Tennessee Population Projections and Underlying Influential Trends

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Demographic Data - Sources

• Decennial Census
• American Community Survey
• Census Bureau Population Estimates
• Population Projections
Decennial Census

- Mandated by Article 1, Section 2 of U.S. Constitution
- Based on actual counts of persons
- Used to determine number of members in House of Representatives from each state
- Provides the base population for the annual population estimates series
Population Estimates

- Calculated number of people living in an area at a specific point in time.
- Derived using models that account for changes in:
  - Births
  - Deaths
  - **Net Migration**
- Used to control/inform ACS, CPS, etc.
- Used for denominators by state/local government agencies and non-profits as denominators in rate calculations and program fund allocations.
Population Projections

• Estimates of the population for future dates
• Relies on assumptions about future births, deaths, and net migration.
  • Big one – that future data will follow some version of prior trends.
• Used by government, business, and non-profits for planning purposes and demand forecasts.
Where are we now?

• At the end of the diving board.
• All information we have since the 2010 census are all estimates . . .
• Extraordinarily good, carefully done estimates,
• But estimates never the less.
What We Did (starting 2017)

• A ‘cohort-component’ model
  • 5-year Age – Sex – Race/Ethnicity - County
• Birth: county-age-race specific birth rates
• Death: Statewide death rates, augmented by SSA tables for changing life-expectancy.
• Net Migration – About that . . .
Invisible Forces

• Net Migration is Unobservable
  • Birth and death are documented in vital statistics ‘Tennessee Department of Health’
  • Net migration is the ‘residual’
    • Population is known
    • Births are known
    • Deaths are known
    • Net Migration makes up the difference

• Most volatile component of population change
• Most critical component of short-term population change.
• Also is the main reason why taking population dynamics is important for a good forecast.
  • It’s not just about if people are moving to a county, but who is moving to a county that affects future pop.
Nitty Gritty on Net Migration

• Use race, age, 5-year age band population estimates by county from 2000-2018.
• Use SSA life tables to project the number of survivors for each.
• Add the births from TDH/VSS to the 0-4 group.
• Use decennial census info on distributions of within-age bands to determine the proportion of each band to age into the ‘next band.’
• The difference between the actual and observed population in ‘t+1’ is the net migration. The average net migration from 2000-2018 is used as the baseline expectation of net migration going forward.
TN Doing What TN Does

• From a population standpoint:
  • Grow at about 1.0% per year on average
  • Noisily
    • 1930’s – 11.4% Growth
    • 1940’s – 12.9% Growth
    • 1950’s – 8.4% Growth
    • 1960’s – 10.0% Growth
    • 1970’s – 17.0% Growth
    • 1980’s – 6.2% Growth
    • 1990’s – 16.7% Growth
    • 2000’s – 11.5% Growth
    • 2010’s – 8.3% Growth (at current pace)
# The Impact of Five Counties (or, Marcia, Marcia, Marcia, Marcia)

## Population

<table>
<thead>
<tr>
<th>Year</th>
<th>Tennessee</th>
<th>Share of State</th>
<th>TOTAL</th>
<th>Davidson</th>
<th>Rutherford</th>
<th>Williamson</th>
<th>Wilson</th>
<th>Sumner</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>6,770,010</td>
<td>0.2330</td>
<td>1,576,980</td>
<td>692,587</td>
<td>324,890</td>
<td>231,729</td>
<td>140,625</td>
<td>187,149</td>
</tr>
<tr>
<td>2010</td>
<td>6,346,105</td>
<td>0.2123</td>
<td>1,347,105</td>
<td>626,681</td>
<td>262,604</td>
<td>183,182</td>
<td>113,993</td>
<td>160,645</td>
</tr>
<tr>
<td>2000</td>
<td>5,689,283</td>
<td>0.1930</td>
<td>1,097,810</td>
<td>569,891</td>
<td>182,023</td>
<td>126,638</td>
<td>88,809</td>
<td>130,449</td>
</tr>
<tr>
<td>1990</td>
<td>4,877,185</td>
<td>0.1807</td>
<td>881,331</td>
<td>510,784</td>
<td>118,570</td>
<td>81,021</td>
<td>67,675</td>
<td>103,281</td>
</tr>
</tbody>
</table>

## Change

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</tr>
</thead>
<tbody>
<tr>
<td>2018-</td>
<td>2010</td>
<td>423,905</td>
<td>0.5430</td>
<td>229,875</td>
<td>65,906</td>
<td>62,286</td>
<td>48,587</td>
<td>26,632</td>
</tr>
<tr>
<td>2010-</td>
<td>2000</td>
<td>656,822</td>
<td>0.3795</td>
<td>249,295</td>
<td>56,790</td>
<td>80,581</td>
<td>56,544</td>
<td>25,184</td>
</tr>
<tr>
<td>2000-</td>
<td>1990</td>
<td>812,098</td>
<td>0.2666</td>
<td>216,479</td>
<td>59,107</td>
<td>63,453</td>
<td>45,617</td>
<td>21,134</td>
</tr>
</tbody>
</table>
Cohort Component Model

• We model population growth as a pure population process.
  • Births
  • Deaths
  • Historical Net Migration

• We do **NOT** include structural economic factors:
  • Structural Economic Changes
  • Planned Development
  • Infrastructure Changes
Why we exclude economic data

• To include economic data in a model, you need:
  • *Consistent* variables and consistent impact.
    • An issued commercial development permit has to *mean* the same thing in County X as it does in County Y.
  • Accurate forecasts of all economic variables included.
    • When accurate, including economic variables may be helpful.
    • Forecast error in economic variables may (and often does) make overall population forecasts less accurate.
  • Most economic variables are even noisier than net migration.
    • Incorporating them ALSO requires an understanding of *who* those variables bring in to a given county.
  • Population growth is actually a pretty stable process.
Key assumption 1

THIS HAS ALL HAPPENED BEFORE
AND IT WILL HAPPEN AGAIN
Key Assumption 2

What's going to happen in 2019-2020
Challenge: knowing when/if there is a structural break
Forecasting across a (possible) structural break
Forecasting across a (possible) structural break
Well, how are we doing?

- Two years ago – projected pop was:
  - 6,769,368
- Most recent population estimate:
  - 6,770,010
    - Only 642 higher than expected.
    - This is crazy close.
- We said the population would grow by 118,174
- The population actually grew by 118,816
- Over a two year window, our projected population growth was right to within half a percent.
How are long term projections changing?

<table>
<thead>
<tr>
<th></th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>7,390,535</td>
<td>7,853,224</td>
<td>8,341,055</td>
</tr>
<tr>
<td>2019</td>
<td>7,393,069</td>
<td>7,840,212</td>
<td>8,306,294</td>
</tr>
<tr>
<td>Change</td>
<td>2,534</td>
<td>13,012</td>
<td>34,761</td>
</tr>
</tbody>
</table>

These are small revisions. Even the 2015 number only implies 2.2% lower population change, total, over the next 30 years, or about .07 pct lower per year growth.

W&P’s 2050 TN number fell by 640K over the last two years.
Births by Number

TN Live Births By Year

- 2001: 72000
- 2002: 74000
- 2003: 76000
- 2004: 78000
- 2005: 80000
- 2006: 82000
- 2007: 84000
- 2008: 86000
- 2009: 88000
- 2010: 80000
- 2011: 78000
- 2012: 80000
- 2013: 82000
- 2014: 84000
- 2015: 86000
- 2016: 88000
- 2017: 90000
- 2018: 92000
Birth Rates

TN Birth Rates (per 1,000 pop) By Year
Births are falling everywhere

• 77 counties had fewer births in 2015 than in 2007

• Only 9 counties had higher birth rates in 2015 compared to 2007.

• 50 counties had fewer births in 2018 than in 2015
Birth Rates

Which do you believe?
Deeper into the Pattern

• Among the white non-Hispanic population, the drop is even more pronounced.
  • Since White non-Hispanics are about 73.5% of the population . . .

• Falling birth rates are a national and global trend.

• Also, considerations for how births are classified – by race of mother or race of child.
  • Leads to some strange ‘net migration’ patterns among children.
Natural Change – big picture

• 2007:
  • 86,661 Births
  • 56,800 Deaths
  • Natural Change: 29,861

• 2015:
  • 81,374 Births
  • 66,329 Deaths
  • Natural Change: 15,045

• 2018:
  • 80,735 Births
  • 71,055 Deaths
  • Natural Change: 9680
How pervasive is shrinking NC?

- 2007: Births > Deaths in 70 counties
- 2015: Births > Deaths in 34 counties
- 2018: Births > Deaths in 24 counties

- From 2015-2018, Natural change decreased in 70 of 95 counties.
- In 89 of 95 counties, natural change is negative or decreasing.
An aging domestic in-migrant population

- Number moved to TN from another state:
  - 2011: 171K
  - 2015: 196K
  - 2018: 209K
- 2011 – 34,600 kids in-migrated; 23,271 individuals aged 55 & up.
- 2018 – 39,254 kids inmigrated; 38,112 individuals aged 55 & up.
- 2015-2018: Individuals aged 55+ account for 60% of the increase in inmigration.
- Since 2011, the number of individuals aged 55+ moving to TN has increased by 64%.
  - The number of 18-24 year olds has decreased by 8%
  - The number of 25-39 year olds has only increased by 29%
A few key numbers on race

• 2010:
  • 75.6% White Non-Hispanic
  • 16.5% Black Non-Hispanic
  • 4.6% Hispanic
  • 3.2% Non-Hispanic, NWoBA.

• 2050:
  • 62.7% White Non-Hispanic
  • 16.7% Black Non-Hispanic
  • 12.8% Hispanic
  • 6.3% Non-Hispanic, NWoBA
Hispanic Population Growth

- 1990: 32,741
- 2000: 123,838
  - 278% Growth
- 2010: 290,059
  - 234% growth
- 2020: 409,704 (projected)
  - 41.2% growth
- 2030: 583,221 (projected)
  - 42% growth
- 2040: 801,894 (projected)
  - 37.4% growth
Age Histogram, 2040
A few key stats

- Right now, there are 2 persons aged 25-50 for each person aged 65+
- Five persons aged 25-50 for every person aged 75+

- By 2040, those ratios are expected to fall to 1.45:1 and 2.8:1 respectively.
  - In 33 counties, we predict the ratio of 25-50s to 65+ will be less than 1.

- Implications for labor force participation and provision of services.
Continued Urbanization: Counties with Projected Largest Change 2018-2040

<table>
<thead>
<tr>
<th>County</th>
<th>Projected Population Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rutherford</td>
<td>180505.5</td>
</tr>
<tr>
<td>Williamson</td>
<td>129832.9</td>
</tr>
<tr>
<td>Davidson</td>
<td>111901.3</td>
</tr>
<tr>
<td>Montgomery</td>
<td>95835.2</td>
</tr>
<tr>
<td>Knox</td>
<td>84510.5</td>
</tr>
<tr>
<td>Wilson</td>
<td>64668.1</td>
</tr>
<tr>
<td>Sumner</td>
<td>63300.5</td>
</tr>
<tr>
<td>Hamilton</td>
<td>50701.3</td>
</tr>
<tr>
<td>Shelby</td>
<td>39656.1</td>
</tr>
<tr>
<td>Maury</td>
<td>29383.9</td>
</tr>
</tbody>
</table>

These 10 counties are projected to account for about 80% of the TN’s population growth. They currently account for 60% (ish) of the current population.

29 counties are expected to contract over the next 30 years.
If I can be of assistance, please reach out mharris@utk.edu