economies

Communication

The Effects of Aging Populations on U.S. Communities

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Abstract: As the population in affluent countries has been experiencing rapid aging, understanding its impact on the regional economy has become an important research topic. In this study, we investigate whether regional population aging has affected the economy in the United States. Using instrumental variables based on age structure, we have identified significant positive impacts on employment growth and negative impacts on the population growth rate. Additionally, there was no significant impact on local wages but a positive impact on rent levels. This can be interpreted as evidence that a higher proportion of the elderly population actually enhances local production and consumption amenity levels, as suggested by the spatial equilibrium model. These results imply that regional population aging may not have a significant negative impact on the regional economy.

Keywords: aging population; regional population structure; regional economy

JEL Classification: J10; J14; R11

1. Introduction

As the U.S. experiences population aging, the extent of this demographic shift varies considerably across regions. For instance, in 1990, the state with the smallest proportion of its population aged 60 or older had less than one-third the share of the state with the largest proportion. This discrepancy becomes even more pronounced at the county level (Maestas et al. 2023). Understanding the potential effects of these regional disparities in population aging on the regional economy is crucial. Businesses might curtail their investments in areas with a high percentage of retirees, potentially leading to slower productivity growth due to a shortage of eligible workers (Maestas et al. 2023; Zhang 2021). Additionally, intergenerational conflicts over investment decisions could arise (Ahlfeldt et al. 2019).

Despite its importance, research on the regional implications of population aging remains limited. To our knowledge, no studies have specifically examined the impact of regional population aging on the economy within a spatial equilibrium context. Some research focusing on state-level analysis (Maestas et al. 2023; Zhang 2021) has found a pronounced negative effect of population aging on local economic growth, GDP per capita, and employment growth. For instance, Maestas et al. (2023) found that a 10 percent increase in the population aged 60 or older leads to a decline of over 5 percent in the growth rate of GDP per capita, using a macroeconomic model. They attribute this trend largely to reduced growth in labor productivity. The magnitude of this effect is comparable to regions having a smaller proportion of the highly skilled "creative class" (Alehegn et al. 2013). Conversely, other studies have reported a less pronounced but still negative influence of population aging on regional economic growth (Kim and Hewings 2013). Gaigné and Thisse (2009) have explored the effects of population aging on urban distribution.

Our paper aims to assess whether the extent of local population aging, defined by the percentage of individuals aged 65 or older, has influenced regional U.S. economies between 1980 and 2010, emphasizing county-level economies. We interpret our findings using the spatial equilibrium model (Roback 1982), a foundational framework for examining

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Citation: Chung, Seunghun, and Oudom Hean. 2023. The Effects of Aging Populations on U.S. Communities. *Economies* 11: 277. https://doi.org/10.3390/economies11110277

Academic Editor: Joydeep Bhattacharya

Received: 11 September 2023
Revised: 28 October 2023
Accepted: 6 November 2023
Published: 9 November 2023

regional economies in the context of migration patterns. To determine the causal effects of an aging population, we employ an instrumental variable estimation grounded in past age structures, following the approach of Maestas et al. (2023). Other techniques for ascertaining causal impact are infeasible, given the absence of national-level experiments affecting the distribution of the elderly across U.S. counties.

The remainder of the paper is organized as follows. Section 2 describes the data, while Section 3 presents the empirical approach. Section 4 provides the main empirical results, and Section 5 the sensitivity analysis. Section 6 discusses the results and examines the potential mechanisms. Finally, we summarize and conclude the paper in Section 7.

2. Data

We use U.S. Census data from 1980 to 2000 and the five-year 2012 American Community Survey. The reason why we use ACS 2012 data over 2010 Census data is that ACS 2012 provides more variables which will be used in this study. First, we calculate the senior share, defined as the share of people aged 65 or older, and then use it to obtain the growth in this share across 10-year intervals. We also collect data on total population, employment, share of minors (age under 18), immigrant share, black share, share of each educational group among the population aged 25 or older (college graduate, some college experience, high school graduate, or high school dropout). Finally, we calculate a birth rate, defined as the number of children under 4 years old divided by 5 and divided by the number of women aged 15 to 45. Table 1 provides descriptive statistics for the data.

Table 1. Descriptive statistics.

Variable	Observation	Mean	S.D.	Min	Max
Growth in senior share in 10 years	9319	0.0095	0.0176	−0.1054	0.1886
Growth rate in employment in 10 years	9349	0.0633	0.2671	−0.747	6.2333
Growth rate in total population in 10 years	9349	0.0684	0.157	−0.8109	1.9105
Senior share	9349	0.1429	0.0431	0.0081	0.3472
Total population	9429	79,898	264,660	67	9,519,338
Share of the population with some college experience	9349	0.2038	0.0767	0.0325	0.4522
Share of college graduates	9349	0.138	0.0693	0.0159	0.6375
Black share	9349	0.0861	0.144	0	0.8649
Share of minors	9349	0.2728	0.0386	0	0.4738
Birth rate	9349	0.3388	0.062	0	0.8652
Share of healthcare sector	9429	0.0358	0.0155	0	0.1647
Metropolitan areas (2000 definition)	9352	0.3459	0.4757	0	1
Share of agricultural employment	9429	0.0911	0.0952	0	0.7178

Note: Due to the availability of variables and indicators utilized in our research, a number of counties are excluded.

3. Empirical Strategy

To estimate the effects of the senior population, we use the following regression specification:

$$\Delta Y_{i(t,t+10)} = \beta Senior\ share_{it} + \sum \gamma_j X_{ijt} + \alpha_i + \tau_t + \varepsilon_{it}. \quad (1)$$

$\Delta Y_{i(t,t+10)}$ is either the 10-year growth rate in population, employment, wage, or housing rent in county i (the reason why we have chosen these variables will be discussed); specifically, $\Delta Y_{i(t,t+10)} = \frac{Y_{t+10}-Y_t}{Y_t}$. X_{ijt} includes the control variables (the total population, population share of immigrants, share of people with some college education, share of college-educated people, share of population that is black, birth rate, employment share in the healthcare sector, and employment share in the agricultural sector). α_i and τ_t are county and year fixed effects.

The selection of these control variables, such as human capital and racial composition, is based on the regional economics literature. Studies have found that these factors can correlate with regional economic growth (Faggian et al. 2019; Glaeser et al. 1995; Peri 2012). Additionally, variables like the share of healthcare and agriculture, as well as birth rate, can correlate with both the proportion of elderly individuals and economic growth (for instance, elderly individuals often prefer to reside in areas with good access to healthcare services).

To pick the dependent variable, we consider the following implications from the spatial equilibrium model. First, consider the impact of a concentration of seniors on the local productivity of younger people. Based on the spatial equilibrium model, if the high share of seniors increases local productivity, then increases in wage (or income level) and rent levels should follow in equilibrium. On the opposite side, if a high senior share decreases productivity, wages and rents should decrease in spatial equilibrium and the share of seniors should increase because they will enjoy lower rent without suffering from lower wages.

Consider the channel of consumer amenities. For simplicity, suppose that people have similar preferences for local amenities regardless of age. If it is the case that a high senior share increases the local amenity, then the wage level should decline and the rent level will increase. In the opposite case, the wage level will increase and the rent level should decline, to compensate for the lower level of amenities.

We can summarize the theoretical predictions in Table 2, which captures the implications for changes in the senior share under various assumptions for how senior share impacts.

Table 2. Implications from the spatial equilibrium.

	Assumptions on the Effect of High Senior Concentration		**Implications on**		
Case	**Productivity Assumed to**	**Amenities Assumed to**	**Wages**	**Rents**	**Employment Growth**
1	Increase	Increase	Ambiguous	Increase	Increase
2	Increase	Decline	Increase	Ambiguous	Increase
3	Decline	Increase	Decline	Increase	Decrease
4	Decline	Decline	Ambiguous	Decline	Ambiguous

Based on this discussion, we will investigate the change in the employment (and population), wage, and rent level to understand the impact of those aged 65 or older on the local productivity and amenities, and, thus, the mechanism behind the impact of old people on the regional economy.

We are concerned about endogeneity from unobserved local-specific economic shocks that influence current and future senior shares. To address this issue, we employ an instrumental variable in the spirit of Maestas et al. (2023). Specifically, the instrument is the share of people aged 55 to 64 from 10 years ago. Table 3 shows the first-stage results of the two-stage least squares (2SLS) regression. The results suggest that the instrument is strong. Also, a positive relationship between the instrument and the share of the senior population is intuitive; places with a high share of the population aged 55–64 years old are more likely to have a higher share of the senior population in the future. Other techniques such as Difference-in Differences for ascertaining causal impact are infeasible, given the absence of national-level natural experiments affecting the distribution of the elderly across U.S. counties.

Table 3. First stage of the 2SLS regression.

	(1)
Variables	**Senior Share**
IV_{senior}	0.417 ***
	(0.0323)
Total population	-1.51×10^{-9}
	(3.32×10^{-9})
Immigrant share	−0.0323 ***
	(0.00934)
Share of people some college experience	−0.0506 ***
	(0.0133)
Share of college graduates	−0.00472
	(0.0113)
Black share	−0.0263
	(0.0225)
Share of minors	−0.113 ***
	(0.0242)
Birth rate	−0.0529 ***
	(0.00804)
Employment share in the healthcare sector	0.194 ***
	(0.0515)
Employment share in agricultural employment	−0.00726
	(0.00782)
Year fixed effect	Yes
County fixed effect	Yes
Observations	9329
F	139.66

Notes: Robust standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4. Empirical Results

Table 4 presents the second-stage results of the instrumental variable regression. Unsurprisingly, Column (1) shows that there is a negative relationship between the senior population and the total population growth. That is, an aging population could lead to a lower fertility rate and a shrinking population.

Table 4. The 2SLS second-stage results.

	(1)	(2)	(3)	(4)
	Growth Rate of Population	**Growth Rate of Employment**	**Growth Rate of Wages**	**Growth Rate of Rent**
Senior share	−1.238 ***	2.551 ***	−2.395	8.962 *
	(0.307)	(0.572)	(1.978)	(4.868)
Total population	-2.71×10^{-7} ***	-6.29×10^{-7} ***	2.34×10^{-7}	-7.65×10^{-7}
	(6.51×10^{-8})	(1.57×10^{-7})	(1.49×10^{-7})	(5.32×10^{-7})
Immigrant share	−0.122	1.209 ***	−0.592 **	−0.0139
	(0.1000)	(0.244)	(0.294)	(0.391)
Share of people some college experience	−0.294 *	−1.720 ***	−1.515 ***	0.383
	(0.151)	(0.330)	(0.367)	(0.524)
Share of college graduates	−0.181	−0.329	−1.418 ***	−1.378 ***
	(0.153)	(0.415)	(0.368)	(0.421)
Black share	−0.359 **	2.367 ***	0.0323	−0.748
	(0.141)	(0.318)	(0.346)	(0.671)
Share of minors	−0.698 ***	2.686 ***	0.453	0.802
	(0.191)	(0.459)	(0.942)	(1.517)
Birth rate	−0.261 ***	−1.200 ***	0.0478	−0.612 *
	(0.0797)	(0.184)	(0.236)	(0.355)
Employment share of healthcare sector	1.469 ***	−0.986	5.589 ***	−3.320
	(0.323)	(1.085)	(0.978)	(2.590)

Table 4. *Cont.*

	(1)	(2)	(3)	(4)
	Growth Rate of Population	**Growth Rate of Employment**	**Growth Rate of Wages**	**Growth Rate of Rent**
Share of agricultural employment	0.00511	−0.177	4.970 ***	−0.869 *
	(0.0814)	(0.110)	(0.618)	(0.496)
Year fixed effect	Yes	Yes	Yes	Yes
County fixed effect	Yes	Yes	Yes	Yes
Observations	9345	9345	6235	6235
R-squared	0.312	0.336	0.786	0.429

Notes: Robust standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Column (2) indicates that there is a positive link between the average wage and the senior population. A possible reason for this positive relationship is that senior people work longer now than their peers did in the past (White et al. 2018); therefore, they could be increasing the supply of labor. Also, a rise in the senior population could increase spending on services such as healthcare; this would lead to an increase in the demand for labor. Figure A1 and Table A1 in the Appendix A show strong evidence that the senior population has a significant positive impact on employment growth in the healthcare industry.

Due to increases in the demand for and supply of labor, the effects of a senior population on wages is theoretically ambiguous. Column (3) shows no significant relation between the senior population and wage growth. On the other hand, Column (4) shows that the senior population has a significant positive impact on housing rent growth. That is, an aging population can increase the demand for housing (Linlin et al. 2016; Sun et al. 2018; Wang et al. 2018).

5. Sensitivity Analysis

We investigate whether there are differential effects of seniors across metropolitan and nonmetropolitan areas. Using the 2000 Census definitions for metropolitan areas, we re-estimate regression specification (1) according to metropolitan–nonmetropolitan status.

Tables 5 and 6 show the estimated effects of the senior population by metropolitan and nonmetropolitan area, respectively. The results indicate that the senior population exerts similar effects on metropolitan and nonmetropolitan regions. Specifically, across these regions, the senior population reduces population growth but increases employment growth. Also, while there is no significant link between the senior population and wages, there is a positive relation between the senior population and housing rent.

Table 5. The 2SLS results for metropolitan areas.

	(1)	(2)	(3)	(4)
Model	**Growth Rate of Population**	**Growth Rate of Employment**	**Growth Rate of Wages**	**Growth Rate of Rent**
Senior share	−1.187 **	3.870 ***	−0.479	7.136 **
	(0.526)	(1.221)	(1.108)	(3.090)
Total population	-2.91×10^{-7} ***	-5.70×10^{-7} ***	-5.31×10^{-8}	-3.25×10^{-7}
	(7.61×10^{-8})	(1.46×10^{-7})	(9.36×10^{-8})	(2.59×10^{-7})
Immigrant share	0.0713	0.719 **	−0.541 ***	−0.0605
	(0.139)	(0.355)	(0.165)	(0.314)
Share of some college experience	−0.326	−3.731 ***	−1.059 ***	1.312 *
	(0.258)	(0.445)	(0.365)	(0.696)
Share of college	−0.293	−0.397	−1.337 ***	−2.591 ***
	(0.226)	(0.562)	(0.335)	(0.641)
Black share	−0.227 *	1.745 ***	0.124	−2.081 ***
	(0.127)	(0.470)	(0.145)	(0.440)
Share of minors	−0.599	4.431 ***	1.309	4.280 ***
	(0.382)	(1.081)	(0.809)	(1.547)

Table 5. *Cont.*

	(1)	(2)	(3)	(4)
Model	**Growth Rate of Population**	**Growth Rate of Employment**	**Growth Rate of Wages**	**Growth Rate of Rent**
Birth rate	−0.458 ***	−1.950 ***	−1.235 ***	−2.132 ***
	(0.160)	(0.314)	(0.305)	(0.496)
Employment share of healthcare sector	1.422 **	−5.469 **	5.709 ***	−3.031
	(0.689)	(2.179)	(1.036)	(2.093)
Share of agricultural employment	0.226	0.699 **	3.672 ***	−0.173
	(0.161)	(0.342)	(0.725)	(0.771)
Year fixed effect	Yes	Yes	Yes	Yes
County fixed effect	Yes	Yes	Yes	Yes
Observations	3229	3229	2162	2162
R-squared	0.436	0.150	0.861	0.459

Notes: Robust standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 6. The 2SLS results for nonmetropolitan areas.

	(1)	(2)	(3)	(4)
Model	**Growth Rate of Population**	**Growth Rate of Employment**	**Growth Rate of Wages**	**Growth Rate of Rent**
Senior share	−1.184 ***	1.724 ***	−2.980	10.92 *
	(0.291)	(0.584)	(2.588)	(6.433)
Total population	-6.71×10^{-6} ***	-1.16×10^{-5} ***	2.30×10^{-6}	-1.09×10^{-5} **
	(1.22×10^{-6})	(1.85×10^{-6})	(2.04×10^{-6})	(4.67×10^{-6})
Immigrant share	−0.146	1.619 ***	−0.486	0.164
	(0.139)	(0.269)	(0.503)	(0.524)
Share of some college experience	−0.134	−0.675 **	−1.554 ***	0.164
	(0.128)	(0.297)	(0.441)	(0.568)
Share of college	−0.00765	0.386	−2.348 ***	0.524
	(0.147)	(0.401)	(0.493)	(0.957)
Black share	−0.844 ***	2.413 ***	−0.581	1.841
	(0.323)	(0.394)	(1.086)	(2.379)
Share of minors	−0.910 ***	1.895 ***	−0.856	1.981
	(0.217)	(0.513)	(1.393)	(3.049)
Birth rate	−0.118	−0.793 ***	0.00267	0.0179
	(0.0766)	(0.218)	(0.226)	(0.557)
Employment share of healthcare sector	1.193 ***	−0.287	6.054 ***	−4.195
	(0.335)	(0.865)	(1.055)	(3.199)
Share of agricultural employment	0.0515	−0.127	4.701 ***	−0.536
	(0.0943)	(0.114)	(0.580)	(0.469)
Year fixed effect	Yes	Yes	Yes	Yes
County fixed effect	Yes	Yes	Yes	Yes
Observations	6100	6100	4073	4073
R-squared	0.258	0.307	0.781	0.439

Notes: Robust standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

6. Discussion

While reduced-form modeling does not enable us to explore the mechanisms behind empirical results, the spatial equilibrium model suggests that an increase in rents and employment, combined with a decline in total population, can be attributed to a combination of two factors: enhanced productivity and an increase in consumer amenities (Roback 1982).

How might a higher proportion of seniors elevate local productivity and amenities levels? Although a comprehensive analysis is beyond the purview of this paper, we propose and examine two potential mechanisms.

Firstly, the elderly often reside in areas with lower rents. Such low-rent areas can become focal points for gentrification. By attracting younger and highly educated individuals, these regions may witness a boost in both productivity and amenity levels. Directly testing this hypothesis with county-level data is challenging. However, our findings indicate that highly educated individuals are not disproportionately migrating to counties with larger senior populations. This observation diminishes the credibility of this proposed explanation (refer to Appendix A Table A1).

Secondly, the medical services sector, closely associated with the elderly demographic, is a rapidly expanding industry and is increasingly recognized as a crucial amenity. Instrumental variable (IV) regression, with the growth rate of healthcare workers as the dependent variable, demonstrates that a larger senior population significantly influences the proportion of healthcare workers (See Appendix A Figure A1 and Table A2). The burgeoning health service industry in counties with a higher percentage of seniors could partially account for the observed increases in productivity and amenities.

This could also elucidate why the findings of this paper diverge from previous research (Maestas et al. 2023), which identified a negative influence of local population aging on employment and economic growth. The geographical differentiation in health services, attributable to population aging, is likely less pronounced between states than between counties. Thus, while the growth of health services in counties with a pronounced aging population might draw workers, this effect is expected to be more subdued at the state level.

7. Conclusions

We delve into the varied effects of an aging population on regional economies within the United States using the instrumental variable method. Our research indicates a negative impact of an aging demographic on overall population growth. Conversely, we observe a positive effect from the increased presence of senior citizens on employment growth in these regions. Although the data does not highlight a significant influence of an aging population on wage levels, it suggests that counties with a larger proportion of seniors often experience enhanced growth in housing rents.

Based on the spatial equilibrium model, our results imply that a more aged population can have a beneficial impact on both productivity and amenities. Additional investigation reveals a rise in employment in the healthcare sector, which caters to an older demographic. This could further augment productivity and amenities, especially given the rapid growth of this sector. For future research, a deeper exploration into this potential mechanism—the expansion of the healthcare sector in areas with an aging population—would be valuable.

Author Contributions: Conceptualization, S.C.; methodology, S.C.; software, S.C.; validation, S.C. and O.H.; formal analysis, S.C. and O.H.; investigation, S.C. and O.H.; resources, S.C. and O.H.; data curation, S.C.; writing—original draft preparation, S.C.; writing—review and editing, O.H.; visualization, S.C. and O.H.; supervision, S.C. and O.H.; project administration, O.H. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data are available upon request.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. The 2SLS second-stage regression result.

	(1)
Variables	**Growth in the Share of College Graduates**
Senior share	−0.0106
	(0.0376)
Total population	8.44×10^{-11}
	(7.37×10^{-9})
Immigrant share	−0.0178
	(0.0257)

Table A1. *Cont.*

	(1)
Variables	**Growth in the Share of College Graduates**
Share of some college experience	0.0635 ***
	(0.0164)
Share of college	−0.633 ***
	(0.0392)
Black share	−0.0686 ***
	(0.0173)
Share of minors	0.0412
	(0.0255)
Birth rate	−0.00616
	(0.0116)
Share of healthcare sector	0.138 *
	(0.0781)
Share of agricultural employment	0.00150
	(0.0153)
Year fixed effect	Yes
County fixed effect	Yes
Observations	9098
R-squared	0.316
F	55.57
Rss	1.590

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

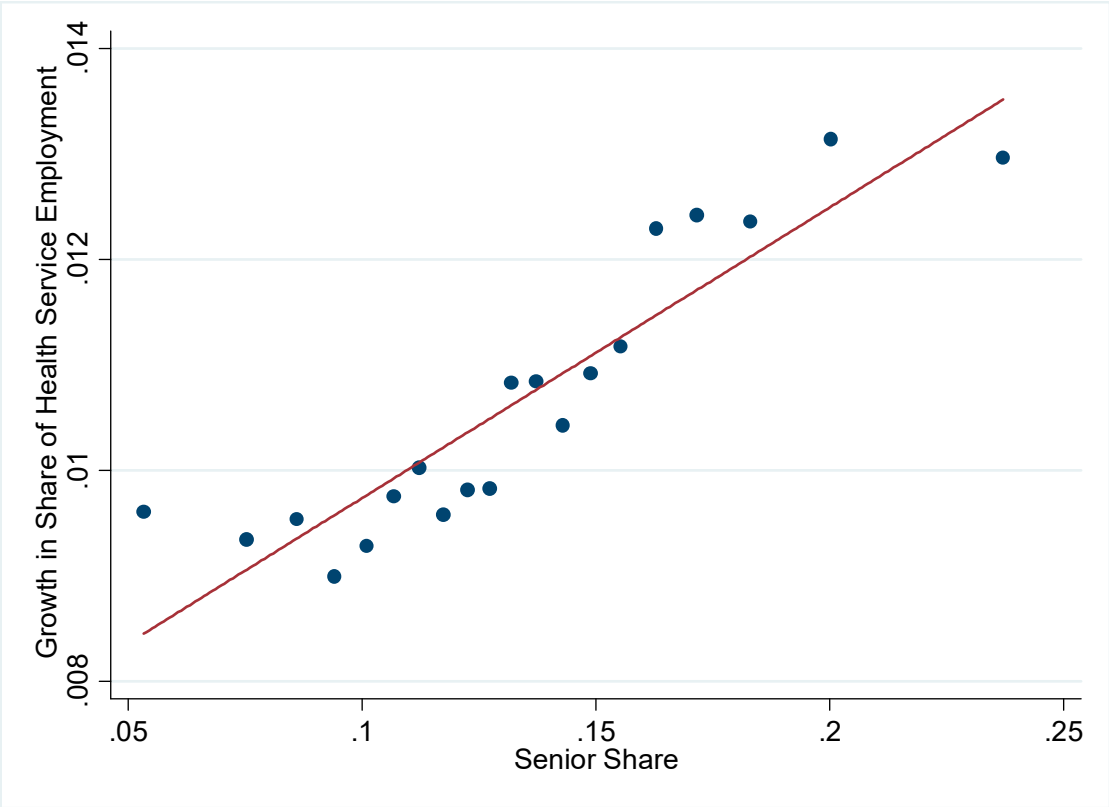

Figure A1. Growth in share of health service employment corresponding to averaged value of current senior share.

Table A2. Second-stage result for growth in healthcare sector.

	(1)
Variables	**Growth in the Share of Health Care Sector Employment**
Senior share	0.0834 ***
	(0.0319)
Total population	-1.93×10^{-9}
	(3.49×10^{-9})
Immigrant share	−0.0878 ***
	(0.0186)
Share of some college experience	0.0164 **
	(0.00782)
Share of college	0.0386 ***
	(0.0101)
Black share	−0.000441
	(0.0150)
Share of minors	0.0262
	(0.0185)
Birth rate	−0.00193
	(0.00324)
Share of healthcare sector	−1.214 ***
	(0.0350)
Share of agricultural employment	−0.0106 ***
	(0.00301)
Year fixed effect	Yes
County fixed effect	Yes
Observations	6070
R-squared	0.759
F	464.5
Rss	0.0710

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

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