number of jobs lost to the global forces of technology and trade. However, the strong link between changes in employment shares across different occupations and changes in participation at the metropolitan areas confirms the importance of the occupational structure of the local labor market in shaping participation trends (Figure 16). Rising

Figure 15. Exposures to Routinization and Offshoring and Subsequent Changes

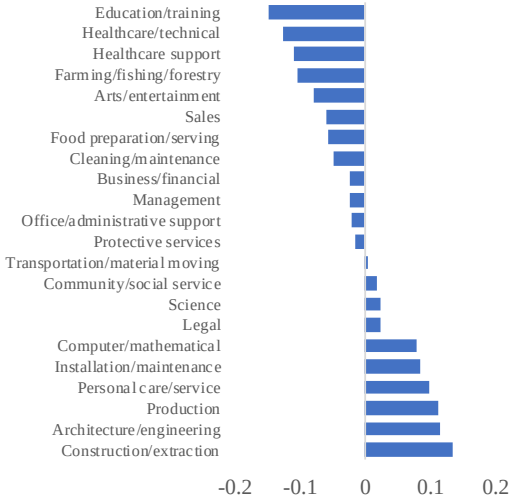


Sources: US Bureau of Labor Statistics; US Census Bureau; and authors' calculations.

[14] These findings are in line with those in Das and Hilgenstock (forthcoming) at the country level.

shares of 'old economy' occupations such as construction and production (despite the vulnerability of such occupations to automation) are associated with larger increases in participation rates (this could be picking up areas where such jobs have not been routinized yet), though so are some of the new/ booming occupations such as computer/mathematical, science or legal services (which may be proxying for more diverse labor markets). Participation rates are generally declining more in areas with a rising share of service sector jobs, especially in education, health care, sales, food service, and cleaning and maintenance. The existence of such strong associations between the employment shares of given occupations and changes in participation rates could potentially point to difficulties in occupational mobility.

Figure 16. Changes in Occupational Employment Shares and Participation Rates



Source: Authors' calculations.
Note: Bars represent correlation correlations of change in the respective occupational employment share and the change in labor force participation rate across metropolitan areas.

These initial findings are in line with Council of Economic Advisers (2016), which highlights that across US states the share of jobs in some industries is correlated with labor force participation rates among prime-age men: specifically, when the shares of employment attributable to construction, mining and to a lesser extent manufacturing are higher, more prime-age men participate in the labor force. Further research could examine these channels in greater detail.

VI. CONCLUSIONS

The paper documents broad-based declines in participation across states and metropolitan areas, though declines in the latter were generally smaller. This, alongside suggestive evidence that there is convergence in participation rates among metropolitan areas, but not states, raises concerns that urban and rural areas may be diverging.

In line with the findings of the existing literature, aging is found to account for about half of the observed decline in participation rates at the metropolitan area level since 2000. Trade and technology, captured here using novel measures of initial local exposures to routinization and offshoring, can explain a further 40–60 percent. While these forces are beneficial for the economy as a whole, these results support the hypothesis that deteriorating job opportunities can increase detachment from the workforce. Different industry and occupational mixes and hence differential exposures to routinization and offshoring can lead to long lasting divergent labor market developments across cities and states.

In the near and medium term, support should thus be provided to workers displaced as a result of automation and globalization to dampen the negative effects of labor market shocks that may be highly concentrated in some sectors, occupations, or geographic areas.

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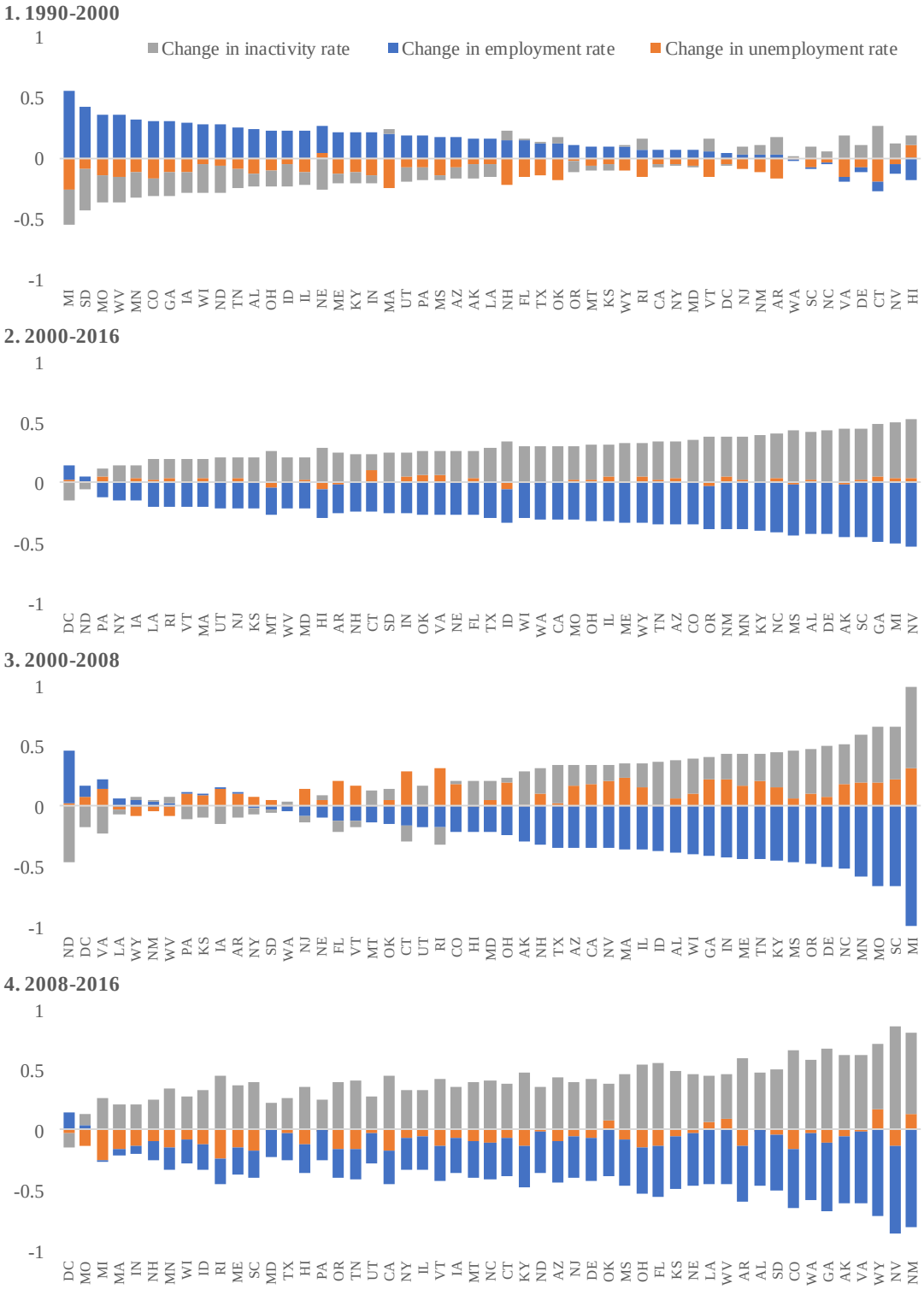
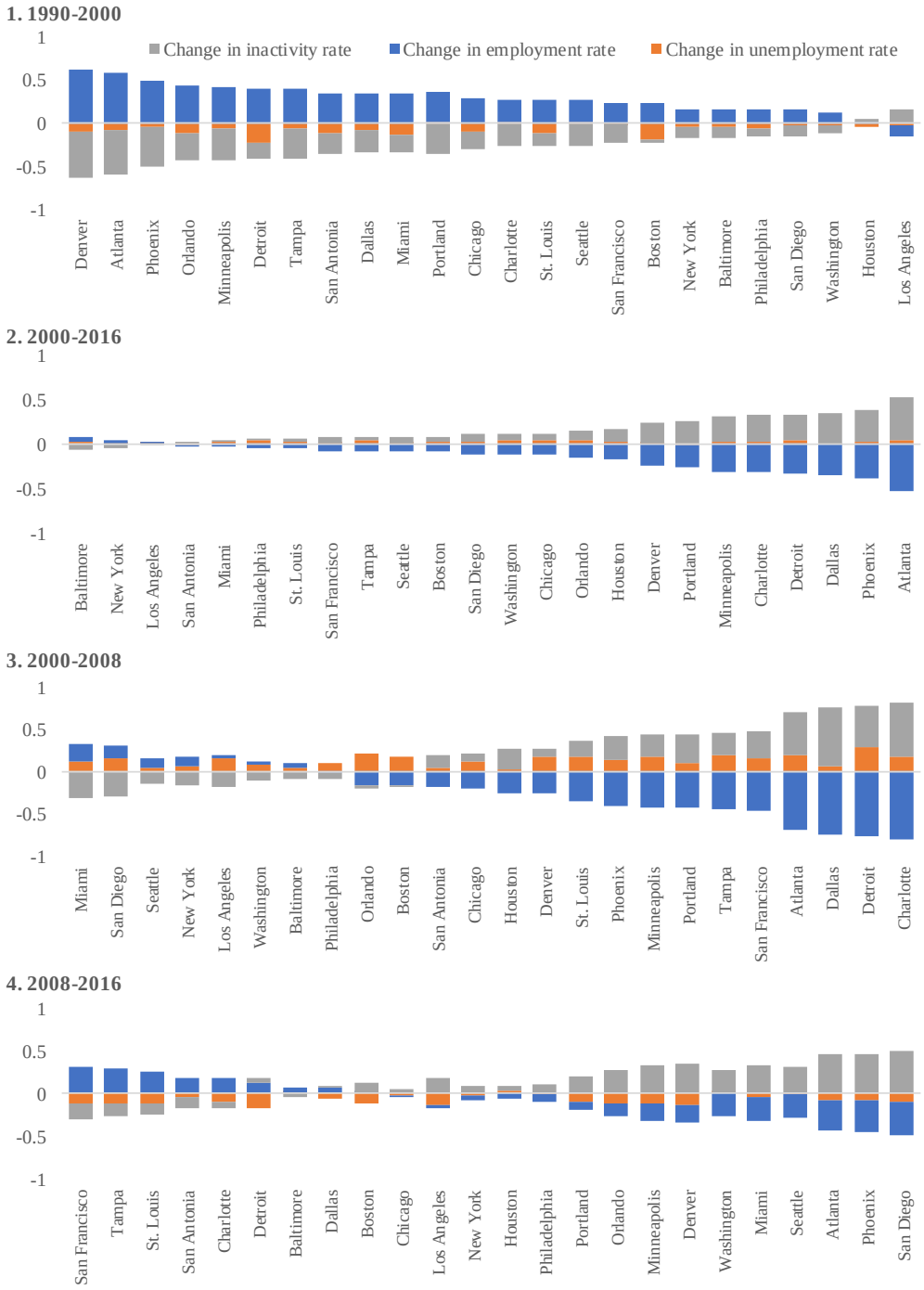
Appendix Figure 1. Changes in Labor Market Dynamics, States
(Percentage points)



Sources: US Bureau of Labor Statistics; and authors' calculations.
Note: Employment rate, unemployment rate, and inactivity rate are defined as total employment, total unemployment, and total inactive population as a percentage of total population.

Appendix Figure 2. Changes in Labor Market Dynamics, Metropolitan Areas
(Percentage points)



Sources: US Bureau of Labor Statistics; US Census Bureau; and authors' calculations.
Note: Employment rate, unemployment rate, and inactivity rate are defined as total employment, total unemployment, and total inactive population as a percentage of total population.