

# Changes in development and demographic trends

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# Outline

- Demographic trends
- How these trends affect the real estate market and development trajectories
- A few words about the future of forecasting at Metropolitan Council



# Trends at a regional scale

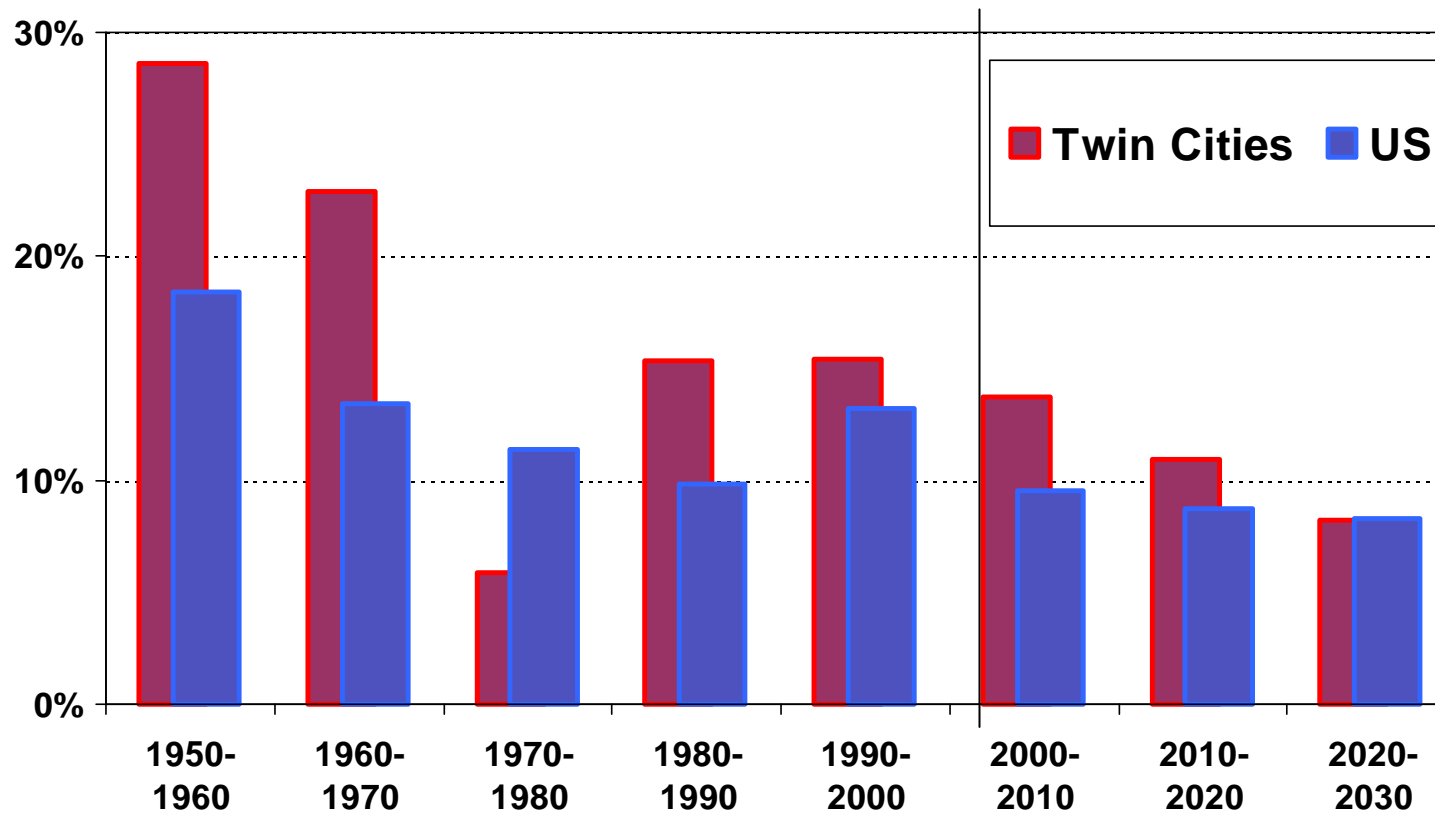
- Gaining almost 1 million in 30 years
- Population churn brings diversity and diversification of the region
  - Adjustment of the population pyramid and the “Gray Boom” and
  - Diversified mix of household types
- Real estate market implications



# Trends at a regional scale

- Other economic trends also impelling land use frugality
- Redevelopment and intensification of land use in the region's core
- But at the same time... continued spread of suburban development

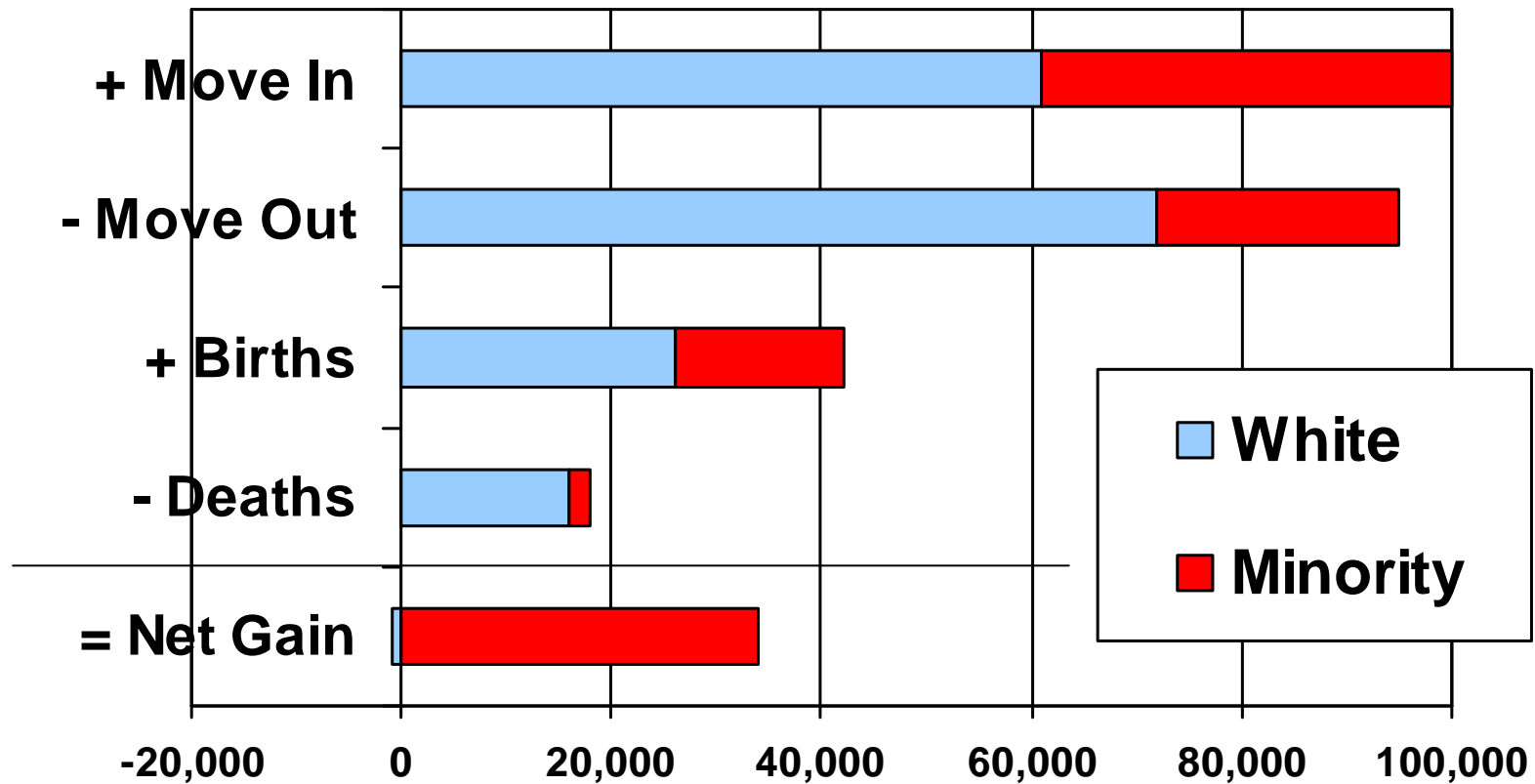
# Met Council Population Forecast Compared to United States: Growth per Decade, 1950-2030



Sources: Census Bureau and Met Council forecasts

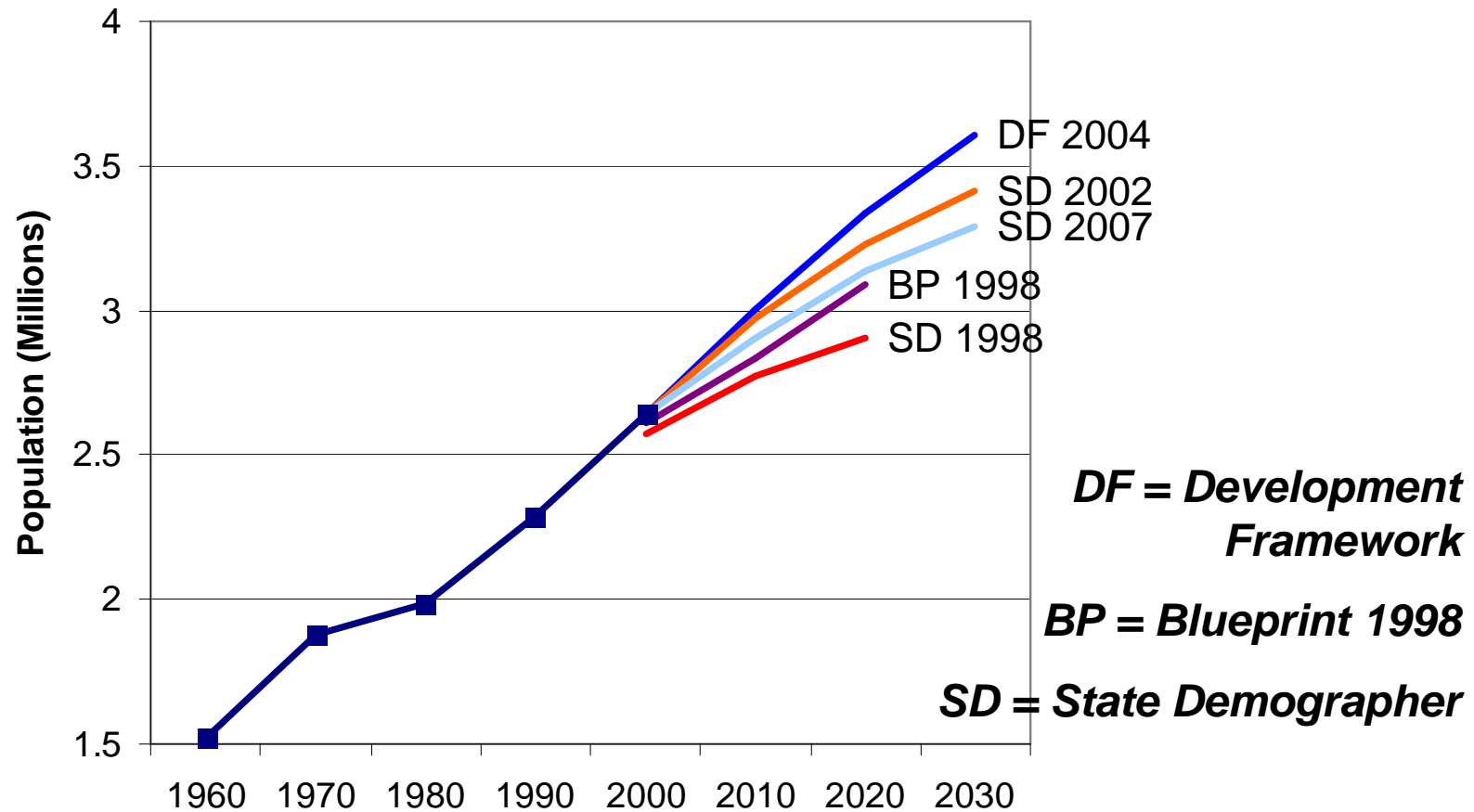


# “Churn” brings a more diverse mix



Sources: Met Council analysis of Census PUMS, MN Dept of Health

# Council and State Demographer forecasts for Twin Cities, 2020-30



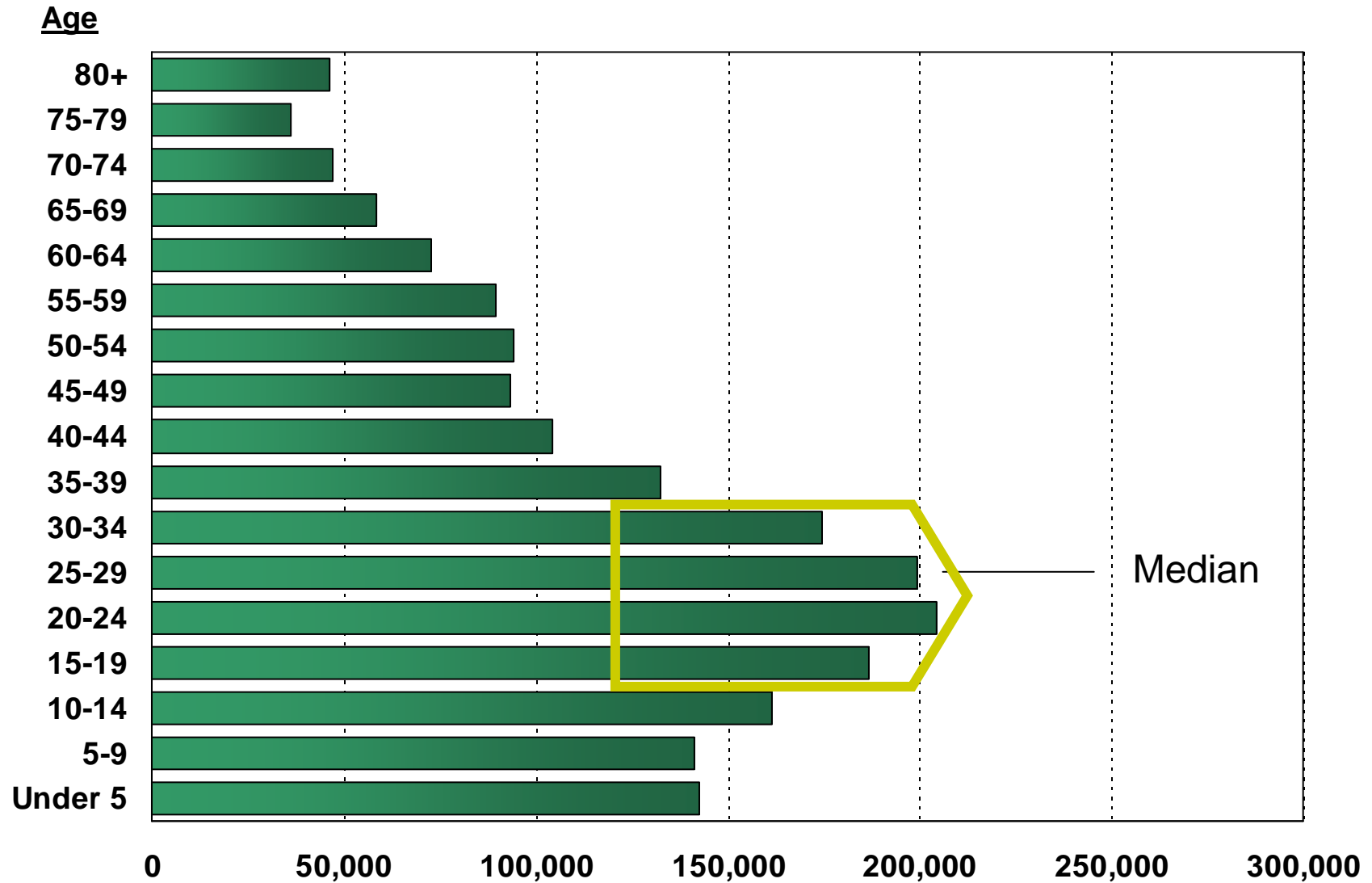


# Diversification of age

- The “population pyramid” is no longer a pyramid.
  - Longer life expectancies
  - Early Baby Boomers reaching retirement age
  - Among US-born, smaller household sizes
  - In the future, a new balance of seniors, middle-aged, young adults, children

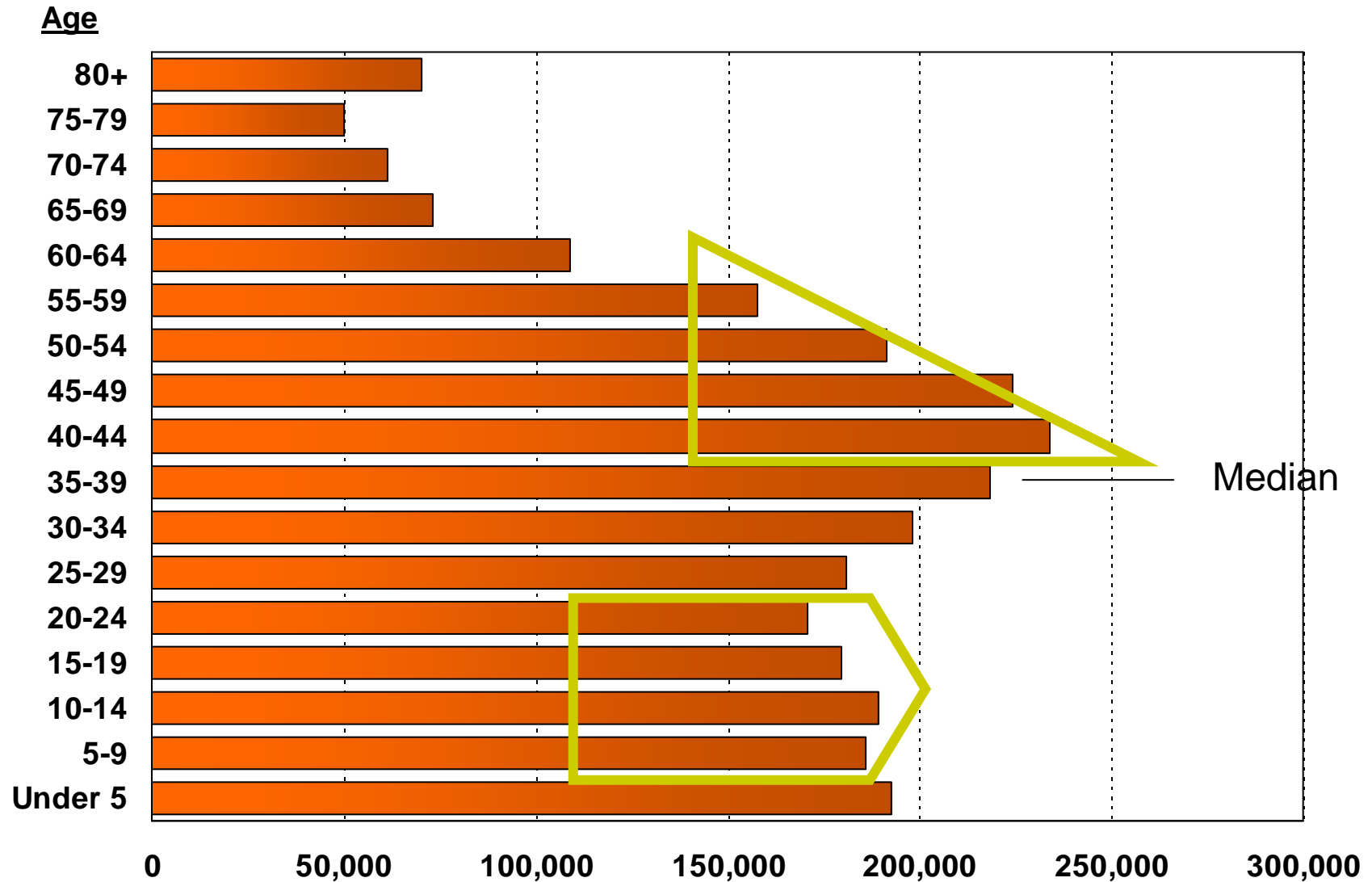


# Twin Cities Region, 1980 Population by Age



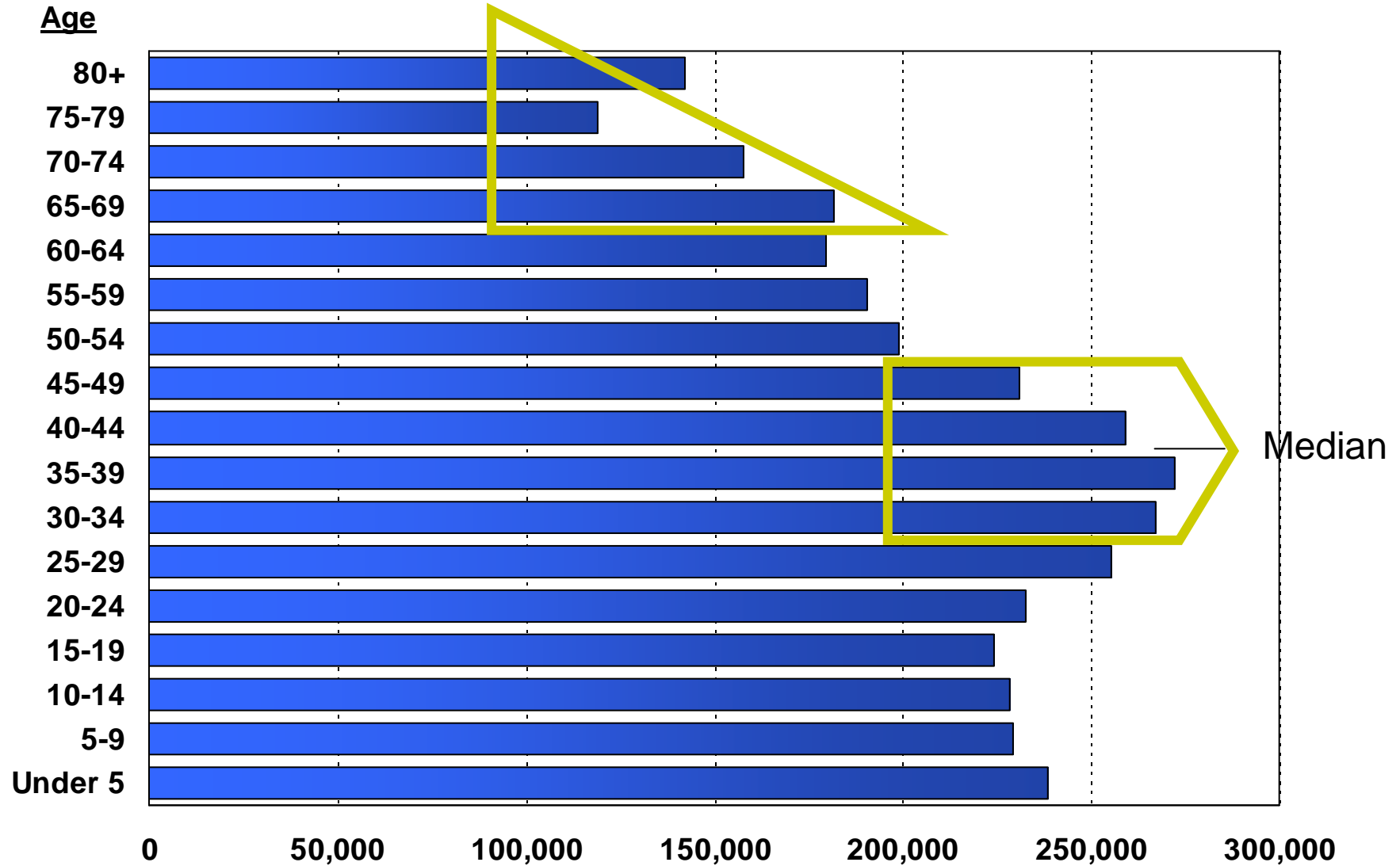


# Twin Cities Region, 2005 Population by Age



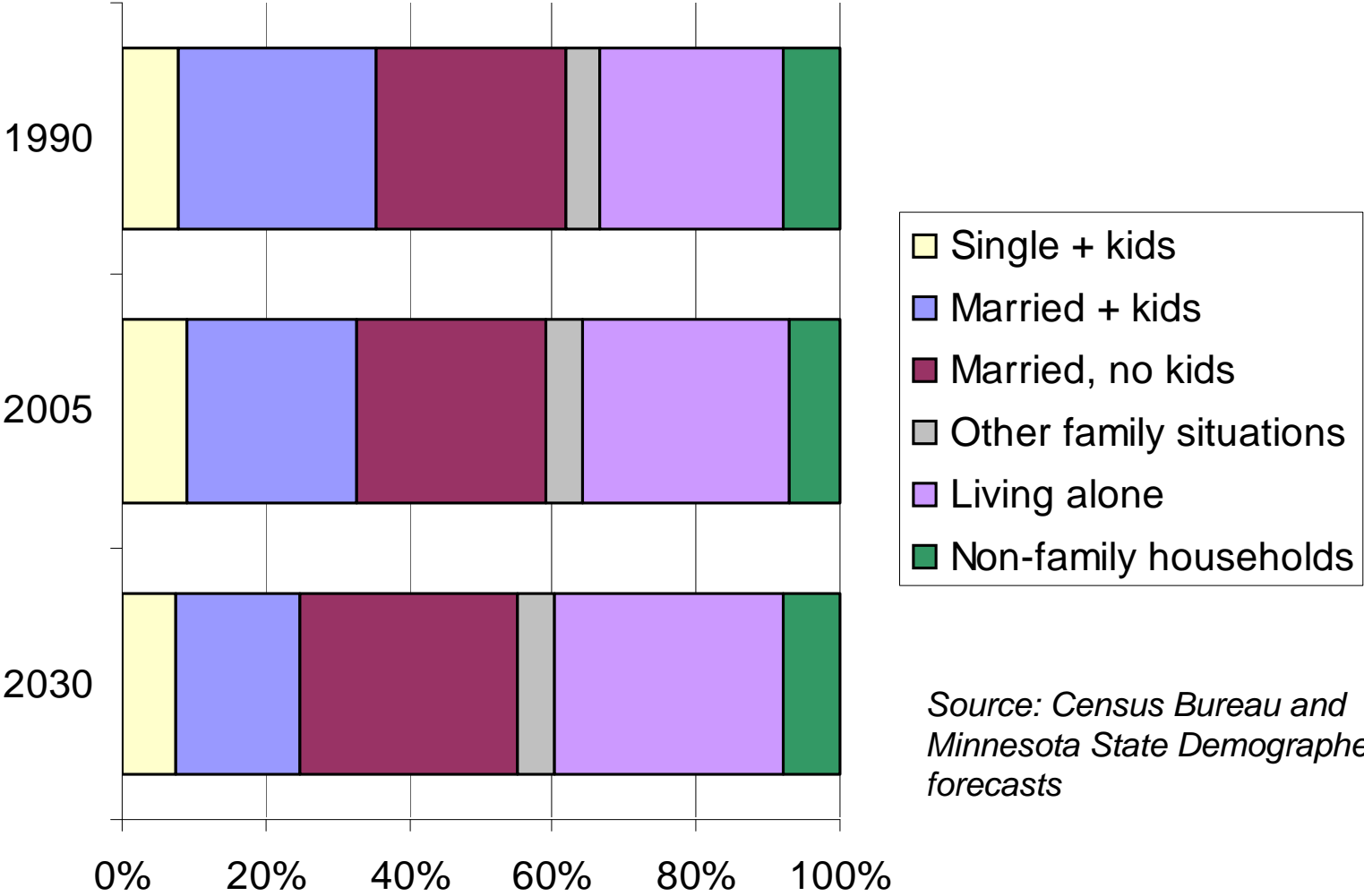


# Twin Cities Region, 2030 Population by Age





# Household mix: Twin Cities, 1990-2030



Source: Census Bureau and Minnesota State Demographer forecasts



# Diversification of household types – each with its own needs

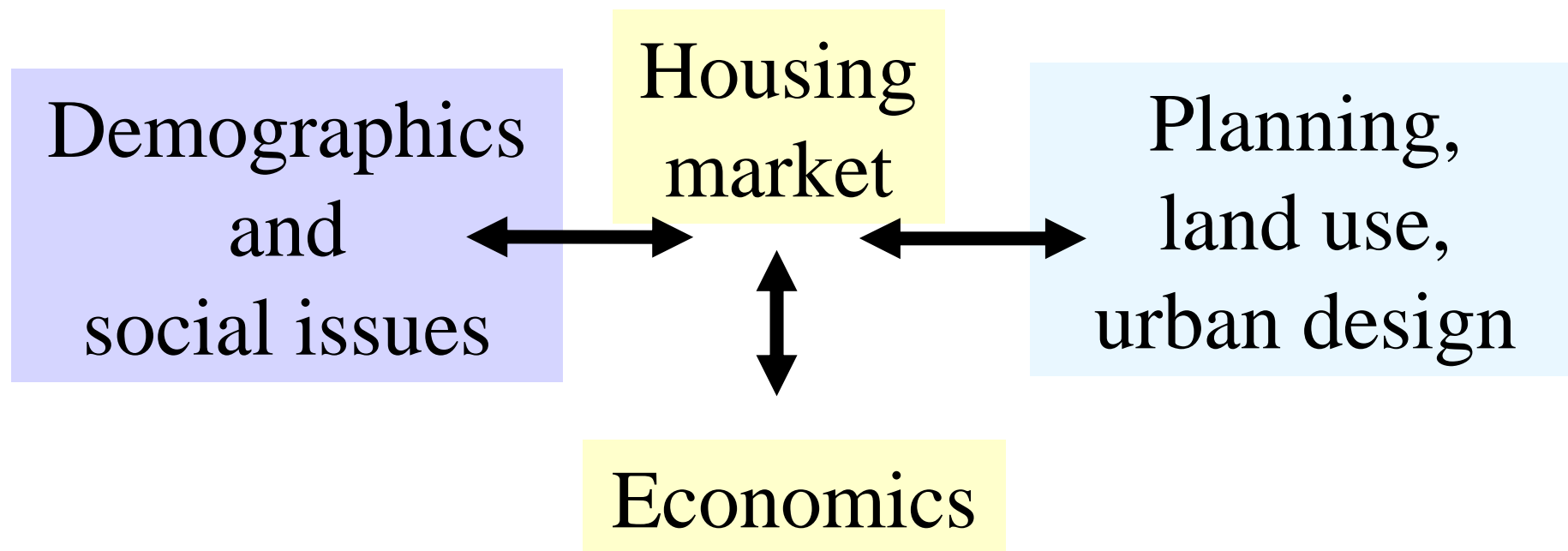
- More empty-nesters
- More people living alone – particularly older seniors
- US-born Gen Y just large enough to replace Baby Boomers
- New, immigrant households will make total Generation Y market *larger* than Baby Boom cohort



# Development implications

- We already have a massive stock of single family detached housing in the metro
- In the future, attached and multi-family housing, as well as senior housing, will be most of what is needed – and built
- Facilities, amenities, services for the new household mix
- (Sub)urban design: Inward community orientation of services, shopping, amenities

At local level, demographics don't determine housing... Housing determines demographics



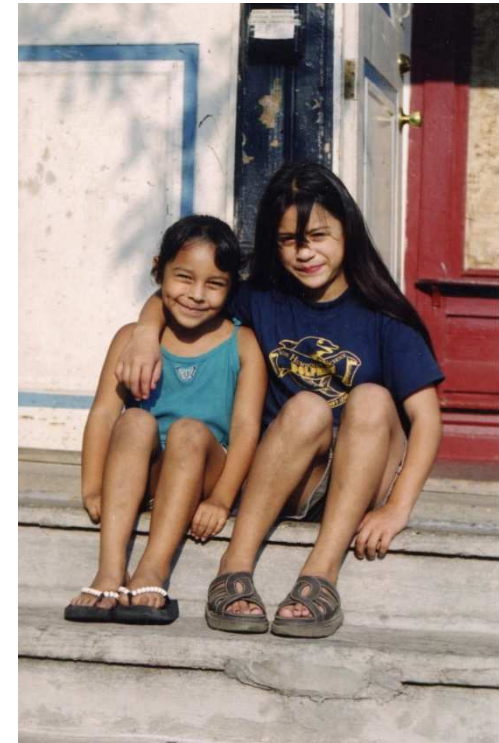


# Residential preference surveys

- Receptiveness to: Mixed use neighborhoods, accessibility, and choice of travel modes
- Still majority misapprehension about density

# Concerns of new Minnesotans

- Housing market structure
- Affordability
- Perceived community character
- Demographics of neighbor families
- Demographics of work opportunities and businesses



*US Census Bureau Photo Services*



# Other economic trends

- Assume the region's economic base will experience only modest, slow growth
- We are living with traffic congestion
- Fuel prices have been buffeted by scarcity episodes. What if scarcity becomes the norm?
- Domestic policies for GHG mitigation could entail price changes that impel behavior changes (different choices)



# Outcomes are not absolute

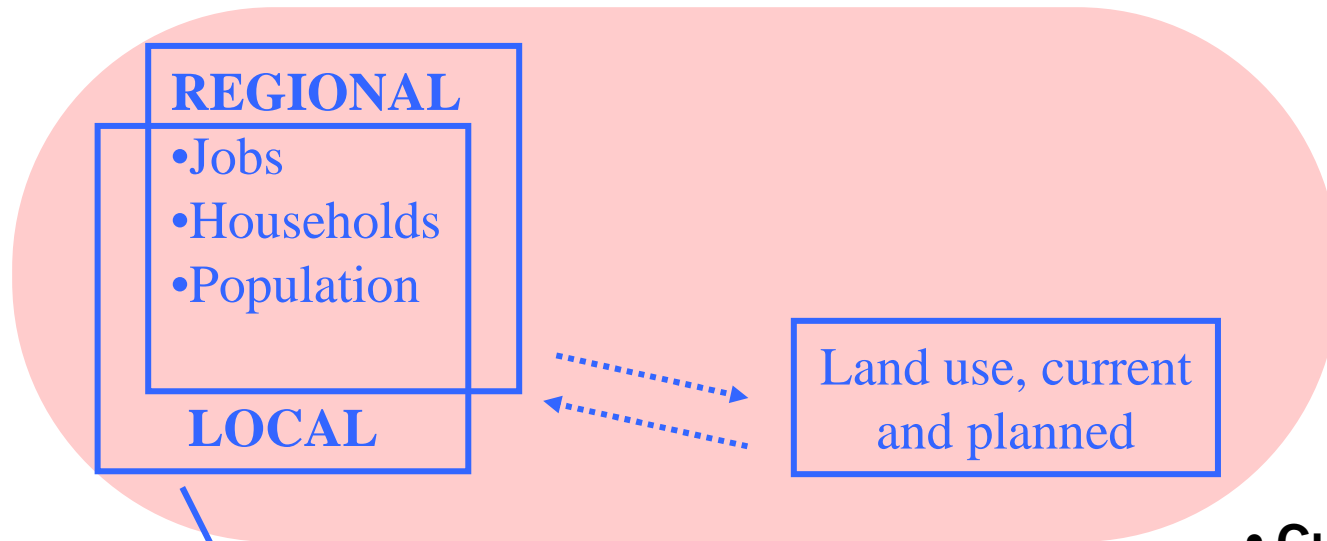
- The developed core will not accommodate ALL future growth, nor even most of the region's growth.
- Reasonable assumptions: The developed core will accommodate 25-35 percent of the region's growth thru 2030
- Accommodating the balance will require a larger area of developed land use.

A decorative graphic on the left side of the slide consists of a vertical blue gradient bar. Overlaid on this are several squares in various shades of blue, arranged in a stepped pattern that ascends from left to right. A dark grey horizontal bar extends from the right edge of these squares across the slide, containing the main title text.

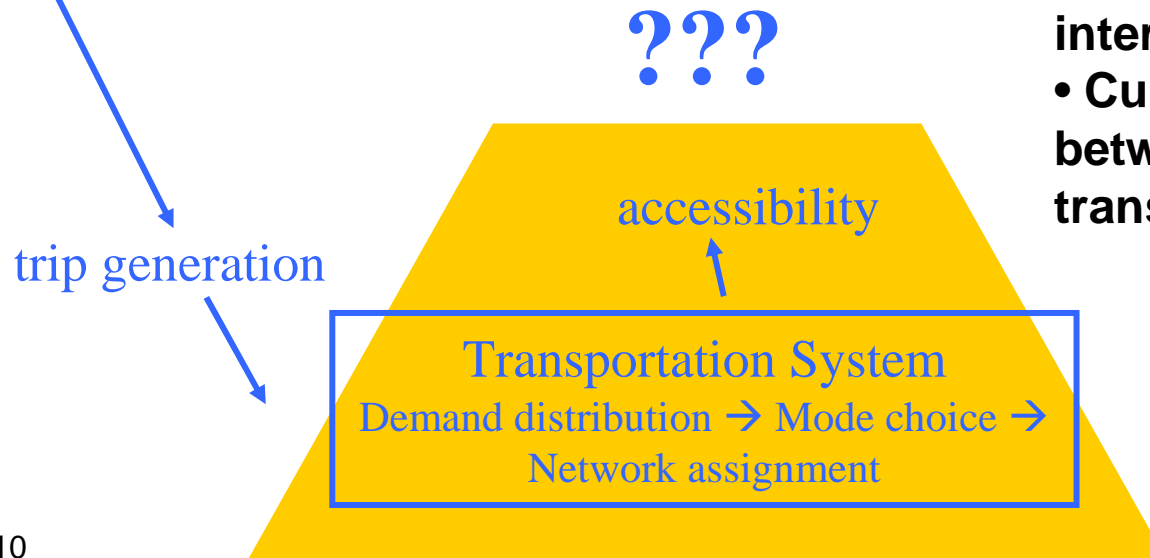
# Options for future forecasting



# Metropolitan Council's current model

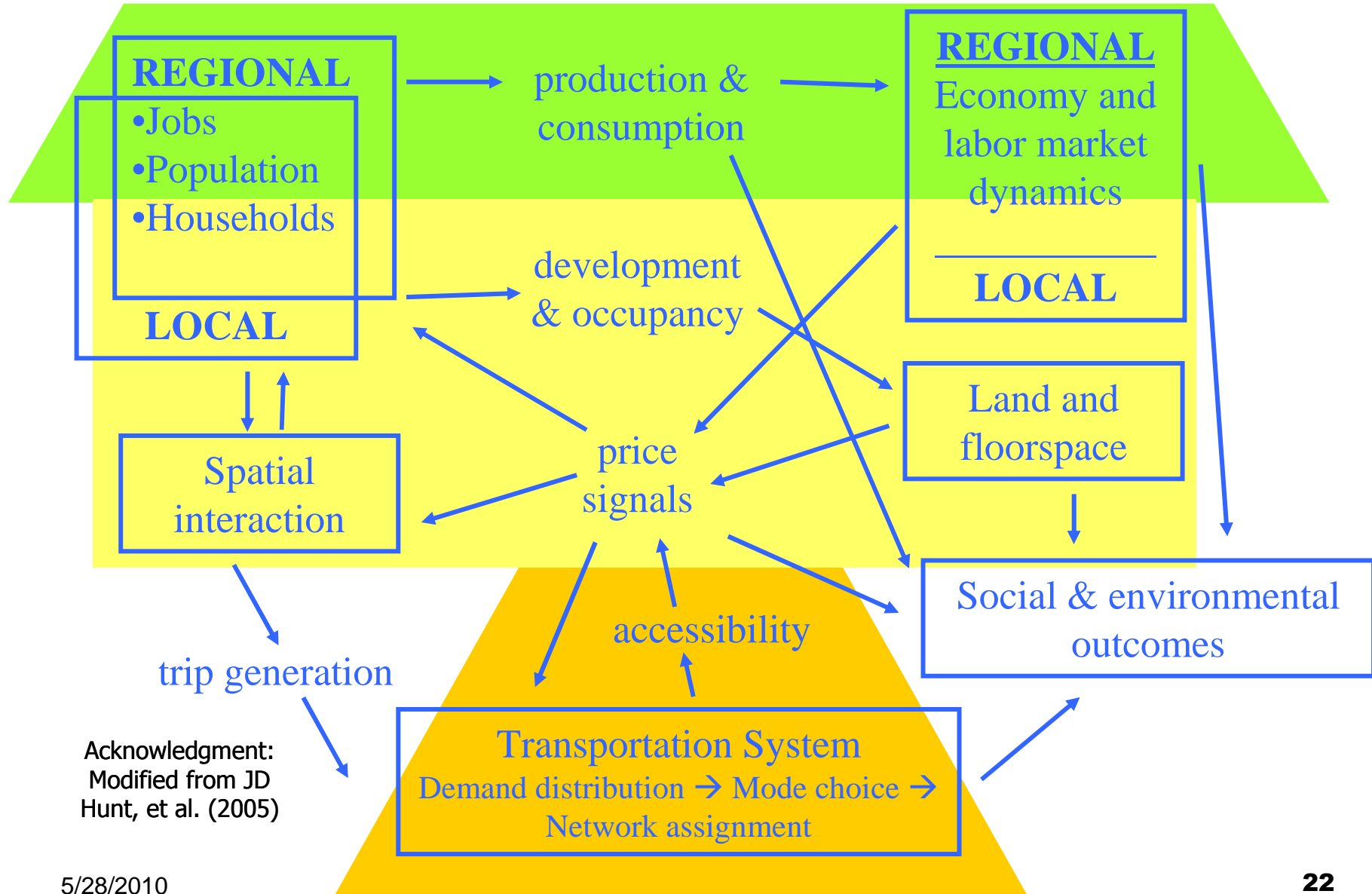


- **Current model does not consider spatial interactions**
- **Currently, no feedback between land use and transportation dynamics**





# Complex Metro & Urban Dynamics: Elements and Interactions



Acknowledgment:  
Modified from JD  
Hunt, et al. (2005)



# Expected forecast models workflow

- A **regional economic model** for economic activity, employment, and population
  - Preferred model: Regional Dynamics (ReDyn.com)
- A **demographic model** for parsing population into households
  - Preferred model: ProFamy (ProFamy.com)
- A **land use model** for allocating future land use, households and employment to the local level
  - Preferred model: Citilabs Cube Land
- **Travel demand model**
  - Currently in use: Citilabs Cube Voyager



# Program Objectives

- Land economics and geographic science validity
- Platform for the prediction of likely distributions of development and activity – *given a set of rules, or given a set of represented behaviors or dynamics*
- Coordination/integration with Travel Demand Modeling (TDM) and ES capital planning
  - Model land use dynamics and transport network together – to better represent trends

# Goals developed via Needs Assessment Workshops



- A model that balances the need for transparency with the need for realism
- Able to test a range of policy scenarios
- A model that provides information on the interaction of the physical environment and development dynamics interact
- Geographic scope and level of detail necessary for regional systems planning
- Flexibility to forecast short-term, long-term, and “build-out”

# Market-based integrated models evaluated against Met Council Needs Assessment

<b>Theoretical foundations:</b>	
■ Understandable methodology, with explanation	Mostly
■ Traceability of results and ability to perform sensitivity tests	Yes
■ Basis in valid regional and urban development theory	Yes
<b>Capacity to model and test a wide range of policies</b>	Yes
<b>Demographic capabilities of model</b>	No – modeled separately
<b>Spatial interaction of physical environment and development:</b>	
■ Flexibility to incorporate variety of layers into model	Yes
■ Allocate growth based on transportation network and accessibility measures	Yes
■ Socioec-land use model outputs used as travel demand model inputs	Yes
<b>Temporal resolution:</b> Ability to forecast 30 years, at 5-10-year intervals	Yes
■ Forecast for very-long-term: 50 years	TBD
<b>Geographic granularity:</b> Micro-level simulation results (parcel level)	Varies by model

# Evaluated against Hunt, Kriger, Miller (2005) review of best practices

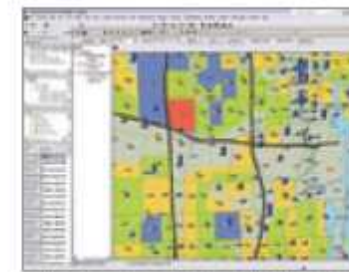
<b>Theoretical foundations:</b>	
■ Real estate market modeled with endogenous pricing – i.e. demand, supply, prices are interdependent and can adjust	Yes
■ Model accounts for key subsystems of region – networks, land use, built environment, activities, travel	Yes
<b>Capacity to model and test a wide range of policies:</b> Provides measures of benefits and costs of policy alternatives	Yes
<b>Spatial interaction of physical environment and development:</b>	
■ Framework for modeling interaction between land use and transportation	Yes
■ Transit representation and sensitivity	TBD
■ Outputs include predicted land use by type, built environment, segment detail on households and employment industry sectors	Yes
<b>Geographic granularity:</b> Analytical units at finest-possible level of detail - so as to maximize behavioral simulation	Varies by model
<b>Feasibility:</b> Parsimonious data requirements	CubeLand – Yes
■ Manageable implementation requirements (given timeline and budget)	CubeLand – Yes

# Cube Land – a market based model

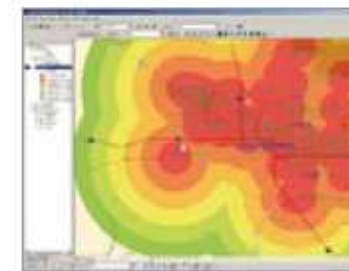
- Equilibrium represented by simultaneous solution of three inter-dependent problems:
  - Location of real estate consumers
  - Supply of real estate
  - Rents and values at market-clearing equilibrium



*study geographic spread of population*



*estimate future population and employment*



*take into account accessibility*



# Background on Martinez's *Modelo de Uso de Suelo de Santiago*

Martinez, Francisco; and Pedro Donoso. "MUSSA 2: A Land Use Equilibrium Model Based on Constrained Idiosyncratic Behavior of Agents in an Auction Market." Paper at TRB Annual Meeting, January 2007. 16 pages.

"MUSSA – Land Use Equilibrium Model." February 2009 presentation at [http://transp-or2.epfl.ch/presentationsSeminares/MUSSA\\_Martinez09.pdf](http://transp-or2.epfl.ch/presentationsSeminares/MUSSA_Martinez09.pdf)

"MUSSA – Its Basis." 4 pages. Website at [www.mussa.cl/E\\_fundamentos.html](http://www.mussa.cl/E_fundamentos.html)



# Cube Land – a market based model

- On demand side, households (h) buy or rent real estate type (v) at certain locations (i)
- Neighborhood choice (location i) determined by income and willingness to pay:

- $B_{hvi} = I_h - \{f(U_h - z_{vi})\}$

- *Where  $U_h$  is typical housing utility for an “h” household*
- *Where  $z_{vi}$  represents package of amenities, neighborhood characteristics*
- *Better package → greater willingness to pay*

- $Max (B_{hvi} - r_{vi})$











- *Subject to available budget of “h” household*



# Cube Land – a market based model

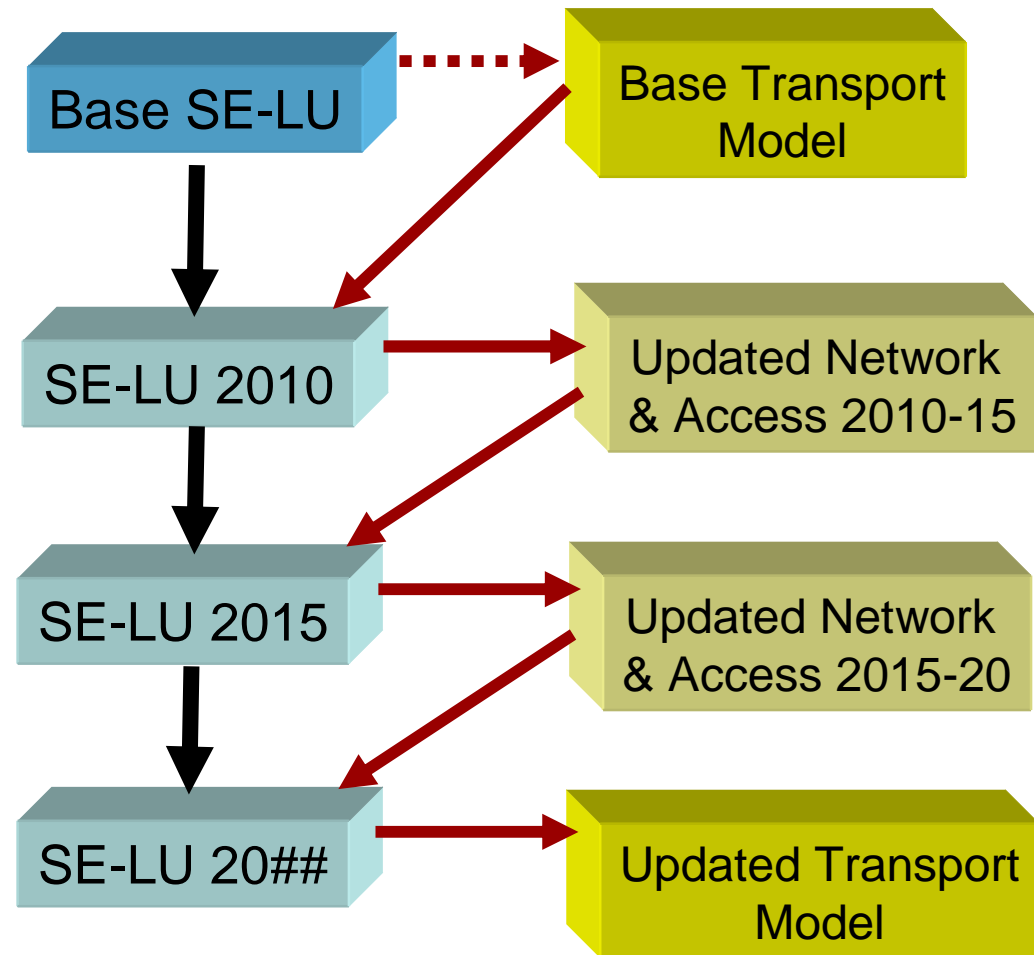
- On supply side, developers (j) will offer housing & built space in quantities (S) of certain type (v) at certain locations (i) in order to maximize profit
  - **$Max \{S_{viJ} * (r_{vi} - c_{viJ})\}$** 
    - *Subject to regulations at location “i”*
    - *And all households in region are matched with housing*
- Predicted location choices and predicted supply are calculated with MNL equations (i.e. choice probabilities)



RESIDENTIAL BUILDING TYPES							
1	Rural Residential			2	1	—	Rural residential includes very large lot residential (1 acre per lot).
2	Large Lot Single Family Residential			1	4	—	Alden Park has mainly large lots in the 1/2 to 1/3 acre size. Gardenland (South Natomas) has grid-streets with 1 acre lots and small houses.
3	Medium Lot Single Family Residential			2	6	—	Standard single family lot of 52x100 min. Allows cul-de-sacs or grid pattern, w/cul-de-sac subdivisions at low end of range. Curtis Park at high end of range.
4	Small Lot Single Family Residential			2	12	—	Small lot subdivisions: Villa Palazzo in Pocket (3,500 sqft lots), standard lots in Laguna West and some low density suburban garden apartments.
5(O)	Townhouse (Owner)			3	15	—	Metro Square in midtown is detached townhouse project at approx. 20 DU/ac. Most standard 2-story apt w/ surface parking are in this range.
5(R)	Townhouse (Rental)						
6(O)	Low-Rise Condos (Owner)			2	24	—	2+ story attached units with structured parking (e.g., tuck-under).
6(R)	Low-Rise Apartments (Rental)						
7(O)	Mid-Rise Condos (Owner)			3	35	—	3 story mid-level development. Less space dedicated to landscaping; more frontage on street.
7(R)	Mid-Rise Apartments (Rental)						
8(O)	High-Rise Condos (Owner)			6	66	—	6 story development with structured parking. Buildings include elevators, interior courtyards, and hallways.
8(R)	High-Rise Apartments (Rental)						

# Integrated modeling

- Travel times, accessibility and networks are updated and inform socioeconomic/land modeling at each 5-year step





# Policy and regulation constraints

- Permissible land uses
- Housing unit density min/max
- Building height max or FAR max
- Protected land and planned parks/reserves
- GIS coverage of aquifer depletion
- Wastewater system capacity constraints?

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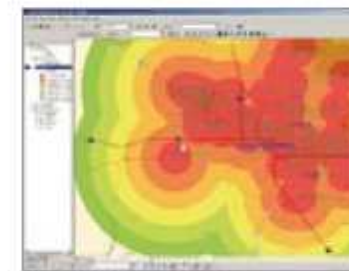
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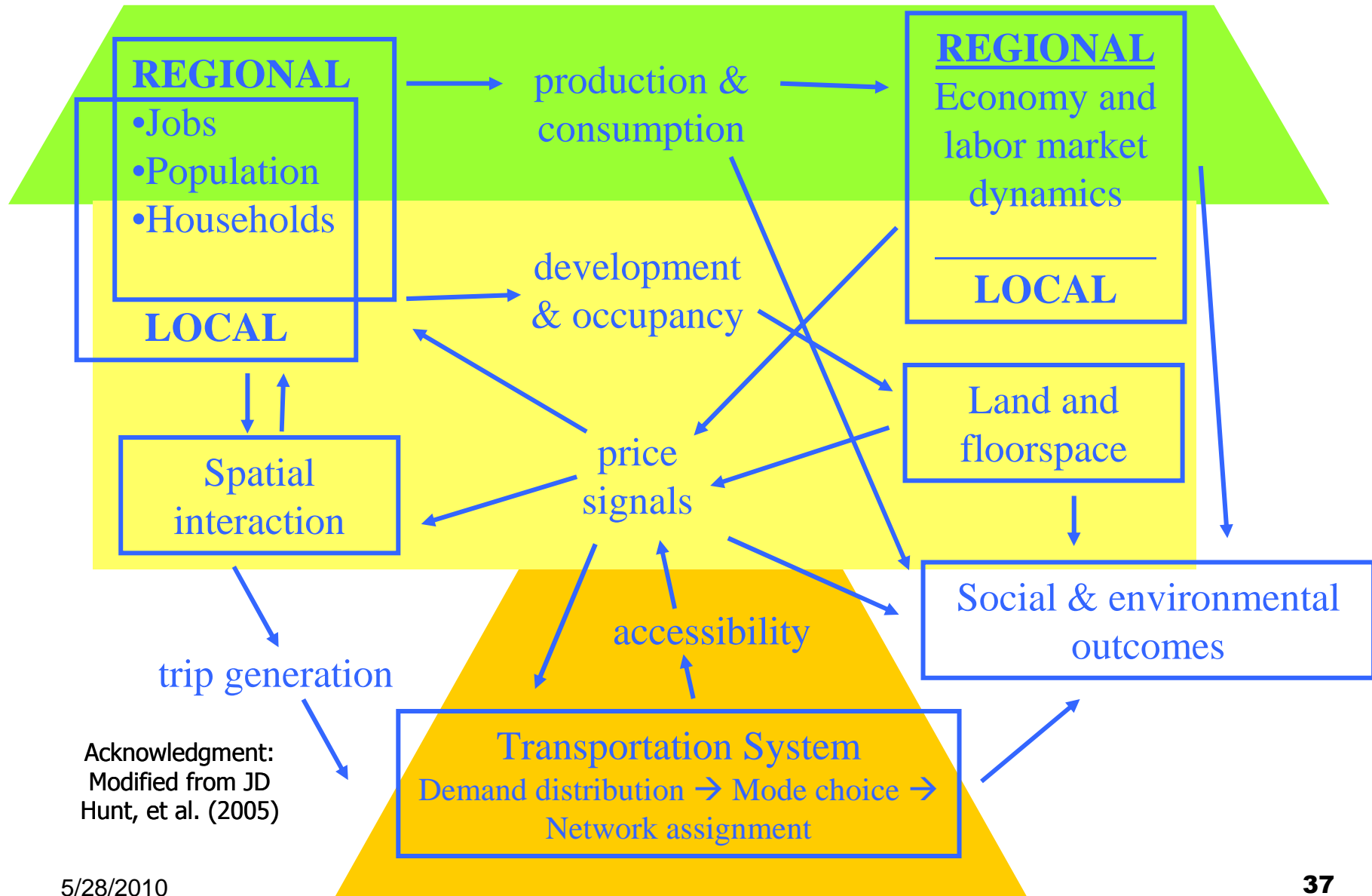
# Integrated modeling preferred

Are these applications possible?... With these tools...	Travel Model Alone?	Integrated Modeling Program?
<b>Land use/transportation interactions:</b> Assess interactive effects of transportation system on land uses, and vice-versa – either “constrained” by land use plans or “free-market”	No	Yes
<b>Land Use Analysis:</b> Predict amount and locations of land uses (residential, commercial, industrial, and employment)	No	Yes
<b>Smart Growth:</b> Analyze the effects and benefits of Smart Growth strategies (infill and TOD in coordination with transit service)	Poorly	Yes
<b>Jobs/Housing Balance:</b> Based on incomes of residents and employees in relation to housing prices	No	Yes
<b>Planning strategies:</b> Assess traffic-related effects/benefits of urban growth boundaries, growth management strategies, impact fees	No	Yes
<b>Transportation System Management:</b> Effects of land uses and help set priorities among competing projects. A consistent approach for comparing potential improvements or alternatives.	No	Yes

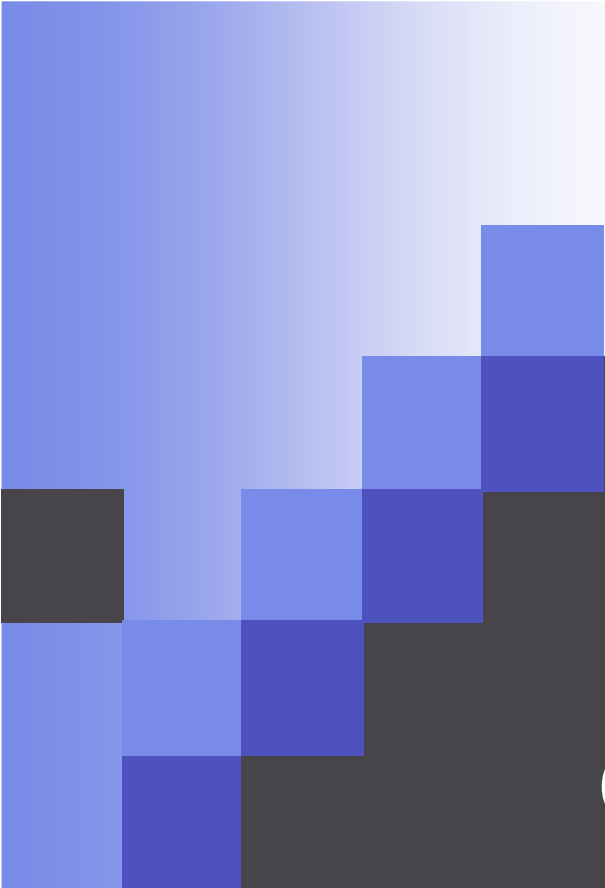
Source: Johnston, R; and M McCoy. (2006): *Assessment of Integrated Transportation-Land Use Models: Final Report*. Online at [www.ice.ucdavis.edu/um/](http://www.ice.ucdavis.edu/um/)



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