Demographic Modeling

- Population → Labor Force → Workforce → Jobs → Jobs by sector (2-digit NAICS)
- Level of geography modeled: Region
- Three demographic dynamics models
  1. Aggregate Population Evolution
     - Done
  2. Disaggregate Population Evolution
     - Done
  3. Disaggregate Household Evolution
     - Design and inputs done, coding in progress

Model 1: Aggregate Population Evolution

- Aggregate cohort-component with gross migration (separate IN and OUT flows)
- Cohorts stratified by
  - Age (0-102), Race (B, W, H, Other), Sex (M,F)
- Base-year data: TX State Demographer (can use other sources)
- Parameters (rates)
  - Birth, Death (TX State Demographer)
  - Migration (based on ACS PUMS)
    - In Domestic, Out Domestic, In Foreign
- People → Households

Model 2: Disaggregate Population Evolution

- Simulation of personal biological (Aging, Surviving, Giving Birth) and social (Migrating) events
- Cohort strata become attributes
  - Age (0-102), Race (B, W, H, Other), Sex (M,F)
- Same base-year data
- Cohort rates are used as event probabilities in a Monte-Carlo type simulation
- Because of the path dependence, changing the seed number leads to a slightly different result
- People → Households

Models 1 and 2: Household Synthesis

- Household role assignment and household formation
- Phase 1: Create disaggregated population (Model 1) or take outputs (Model 2)
- Phase 2: Assign roles (ACS PUMS probabilities) while maintaining aggregate accounting balances
  - Householder/Member/GQ, Household Size (1-10), Presence of children (Yes, No)
  - Requires iteration for balancing
- Phase 3: Assemble individuals into households
- Phase 4: Assign income to householders (ACS PUMS probabilities) – maintaining or converging ethnic differences

Models 1 and 2: Household Synthesis

- Works great, but …
  - Household continuity over time is missing
  - Acceptable if all we need to know is total number of households in each category
  - Not at all helpful if we want to differentiate between “new” and “old” households
  - Example: As baby-boomers age we get more households with householder 65+
    - Can we use that increase as a proxy for housing demand?

Model 3: Disaggregate Household Evolution

- Builds upon a population simulation, adds household complexity
- Simulation of
  - Personal biological events
    - Aging, Surviving, Giving Birth
  - Personal social events
    - Marriage, Divorce, Child Leaving Parent's Household
  - Household social events
    - Migration, Relocation

Model 3: Disaggregate Household Evolution

- No synthesis required!
- Explicit and immediate consequences for the housing market
  - 1 household = 1 housing unit
  - Vacated units due to death, marriage, out-migration
  - Demand for housing units due to marriage, in-migration, relocation, etc.
- Keeping full accounting of the housing units without linking them to specific geographic locations!

Developing Base Year Households

- Census (or other source) Population Estimates
  - Assemble households
  - Assign to locations (buildings)
- ACS PUMS Households
  - Expand to match ACS Summary counts (by household size)
  - Assign to locations (buildings)
- Info-USA (or other geocoded source) Households
  - Match to buildings
  - Retain the householders attributes
  - Impute attributes for the members
  - Control for household size distribution

Developing Base Year Employment

- Reconcile record-level Info-USA and ES-202
- Match to buildings
- Correct empty and overcrowded buildings
- Verify large employers
- Verify schools

Demographic Modeling

- Is there a segment of the population or economy that has been “easy” or “hard” to model?
  - No
- What other interesting new tools have you implemented in the past year (or working on this year)?
  - Regional Land Use Information System
    - http://arcgis02.h-gac.com/RGF_2040/
- Lessons learned?