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Researching the causes and consequences of unemployment

Birth Dearth and Local Population Decline

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ABSTRACT

Local population decline has spread rapidly since 1970, with half of counties losing population between 2010 and 2020. The workhorse economic models point to net out-migration, likely driven by changing local economies and amenities, as the cause of this trend. However, we show that the share of counties with high net out-migration has not increased. Instead, falling fertility has caused migration rates that used to generate growth to instead result in decline. When we simulate county populations from 1970 to the present holding fertility at its initial level, only 10 percent of counties decline during the 2010s.

JEL Classification Codes: J11, J13, N92, R11

Key Words: fertility, population decline, migration, counties, simulations

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Introduction

Local population decline is a large and growing problem in the United States. More than half of counties lost population between the 2010 and 2020 censuses (Mackun, Comenetz and Spell 2021). This was a steep increase from the 2000s, when 35 percent lost population, and only 22 percent of counties declined in the 1990s. Decline over a longer time period is also common—30 percent of counties had lower population in 2020 than in 1970.[1]

This population decline creates problems for both public finances and the local economy. Slow population growth can make it difficult for local governments to cover fixed costs such as pension liabilities and infrastructure maintenance (Breyer and Kolmar 2002; Butler and Yi 2022), particularly given their reluctance to reduce payroll (Berry, Grogger and West 2015). It also raises the potential for a "death spiral" resulting from the feedback loop between declining population, higher taxes, and lower services (Holmes and Ohanian 2014; *The Economist* 2024). In addition, decline slows local economic growth by reducing the number of potential entrepreneurs and innovators (Jones 2022; Karahan, Pugsley and Şahin 2024), as well as the available customer base and labor force. These issues may be especially acute at the local level due to government borrowing constraints and the susceptibility of small areas to large relative changes in population.

However, the spread of local population decline has received little attention in the economics literature. The most related work points to the potential importance of net out-migration. A large literature, much of it following Blanchard and Katz (1992), illustrates that people migrate in response to differentials in real wages or amenities. Moretti (2012) shows that these spatial differentials have been increasing, driving migration away from "left-behind" areas. Similarly, the workhorse urban models like spatial equilibrium (Rosen 1979; Roback 1982) and Tiebout (1956) only generate population change through migration. These academic findings are consistent with a narrative that figures prominently in conventional wisdom and the popular press—worsening local amenities or job opportunities have increased out-migration in many places, driving population decline.[2]

The connection between decline and migration is intuitive and indisputable. However, we show

[1] While the COVID-19 pandemic accelerated decline, these figures are nearly the same using 2019 as the end point.

[2] To illustrate the prevalence of this narrative, we asked OpenAI's ChatGPT for 10 reasons why a town's population might decline. The response included many specific factors related to migration and its drivers, suggesting that this link figured prominently in its training data.

that changes in a different factor—fertility—were necessary for decline to spread over the past 50 years. Our results suggest a simple story. High fertility used to provide a strong demographic tailwind that allowed many counties to grow despite having moderately negative net migration rates. As that tailwind has slowed, natural growth in more and more places has fallen below the level needed to compensate for their net out-migration. In contrast, the large negative net migration rates that were nearly universal among declining counties in the 1970s and 1980s have not become more common over time. Broadly speaking, our findings illustrate how differences in local outcomes can be driven by aggregate trends that are not included in typical urban models, especially in the long run. Neglecting these aggregate trends can lead to overestimates of the importance of local factors.

In the first half of our analysis, we study the basic relationships between population growth and birth, death, and net migration rates over the 1970–2019 period (avoiding the COVID-19 pandemic). We define *decline* as a decrease larger than 2 percent of baseline population throughout our analysis, in order to minimize the influence of small census enumeration errors. After illustrating the steady increase in the share of counties falling below this threshold in each decade, we decompose the overall growth rate into flows of births, deaths, and net migration (inclusive of international immigration). Because IRS data on county-county migration was not published until 1991, we use historical data on county births, deaths, and age distributions to infer net migration. Fertility has fallen dramatically and relatively uniformly across counties. In contrast, net migration has followed different paths at different points in the population growth distribution. In general, migration rates are converging over time, with the fastest-growing counties seeing steady declines, while rates among the slowest growers have remained constant. Finally, county-level mortality has not changed much during the sample period.

We then present two stylized facts that illustrate the relationship between population decline and changes in fertility and net migration. First, we compute, separately in each decade, the probability that a county with a given net migration rate experienced population decline. At all levels of net migration, this probability increases sharply over time. For example, in the 1970s and 1980s, only 15 percent of counties with annual net migration around –2 per 1,000 people declined. In the 2010s, over 40 percent of counties in this range declined. This shows that the fertility decrease was large enough to significantly increase population decline without any changes to the distribution of

migration rates. Second, we show that the share of counties with the large net out-migration rates that were characteristic of declining counties in the 1970s and 1980s has not increased over time. This suggests that an increase in the number of places experiencing a "mass exodus" is not driving the spread of decline, although changes elsewhere in the distribution of net migration rates could still play a role.

In the second half of our analysis, we build and calibrate a simple demographic model of annual county population change from 1970 to 2019. The model allows us to more systematically assess the role of changing birth rates, accounting for correlation in migration and fertility changes, as well as the longer-run effects that result from changes in a particular year. We use the model to simulate how population trends would have evolved if migration and mortality rates had followed their observed course but fertility had stayed at its 1970 level. We take a partial equilibrium approach, omitting potential spillover effects on migration and deaths that may result from counterfactual changes to birth rates. This yields a simple and transparent benchmark of fertility's role in slow local growth, in the spirit of a decomposition or an accounting model.

In the model, we take the 1970 age distribution in a given county as the starting point and then compute its 1971 age distribution in the following way. We add new births according to the county-specific birth rate and the number of women aged 15–44, remove individuals according to an age-specific death rate, and mechanically move people across age bins. We then add or subtract individuals according to the county's age group-specific net migration rate (inclusive of net international immigration), which yields our final age distribution and population count for the county in 1971. We then iterate to the next year and repeat through 2019.

When we simulate county populations holding fertility rates at 1970 levels, we find that the 25th percentile county grows by 26 percent between 1970 and 2019, versus the observed 25th percentile of –6 percent. Among counties that have lost population since 1970 in reality, 55 percent would have instead grown. Finally, in the 2010 to 2019 time period, in which a full 41 percent of counties met our threshold of decline in reality, only 9 percent of counties decline in the simulation.

These simulation results imply that declining fertility was necessary to generate population decline in most cases. Counties with even moderate negative net migration would have sustained growth had the demographic tailwind remained at its 1970 levels. While local amenities and labor markets have changed over this time period, it appears that their effect on net migration was not

large enough to create widespread population decline in the absence of falling birth rates. Our simulation quantifies this intuition, but we again emphasize that it is a partial equilibrium model.

To conclude the paper, we use fertility and mortality projections from the Congressional Budget Office (CBO) to project county populations from 2019 to 2070, providing some speculative insight on future local population trends.[3] Holding net migration rates at their pre-pandemic 2015–2019 levels and setting fertility and mortality according to the CBO's relatively optimistic projections, we project that 51 percent of counties will decline by more than 2 percent between 2019 and 2070. These results suggest that local population decline will become a more pressing problem in the near future even if fertility rates rebound as the CBO predicts.

Our results add to the literature on local population dynamics, especially prior work that has focused on demographic factors (Boustan and Shertzer 2013; Baum-Snow and Hartley 2020; Thiede et al. 2017). They also expand the large literature on effects of falling birth rates (e.g., Hopenhayn, Neira and Singhania 2022; Goodhart and Pradhan 2020; Jones 2023). Finally, because of the intimate linkages between population change and local economies and government finance, this paper is relevant to work that projects future tax revenues (Felix and Watkins 2013), economic growth (Maestas, Mullen and Powell 2023), and student enrollment (Grawe 2018). These relationships may be a fruitful area for further research.

1 Data Sources

The analysis data set consists of annual population, fertility, mortality, and net migration estimates for the set of U.S. counties between 1969 and 2019. Population estimates at the sex-by-age level are drawn from the Surveillance, Epidemiology, and End Results (SEER) Program. For the 1969–1988 period, data on births and deaths by age group are drawn from National Center for Health Statistics data, as curated by the National Bureau of Economic Research. For the 1989–2019 period, we draw births and deaths from the Center for Disease Control's full count microdata (National Center for Health Statistics 2023*a*,*b*). Unfortunately, data on migration between counties is not available for the early part of the sample period. We impute net migration, inclusive of international immigration, for each county in year t as the difference between the observed population in $t+1$ and a prediction

[3]We begin the simulation in 2019 because 2020 is the last year in which all of data sources are available, and using the pandemic year as the base year would create a number of undesirable complications.

of the population based on observed birth and deaths.

While these are the best available data sources, enumerating the population is a difficult task, and estimates are imperfect. In our setting, it is particularly important to account for issues that may arise because of the "re-benchmarking" of annual population estimates that occurs with each new decennial census. The Census Bureau constructs population estimates in the years following a decennial census by using that census as a baseline and then adding estimates of migration and births and subtracting an estimate of deaths. When the next decennial census arrives, the new population count may not align perfectly with the estimate based on the prior decennial census. Suárez Serrato and Wingender (2016) show that these errors can be significant, especially at the county level.

We do two things to mitigate the impact of enumeration errors on our estimates. First, the SEER population data uses the Census Bureau's intercensal estimates, which retrospectively adjust, for example, the 1991–1999 estimates after the 2000 decennial census is released. This reduces differences in the population estimates between a decennial census year and the year prior. Second, we define population decline as a decrease of over 2 percent, which reduces the chance that we classify small enumeration errors as population decline.

2 Trends in Population Decline, Fertility, and Migration

2.1 Decline and Fertility by Region and Urbanicity

Figure 1 shows the time series of the share of counties that have seen their population decline since 1970, stratifying by Census region in Panel A and urban-rural status in Panel C. The share of shrinking counties steadily increased to just under 30 percent in 2019, although there have been some fluctuations due to re-benchmarking in decennial census years, changes in federal immigration policy, and demographic cycles. Decline was initially concentrated in the Midwest and Northeast, while the South has seen the most rapid spread since 2000. Unsurprisingly, rural counties are most likely to decline, and suburban counties are least likely.

While the figure shows decline relative to 1970, trends in decline within each decade are informative about the spread of decline more recently. During the last 30 years, the share of declining counties in each decade has steadily increased from 16 percent in the 1990s to 27 percent

in the 2000s to 41 percent between 2010 and 2019. The 1970s also fit this monotonic trend, with only 14 percent declining, but the 1980s have an anomalously high decliner share of 39 percent. The 1980s figure likely reflects some real trends, such as low international immigration and a recession that disproportionately affected the rural counties that were already susceptible to decline. However, there is also reason to suspect that the 1980 Census was a relative overcount and the 1990 Census, a relative undercount, which would create artificially high rates of decline in the 1980s.[4]

Next, the right panels of Figure 1 show observed fertility rates by Census region (Panel B) and by urbanicity (Panel D). Average fertility rates have fallen sharply since the early 1970s, which has been variously ascribed to the greater availability of abortion and reliable contraception (Goldin and Katz 2002; Bailey 2006, 2010; Myers 2017), the decline in teenage pregnancy (Kearney and Levine 2015) and unintended births (Buckles, Guldi and Schmidt 2022), rising educational attainment, the decline in relative male earnings (Kearney and Wilson 2018), and "marriageable" men (Kearney and Levine 2017). This steep drop occurred across all regions and urbanicities.

While decreased fertility obviously slowed population growth, its quantitative importance in the spread of local population decline is unclear. Migration has also seen a host of strong trends that could be driving decline in various places, including the growing attraction of economic superstar cities (Moretti 2012), the continued decline of manufacturing (Charles, Hurst and Schwartz 2019), rising gentrification (Baum-Snow and Hartley 2020; Couture and Handbury 2020), and Black suburbanization (Bartik and Mast 2022). Rising mortality could also hamper growth in some counties (Case and Deaton 2015). In the next two subsections, we provide some additional statistics that shed light on the relative importance of fertility and other factors.

2.2 Decomposing Population Change Into Flows

In Figure 2, we examine how net migration, mortality, and births have changed in counties with different rates of population growth. We break counties into terciles based on their growth rate in each decade and plot the mean flows among the counties in each tercile. Because of the way we impute net migration, the three flows sum exactly to the population change.

We again see that births have fallen sharply and similarly in all categories, with a reduction of

[4] Suárez Serrato and Wingender (2016) show that the mean county saw its population updated positively by the 1980 Census, while the mean update was negative in 1990. In addition, the Census Bureau estimated that the 1990 Census undercounted the national population by about 1.6 percent, larger than other years in our period.

about 4 births per 1,000 people. Mortality has increased by only about 1 death per 1,000 population in the lower two growth deciles and remained constant in high-growth counties. The change in net migration looks quite different at different points in the population growth distribution. The bottom tercile mean has increased from –6.6 net arrivals per 1,000 in 1970 to about –6.3 in 2019, while the top tercile has declined rapidly, from 23 to 6.8. Finally, the middle tercile has oscillated between –1 and 5. In the final panel, we see the combined effect of these changes in flows—population growth has decreased in all terciles, but by much more in the high-growth group.

This decomposition provides some insight on each flow's role in population decline. First, migration rates have changed in a nuanced way. The largest decrease has been in high-growth counties that were unlikely to be on the margin of decline, and migration rates in areas closer to that margin have stayed positive or close to it. The combined effect of these migration rate changes on decline is difficult to infer from simple statistics. Second, the decline in fertility has been so widespread that it almost certainly shifted some counties into decline. Finally, changes in mortality are likely unimportant relative to the other two factors.

2.3 Stylized Facts on Fertility's Role in the Spread of Population Decline

We next present two stylized facts that illustrate important features of the connection between spreading decline and changes in fertility and net migration. First, in Panel A of Figure 3, we show that the probability that a county's population declines in a given decade has increased markedly over time, even after conditioning on the county's net migration rate. For example, consider a county with annual net migration between –4 and –2 per 1,000 baseline population—roughly the 20th to 25th percentiles of net migration in the 1970s. In the 1970s and 1980s, only 20 percent of counties in this range saw their overall population decline. In contrast, 56 percent declined in the 2000s and 2010s. This illustrates that the decrease in natural growth, which is driven almost entirely by falling fertility, is strong enough to drive significant increases in population decline, even without any change in net migration.

Second, in Panel B of Figure 3, we plot the share of counties with highly negative net migration rates or very low natural growth rates. We set thresholds of –11 and –6 net migrants per 1,000 people, which were the median and 75th percentile of net migration among declining counties in the 1970s. The share of counties with migration below –6 has held steady around 14 percent, while the

share falling below –11 has remained between 4 and 8 percent.[5] (The 1980s are again an outlier in this graph, for the same reasons discussed in the previous subsection.) In contrast, the share of counties with natural growth below 2.5 per 1,000 people has skyrocketed from around 20 percent in the 1970s to over 70 percent in the most recent decade. In other words, high negative net migration rates are not becoming more common, but low natural growth rates are spreading rapidly.

These stylized facts do not imply that fertility is fully responsible for increasing decline—changes at other points in the migration distribution could tip counties out of positive growth, and the correlation between fertility changes and migration changes may also be important. Moreover, there are long-run dynamics that these figures do not account for, as what happens in one decade matters for the next. The model in the next section accounts for these complications to say something more precise. However, the raw data strongly suggests that falling fertility has played an important role in decline, while an increase in the number of counties experiencing a "mass exodus" has not.

3 Population Simulation Methodology

We next use a simple demographic simulation to quantify the importance of fertility changes in population decline. The model takes an accounting approach—it starts with the 1970 age distribution in each county, and in each subsequent year mechanically ages the population and adds or subtracts births, deaths, and net migration. Because we calculate these population flows within granular age bins and sequentially construct the population estimates for each year, the simulation incorporates subtle effects such as the change in net migration that results from a change in the age distribution of the population, or the echo effect of increased births in one year on fertility 30 years later. This enables much more precise measurement of the effect of fertility changes on population than the summary statistics in the previous section. We use the model to estimate county populations under the counterfactual assumption that fertility had remained at its 1970 level, but all other factors followed their observed trajectories.

We emphasize that the model is partial equilibrium and intended to decompose the role of falling fertility in a mechanical or accounting sense. Incorporating general equilibrium effects would likely

[5] Note that these trends are occuring as the overall rate of domestic migration steadily decreases (Molloy, Smith and Wozniak 2017; Jia et al. 2023; Olney and Thompson 2024), potentially due to the aging of the population, spatial inequality in housing prices, or the growing strength of local ties (Zabek 2024; Coate and Mangum 2022).

lead to even higher simulated population in the low-growth counties we are most interested in. For example, increased population may improve local amenities and job opportunities, increasing the net migration rate. The countervailing force would be increases in housing costs, which may be small in counties close to the margin of decline given high elasticities of supply in less-developed areas (Baum-Snow and Han 2024) and housing's durability (Glaeser and Gyourko 2005).

The simulation takes the 1970 population in each county, separated into a set of age bins, as a starting point. We then construct the population in each age bin in each county in each subsequent year. We model population counts for age group a in county c in year t as:

$$\begin{aligned} Population^{Sim}_{act} = & \, Population^{Sim}_{ac,t-1} \\ & - \left(MortalityRate_{ac,t-1} * Population^{Sim}_{ac,t-1} \right) \\ & + \left(NetMigrationRate_{ac,t-1} * Population^{Sim}_{ac,t-1} \right) \\ & - \left(AgeOut^{Sim}_{ac,t-1} - AgeOut^{Sim}_{a-1,c,t-1} \right). \end{aligned} \tag{1}$$

We use age groups 0–4, 5–14, 15–24, 25–34, 35–44, 45–54, 55–64, 65–74, 75–84, and 85+, with a indexing them ordinally. For the youngest age group, we remove the flow of people aging into the group and replace it with the number of births, which we denote by $Births^{Sim}_{c,t-1}$. We define the terms inside Equation (1) as follows.

- $MortalityRate_{ac,t-1}$ is the observed age-specific mortality rate in the county and year, computed using NCHS and CDC data to populate the numerator and SEER data for the denominator.

- $NetMigrationRate_{ac,t-1}$ is observed net migration as a share of the baseline population in the age group. Note that this specification implies that a simulated change to the baseline population in one year will change the amount of net migration in the following year. While net migration is not directly observed, we can back it out at the year-by-age group level by comparing the population change in an age bin to what would be expected based on observed births, deaths, and counts of those aging in and out. Specifically, we rearrange Equation (1),

populating all terms on the right-hand side with their observed values:

$$NetMigrationRate_{ac,t-1} = \frac{\Delta Pop_{act} - Deaths_{ac,t-1} + (AgeOut_{a-1,c,t-1} - AgeOut_{ac,t-1})}{Pop_{ac,t-1}}$$

- $AgeOut_{ac,t-1}$ is the number of people who aged out of age group a between $t-1$ and t, while $AgeOut_{a-1,c,t-1}$ is those who age in from the age group just below. $AgeOut$ is computed as:

$$AgeOut_{act} = \left(\frac{Births_{c,t-s}}{\sum_{j=t-s+k}^{t-s} Births_{c,j}} \right) \times Pop_{act} \tag{2}$$

  where s indexes the number of years prior to t that the people who are aging out of a were born and k indexes the number of years prior to s when the youngest people in age group a were born. Since no one ages out of the oldest age group, we tweak Equation (1) to drop the age out term $AgeOut^{Sim}_{10c,t-1}$ and reconstruct $NetMigrationRate_{10c,t-1}$ accordingly.

- $Births^{Sim}_{c,t-1}$ is the simulated number of births. This is computed as the fertility rate for the county ($FertilityRate^{Sim}_{c,t-1}$) multiplied by the number of women aged 15–44 in that year ($PrimeAgeFemales^{Sim}_{c,t-2}$).

By design, this model allows us to initialize the age distribution with the observed values in the baseline year, populate $MortalityRate$ and $NetMigrationRate$ with their observed values, calibrate the fertility rate, and iterate from one year to the next indefinitely. We verify that our model matches observed populations when setting fertility equal to the observed values and then repeat the simulation under our counterfactual fertility assumption.

4 Population Simulation Results

4.1 Main Results

Our main results are simulated county population estimates under the assumption that county-level fertility rates had remained constant at their 1970 levels (i.e., $FertilityRate_{c,t} = FertilityRate_{c,1970}$ for all t). Table 1 compares simulated county populations and growth rates to the observed values.

The first panel shows that the simulated distribution of county population is shifted to the right of the observed distribution, which is unsurprising given that the simulated 2019 national population

is 29 percent higher than the observed value. In the second panel, we show the distribution of growth rates relative to 1970. It suggests that higher fertility rates would have had a large impact on population growth in areas that have struggled with decline. The 25th percentile county in the simulation grows by 26 percent between 1970 and 2019, which is much higher than the observed 25th percentile of –5.8 percent and almost as large as the median observed growth rate.

The third panel of Table 1 shows the growth rate within each decade, rather than the cumulative change since 1970. Focusing on the 25th percentile (roughly the counties that are on the margin of decline), we see that the simulated decadal growth rate begins at 5.7 percent in the 1970s and falls slightly to 2.6 percent in the 2010s. This is a sharp contrast to the observed growth rate at this quantile, which falls from 3.0 percent to –4.3 percent as population decline gradually spreads. In the fourth panel, we show the share of counties that declined by 2 percent or more between 1970 and the reference year. In 2019, 27.8 percent of counties fell below this threshold in reality, while only 11.9 percent do in the simulation. This implies that 55 percent of counties that actually declined instead see positive growth in the counterfactual. Finally, the fifth panel reports the observed and simulated share of counties that decline by 2 percent or more within each decade. The simulated versus observed difference in the decliner share between 1970 and 1980 is relatively small (11 and 14 percent, respectively). However, between 2010 and 2019, only 8.7 of counties declined in the simulation, compared to over 40 percent in reality. This suggests that without falling fertility, the rate of local population decline within each decade would have remained at roughly its 1970 level.

Note that the difference between observed and simulated growth rates grows slowly over time, as a change in fertility initially only affects the number of infants before slowly propagating up the age pyramid as time elapses. We examine age dynamics further by plotting the simulated and observed national population pyramids for each decade in Appendix Figure A1. In 1981, the simulation has increased the 0–4 age population by 33 percent, while ages over 15 are unchanged. By 2019, this change has percolated up through the 45–54 age group, increasing the total population under 54 by 41 percent. This gradually changes not only total population, but also the age structure in the population. In the counterfactual, the pyramid retains a similar shape to 1970, while it drastically flattened in reality as the ratio of older people to younger people increased. This illustrates that falling fertility affects local labor supply and pension liabilities not only by reducing population but also by changing the age structure.

Finally, in Appendix Figure A2, we examine the relative magnitude of net migration and net births (i.e., births minus deaths) in counties that declined between 1970 and 2019. Panel A shows the observed total values, summed across these counties, while Panel B shows simulated values. Observed net migration has always been negative in this set of counties, although it increased from roughly –500,000 during the 1970–1990 period to about –150,000 during the 2000–2019 period, coinciding with falling migration rates in the United States generally. However, this trend was almost exactly offset by net births' decrease from 300,000 to 0. In Panel B, we see that simulated net births instead steadily increase, while net migration retains the observed pattern, but scaled up by the simulated population increase. Simulated net births are high enough to offset net migration in almost every year after 1990.

4.2 Alternative Parameterizations and Heterogeneity

In Table A1, we examine how the share of observed declining counties that grow in the simulation varies by region and urbanicity, as well as when freezing fertility at different baseline levels. The first row shows results when maintaining the birth rate at 1970 levels, as in the baseline simulation. The share of decline that is reversed varies from 80 percent in the Northeast to 47 percent in the Midwest, with the South and West falling around 60 percent. Core urban (77 percent) and suburban counties (75 percent) are most likely to see decline reversed, while the share is smaller in rural counties (53 percent). These differences result from which areas have more declining counties that are close to the margin of growth and from which areas saw a larger fertility decrease after 1970.

The second and third rows show the share of decline that is reversed when freezing fertility at 1980 and 1990 levels. Here, the set of observed decliners is those whose population fell between the base year and 2019. With the 1980 base year, 32 percent of declining counties instead grow in the simulation. However, with the 1990 base year, the share of reversals falls to 9 percent, likely because fertility in the rural areas most susceptible to decline was significantly higher in 1980 than in 1990.

4.3 Discussion and Caveats

We again emphasize that these are partial equilibrium results. Our simulation speaks to the following thought experiment. Consider a rural county where, prior to 1970, the average family had five children, and 40 percent of the children moved to urban areas after coming of age. Loosely speaking,

this county would grow by 50 percent each generation, as three remaining children replace two parents. Suppose that in reality, we observed that fertility fell to three children per family after 1970, and the urbanization rate increased to 45 percent, leading the county's population to rapidly shrink. What would have happened to county population if the fertility rate had instead remained at its initial level but the urbanization rate still increased to 45 percent? Our results do not tell us how the urbanization rate would have evolved differently under the counterfactual fertility rate, which may have been affected by equilibrium effects like increases in the number of good jobs or grocery stores, faster housing cost growth, or changes in intangible factors.

However, our results nonetheless show that falling fertility rates have played a major role in local population decline over the past 50 years. Net migration, potentially driven by the changes in quality of life and job opportunities, also directly affects population, as emphasized in workhorse static urban models and the popular press. But whether a given rate of net migration translates into population decline depends on the strength of natural growth in a county. Most counties no longer enjoy the strong cushion of natural growth that they did 50 years ago, and neglecting this fact can lead to an overestimate of the importance of migration and changes in amenity or wage differentials.

5 Projections of Future Population

To conclude the paper, we make forward-looking projections about the local consequences of fertility decline. This is important both because fertility continues to trend downward and because the effects of already realized fertility changes will not be fully felt for decades.

We use the same demographic simulation as above to project county populations through 2070, drawing on projected mortality and fertility rates from the Congressional Budget Office (CBO). Ideally, we would begin with 2023 populations and then calibrate the simulation using values from a relatively typical time period. Unfortunately, 2020 is the last year in which all of our data sources are available. To obtain a projection that is not strongly influenced by the abnormal pandemic era, we begin with 2019 county populations, then construct subsequent years using the CBO's 2022 fertility and mortality projections and observed net migration between 2015 and 2019. For fertility, the CBO projects an increase from 1.61 children per woman in 2021 to 1.85 children per woman by

2029 (a 15 percent increase) and stable fertility rates thereafter. For mortality, they project life expectancy improvements in line with the pre-pandemic period.

As a baseline, we use the national CBO projections to project county-level changes in mortality and fertility by assuming that county-level rates will evolve from their 2019 value in parallel with the national rates. We assume that county-level net migration-by-age rates will remain fixed at their average 2015–2019 levels.[6] We also consider the alternative scenario that county-level fertility and mortality rates will only rebound to pre-pandemic levels (2015–2019 average values) and not improve further.

Table 2 shows projection results under both scenarios. The first panel shows total population in each decade, and we see that both the 25th percentile and median shrink from 2019 to 2070 in both projections. Under the frozen fertility and mortality rates scenario, we project that the 25th percentile of county population will actually be smaller in 2070 than in 1970 (8,201 versus 9,350), even though the projected national population will grow by 227 percent over the same time period.

The second and third panels of the table report projected growth since 2019 and within each decade. Under the optimistic CBO projections, the median county shrinks in each decade until the 2050s, when slight positive growth emerges. With the frozen fertility and mortality rates, we predict that median will shrink by over 2 percent in every decade. Finally, the last two panels show the share of counties in each decade whose population falls by over 2 percent relative to either the 2019 baseline or the projected population at the start of the decade. For both outcomes and both sets of assumptions, the simulation predicts widespread decline that is similar to or greater than what was observed between 2010 and 2020.

Summarizing, if current trends continue, the majority of counties are probably past their population peak with little prospect of immediate recovery. However, under the CBO's optimistic fertility and mortality projections, we would instead see some declining counties return to growth around the mid-21st century. Of course, this exercise is speculative and sensitive to future policy changes. Changes to immigration policy, in particular, could have a large effect on population growth, and the projection considers a very long time period in which other factors could also drastically change. However, the results suggest that absent a broad-based recovery in births or significant

[6]This assumption partly reflects the CBO's own projection that net immigration's contribution to growth will be essentially flat from 2021 to 2070.

changes in migration patterns, population growth will take on an increasingly winner-take-all quality among U.S. counties, with a higher and higher share shifting into decline.

6 Conclusion

In this paper, we document the spread of local population decline in the United States since 1970 and illustrate the important role played by falling fertility rates. We also project that, in the absence of large changes to fertility, domestic migration, or international immigration, this problem will only grow worse in the future, leading population growth to be concentrated in a relatively small number of counties while most experience persistent decline.

These results illustrate that the story of local population decline is more nuanced than the mass exodus narrative that is often emphasized in the popular press and, implicitly, by static urban models. This may be helpful to policymakers facing public finance or local labor market issues. Our findings also illustrate that aggregate trends need to be accounted for when considering the drivers of local outcomes, especially in the medium or long run.

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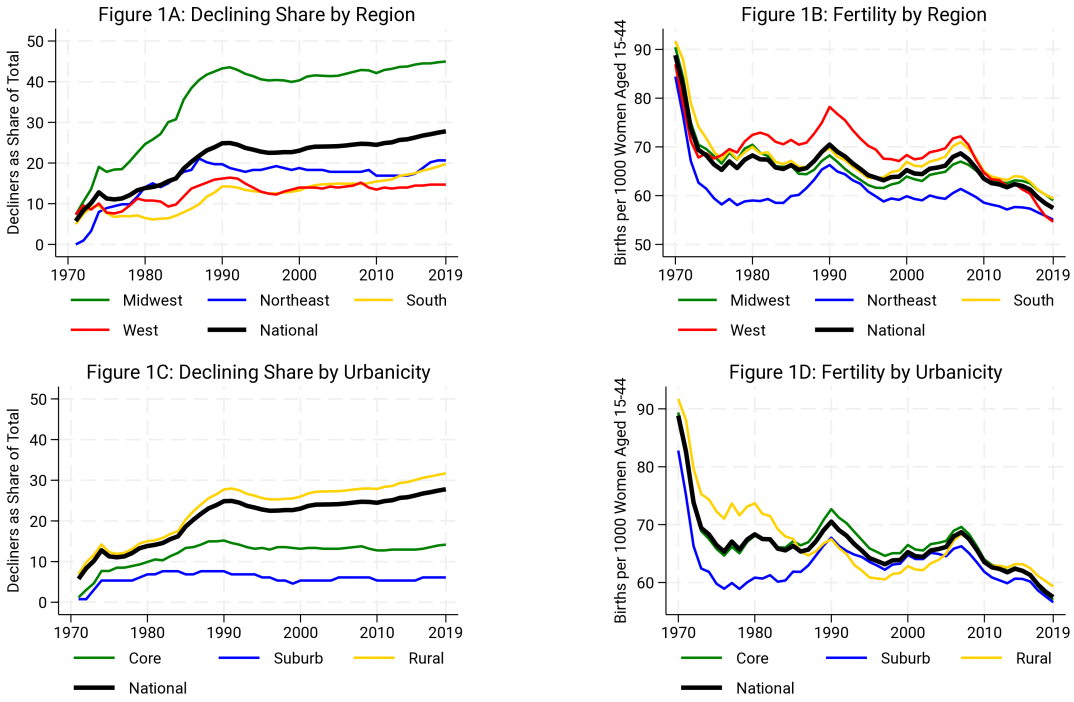
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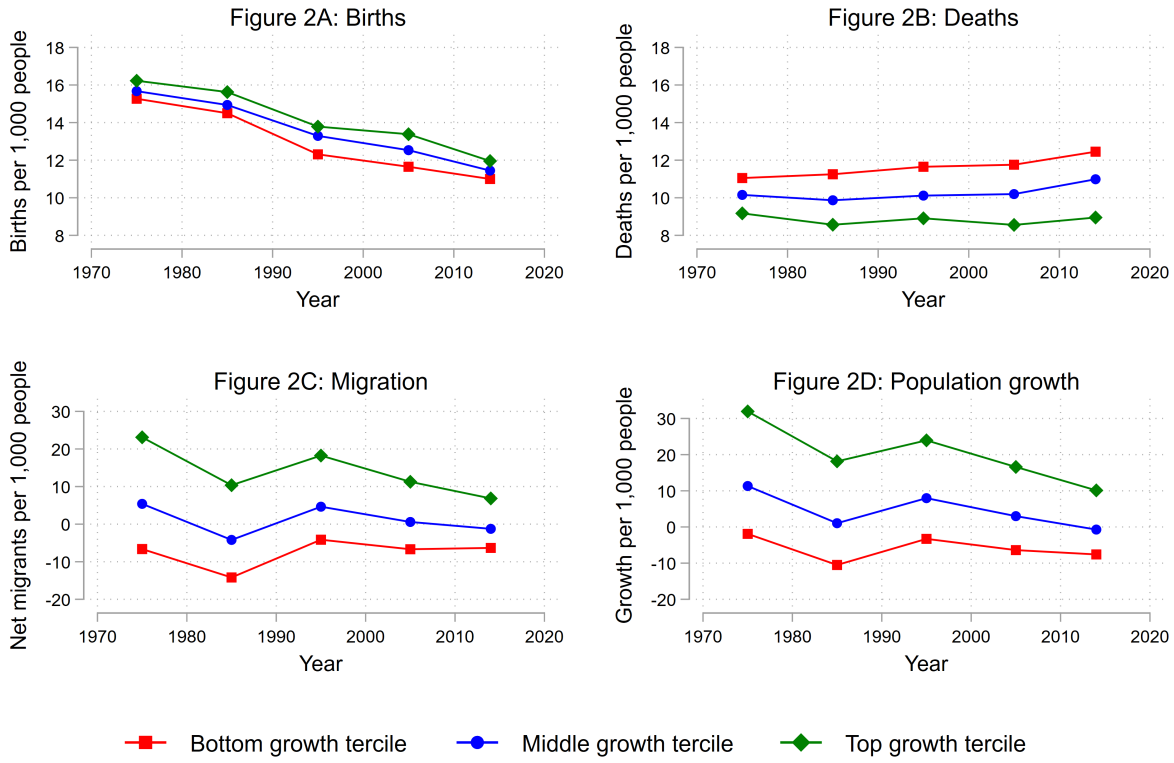
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Figure 1: Trends in Fertility and Local Population Decline from 1970 to 2019



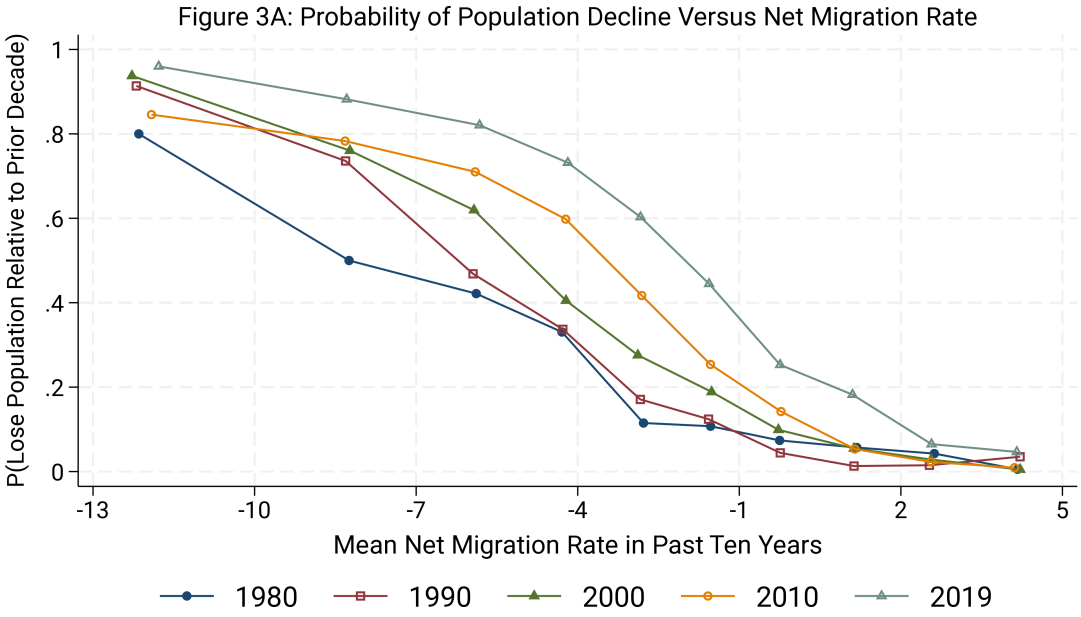
SOURCE: Authors' calculations drawn from the SEER data and the NCHS natality microdata.
NOTE: The left panels show the share of counties whose population is below their 1970 levels by U.S. Census region (Figure 1A) and by urbanicity (Figure 1C). The right panels show the fertility rate per 1,000 women aged 15–44 by U.S. Census region (Figure 1B) and by urbanicity (Figure 1D). Decline defined as population falling by more than 2 percent of the population in the base period.

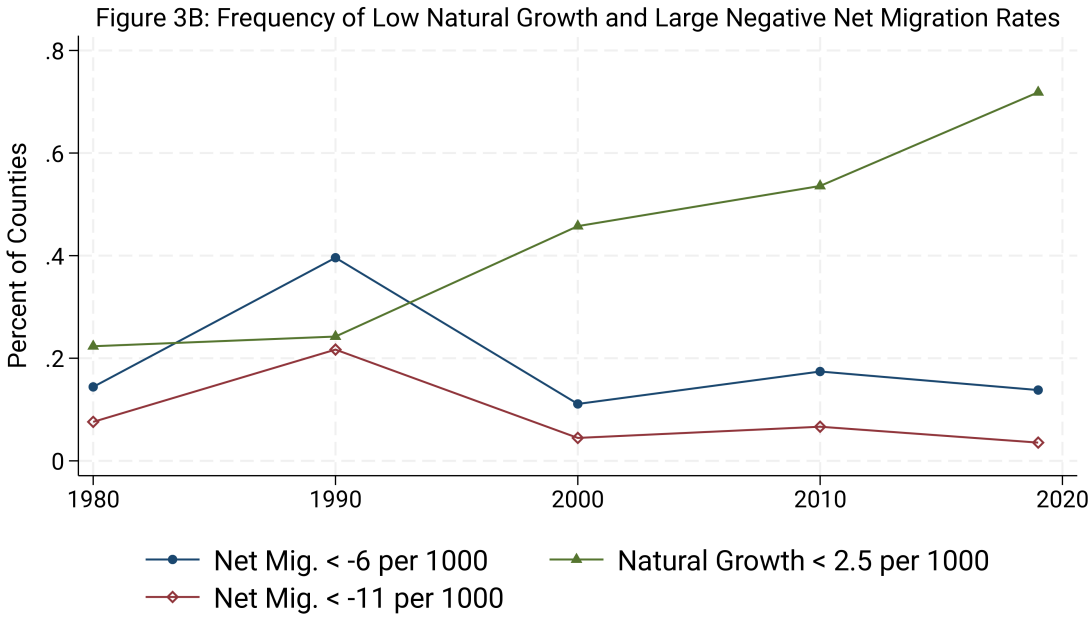
Figure 2: Demographic Flows by Tercile of Population Growth



SOURCE: Authors' calculations drawn from the SEER data and the NCHS natality and mortality microdata.
NOTE: This figure shows how demographic flows have changed over time among counties with different levels of population growth. Counties are stratified according to terciles of population growth in each decade. Flows are measured as the mean annual value within each decade, normalized by population at the start of the decade. Net migration includes net international immigration.

Figure 3: Stylized Facts on the Relationships between Population Decline, Fertility, and Migration





SOURCE: Authors' calculations drawn from the SEER data and the NCHS natality and mortality microdata.
NOTE: Panel A shows the probability that a county's population has declined over the previous 10 years conditional on its average net migration rate over that period, separately for each decade in the sample period. Decline is defined as a decrease of greater than 2 percent of the base period population. Panel B shows the share of counties in each decade that had low natural growth rates (defined as below 2.5 per 1,000 people) and large negative net migration rates (defined as either below –6 per 1,000 or below –11 per 1,000).

Table 1: Observed and Simulated County Population Growth from 1970 to 2019

	Observed				Simulated			
	Mean	p25	Median	p75	Mean	p25	Median	p75
Total Population								
1970	66,558	9,350	18,796	43,357	66,558	9,350	18,796	43,357
1980	74,136	10,551	21,844	51,673	76,880	10,796	22,433	53,544
1990	81,443	10,463	22,463	56,215	88,490	11,202	24,389	61,437
2000	92,059	11,405	25,215	62,768	105,007	12,904	28,684	73,917
2010	100,904	11,263	26,059	67,739	121,762	13,785	32,513	85,014
2019	107,099	11,055	26,166	69,127	138,172	14,759	34,871	94,142
Growth Since 1970								
1980	16.2%	3.0%	12.1%	23.5%	19.6%	5.7%	15.1%	27.1%
1990	23.5%	-1.9%	13.6%	32.5%	33.8%	5.3%	23.4%	45.1%
2000	42.4%	-0.2%	23.0%	55.1%	65.0%	14.2%	42.2%	81.1%
2010	56.7%	-1.4%	27.2%	69.8%	95.7%	21.0%	57.7%	113.1%
2019	64.0%	-5.8%	26.1%	76.8%	123.1%	26.1%	68.8%	138.6%
Decadal Growth								
1980	16.2%	3.0%	12.1%	23.5%	19.6%	5.7%	15.1%	27.1%
1990	4.0%	-6.2%	1.2%	9.6%	9.2%	-1.8%	6.5%	15.8%
2000	11.0%	0.9%	8.3%	17.3%	18.2%	7.2%	15.4%	25.3%
2010	5.2%	-2.6%	3.1%	10.2%	12.8%	4.6%	10.4%	17.9%
2019	0.8%	-4.3%	-0.6%	4.4%	8.8%	2.6%	7.3%	12.8%
$\mathbb{1}$(Declined Since 1970)								
1980	13.8%				10.7%			
1990	24.8%				16.6%			
2000	23.0%				13.3%			
2010	24.5%				12.3%			
2019	27.8%				11.9%			
$\mathbb{1}$(Declined in Decade)								
1980	13.8%				10.7%			
1990	39.0%				24.4%			
2000	15.5%				6.7%			
2010	27.0%				8.8%			
2019	40.9%				8.7%			

SOURCE: Authors' calculations drawn from the SEER data and their simulation.
NOTE: The first three panels of this table report the distribution of population counts, growth rates since 1970, and decadal growth rates in both the observed data and the simulation that freezes fertility at 1970 levels. The final two panels show the share of counties that declined relative to 1970 and within each decade, with decline defined as a population decrease larger than 2 percent of the base period population.

Table 2: Projected County Population Growth from 2019 to 2070

	CBO Fertility and Mortality				2015–2019 Fertility and Mortality			
	Mean	p25	Median	p75	Mean	p25	Median	p75
Total Population								
2019	107,164	11,055	26,186	69,513	107,164	11,055	26,186	69,513
2030	110,269	10,450	25,896	70,697	110,788	10,378	25,653	70,136
2040	117,589	10,023	25,338	71,653	117,540	9,669	24,651	69,964
2050	125,728	9,675	25,255	74,315	125,478	8,991	24,182	71,974
2060	137,529	9,630	25,321	79,310	136,442	8,654	23,474	74,429
2070	155,174	9,526	25,860	81,404	151,565	8,201	22,910	75,524
Growth Since 2019								
2030	-0.4%	-7.4%	-2.0%	5.0%	-1.3%	-8.3%	-2.9%	4.2%
2040	1.0%	-14.4%	-4.1%	10.9%	-2.1%	-16.9%	-6.8%	7.4%
2050	4.8%	-20.1%	-5.6%	17.5%	-0.7%	-24.4%	-10.4%	11.4%
2060	13.5%	-24.2%	-4.9%	27.3%	3.9%	-30.4%	-13.0%	17.5%
2070	28.2%	-28.0%	-2.9%	39.9%	12.1%	-35.9%	-14.8%	24.0%
Decadal Growth								
2030	-0.4%	-7.4%	-2.0%	5.0%	-1.3%	-8.3%	-2.9%	4.2%
2040	0.0%	-7.4%	-2.0%	5.5%	-2.2%	-9.4%	-4.0%	3.1%
2050	0.6%	-7.2%	-1.5%	6.3%	-1.6%	-9.1%	-3.7%	3.9%
2060	2.8%	-5.6%	0.7%	8.7%	-0.5%	-8.2%	-2.5%	5.1%
2070	4.0%	-4.9%	1.8%	10.2%	-0.2%	-8.1%	-2.2%	5.4%
$\mathbb{1}$(Declined Since 2019)								
2030	50.2%				54.5%			
2040	54.7%				61.3%			
2050	55.5%				62.6%			
2060	53.7%				62.5%			
2070	50.8%				61.9%			
$\mathbb{1}$(Declined in Decade)								
2030	50.2%				54.5%			
2040	50.0%				58.9%			
2050	47.5%				57.4%			
2060	39.3%				52.3%			
2070	34.9%				50.7%			

SOURCE: Authors' calculations drawn from the SEER data, the Congressional Budget Office's projections, and their simulation.

NOTE: This table reports results from our population projection. The left columns use the CBO's projected fertility and mortality, while the right columns instead freeze those variables at the 2015 to 2019 averages. Both parameterizations freeze net migration at its 2015 to 2019 average. The first three panels report the distribution of population counts, growth rates relative to 2019, and decadal growth rates. The final two panels show the share of counties projected to decline relative to 2019 and within each decade, with decline defined as a population decrease greater than 2 percent of the base period population. Three counties with very small baseline populations are dropped to avoid skewing the mean growth rate in later years of the projection. These are Loving County, TX (FIPS Code 48301), Hudspeth County, TX (48229), and Trousdale County, TN (47169).

Online Appendix

A Adjusting Simulation for Excess Immigration

A side effect of our simulation's design is that it mechanically inflates the number of net immigrants annually. This occurs because as we apply the observed net migration rates by age groups to a growing population base as the population pyramid grows, this causes some of the extra births to translate into excess immigrants, even though we aim to keep the number of net immigrants constant.

We note here that net immigrants is going to include everyone who moves into the 50 U.S. states plus D.C. from another jurisdiction, including those who migrate in from U.S. territories such as Puerto Rico. This is an artifact of the SEER data, which does not provide counts on U.S. territories.

We remove these excess immigrants via several steps so that our simulation also has the same number of total net immigrants as was actually observed. First, we note that while we cannot distinguish between immigrants from domestic migrants, we can back out total immigration by age group by summing together net migration counts across all counties in a given year:

$$NetImmigration_{at} \equiv \sum_{c} NetMigration_{act} \tag{3}$$

This identity works because the sum of domestic migration counts across all counties must equal zero, meaning net immigrants comprise the balance of national net migrants. We then calculate how many extra immigrants our simulation creates at the national level as:

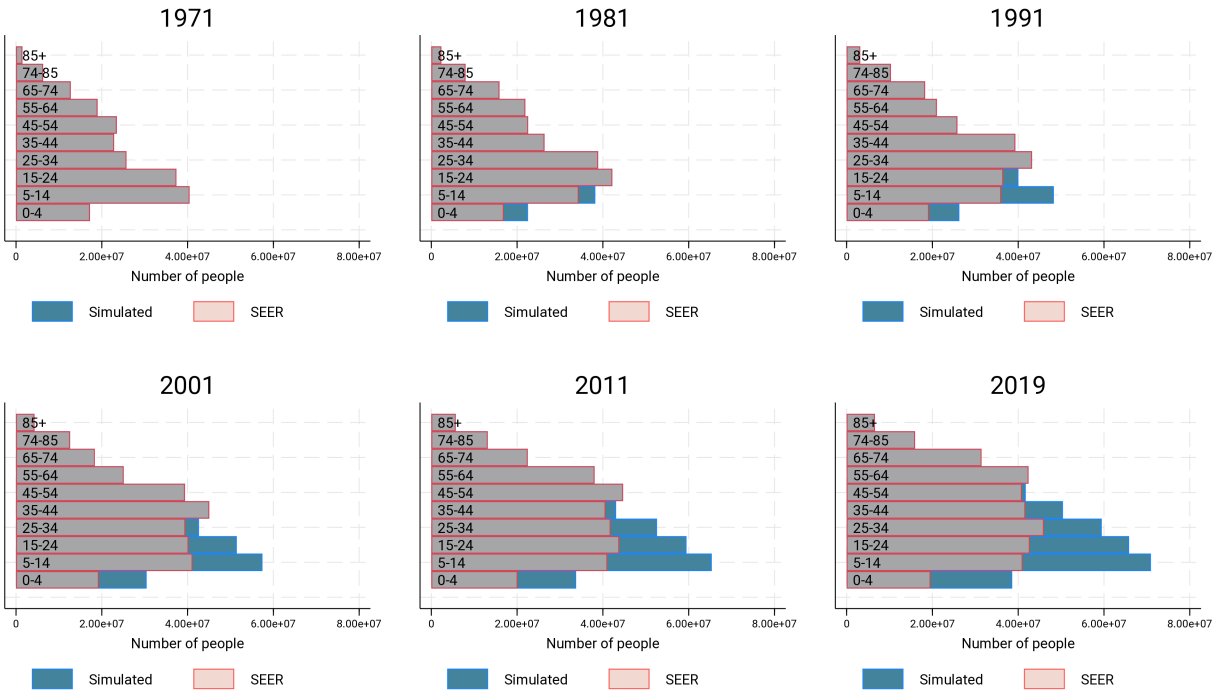
$$ExcessImmig_{at} = NetImmigration_{at}^{Sim} - NetImmigration_{at} \tag{4}$$

We then take this total number of excess immigrants per year and subtract it from each county according to their share of the total foreign-born population who arrived between 1960 and 1970 which we obtained from 1970 U.S. Census data via IPUMS (Manson et al. 2022). After the net migration counts are adjusted in this fashion, we find that net immigration counts are the same in both the simulation and in the observed data. Similarly, for Table A1 when we calculate the share of counties whose decline was reversed using different base years, we re-benchmark the county-level distribution of the total foreign-born population using the county-level share who arrived across the most recent period relevant to that base year.[7]

[7]For 1980, we use the distribution of those who arrived from 1975 to 1980. For 1990, we use the distribution of those who arrived from 1987 to 1990.

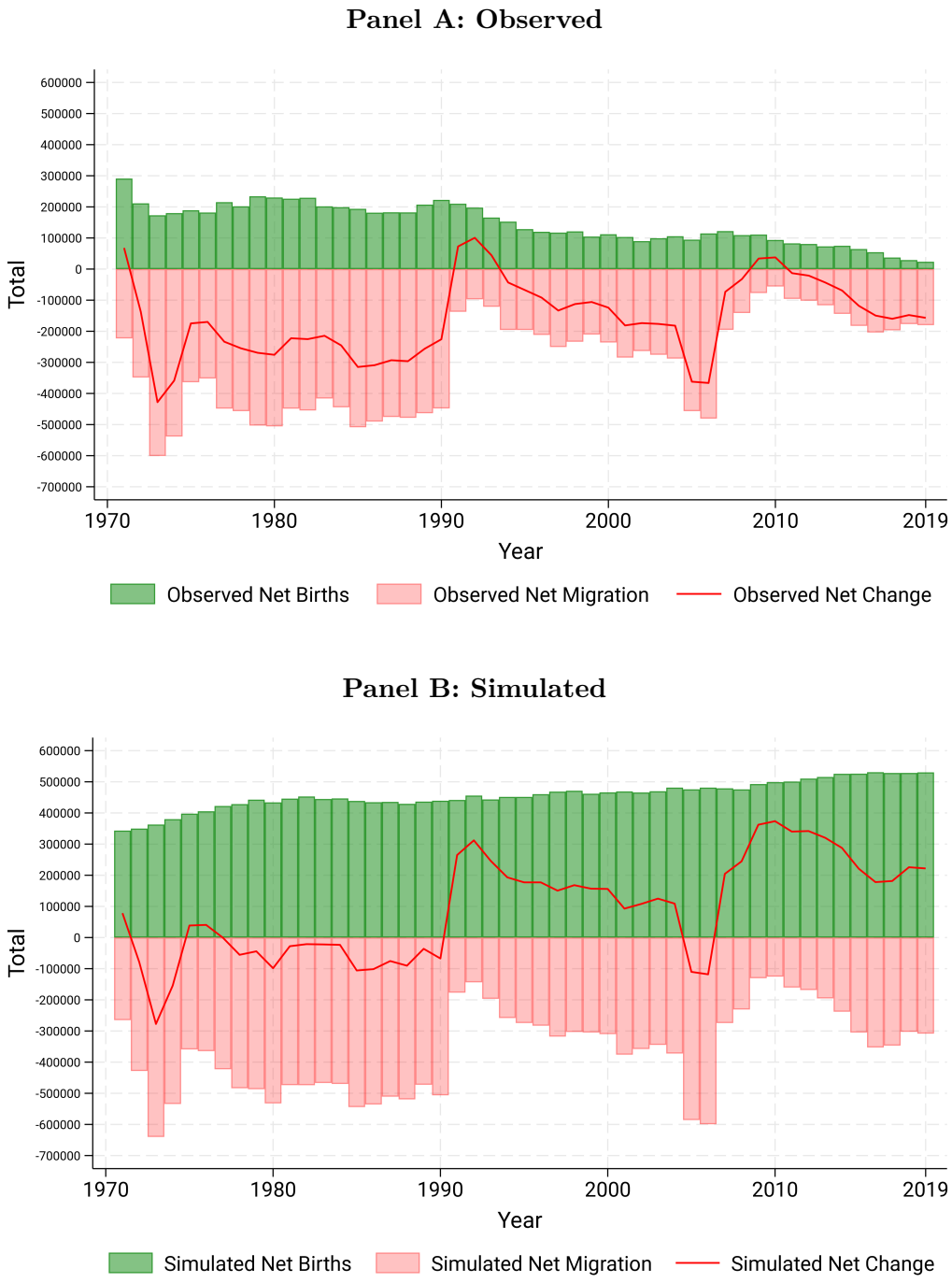
B Additional Figures and Tables

Figure A1: National Population Pyramid



SOURCE: Authors' calculations drawn from the SEER data and their simulation.
NOTE: Figure A1 shows national-level population pyramids for selected years for both the observed population (SEER, in pink) and for the simulated population (in blue).

Figure A2: Components of Population Change



SOURCE: Authors' calculations drawn from the SEER data and their simulation.
NOTE: Figure A2 shows the annual contribution to total population change from net births (green) versus net migration (pink) among the counties whose population declined between 1970 and 2019. The sum of net births and net migration in each year is shown with the red line. Panel A shows these dynamics using the observed data, while Panel B shows the results from the simulation.

Table A1: Share of Decline Reversed in Regions and Urbanicities by Base Year

	National	Regions				Urbanicities		
		Midwest	Northeast	South	West	Core	Suburban	Rural
Percent Reversed								
1970	55.2	47.3	79.5	63.5	61.7	77.1	75.0	53.0
1980	31.5	27.1	33.3	34.0	48.1	27.4	28.6	31.9
1990	8.5	5.2	23.1	9.6	16.4	14.1	20.0	8.2

SOURCE: Authors' calculations drawn from the SEER data and their simulation.
NOTE: Table A1 reports the share of decliners that would have reversed from decline to growth by 2019 overall as well as by Census region and by county urbanicity. Decline defined as a percent change in population from the base period of –2 percent or less.