How will land use policies affect travel? The importance of residential sorting

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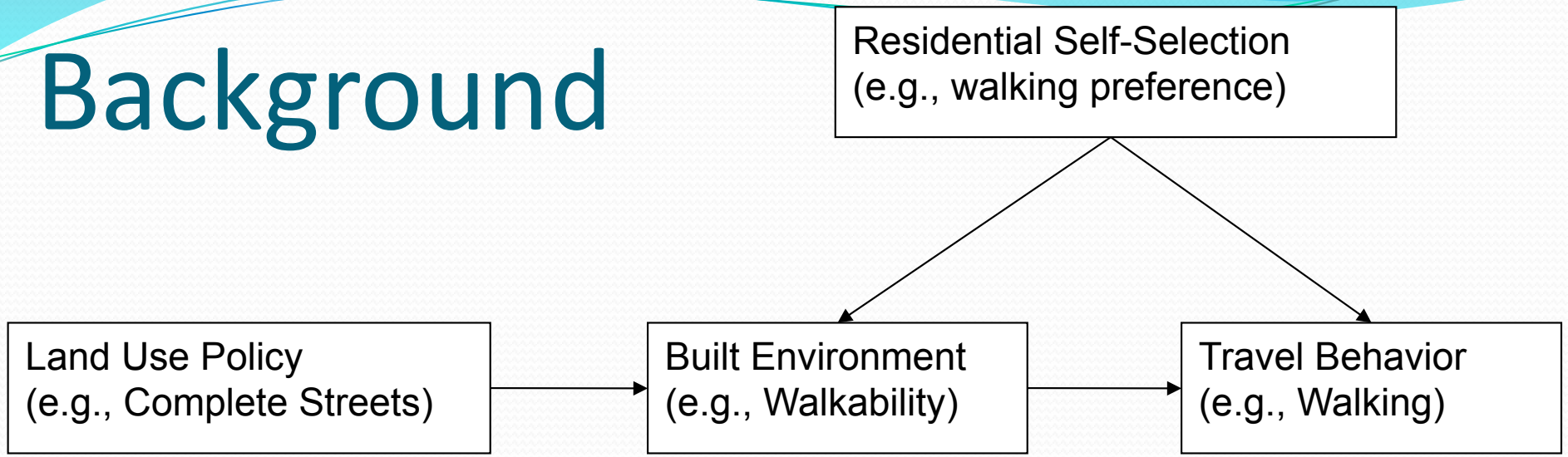
Background



- Research questions
  - Does residential self-selection influence travel?
  - Does the built environment have an independent influence on travel?
  - What are the relative contributions of self-selection and the built environment?
  - …
- 2010 ACSP: Consequences of ignoring self-selection in practice
- “this is not a situation where the two parties are miles apart”

Outline

- Introduction – motivation of the study
- Self-selection and estimation
- Self-selection and prediction
- Conclusions and recommendations

Introduction

- Cost of sprawl <- land use regulations

- Land use and transportation policies
  - 2008: California Senate Bill 375, regional sustainable community
  - 2009: HUD-DOT-EPA Interagency Partnership for Sustainable Communities
  - 2010: Minnesota, Complete Streets
  - 2010: Portland, $613 million on bike infrastructure

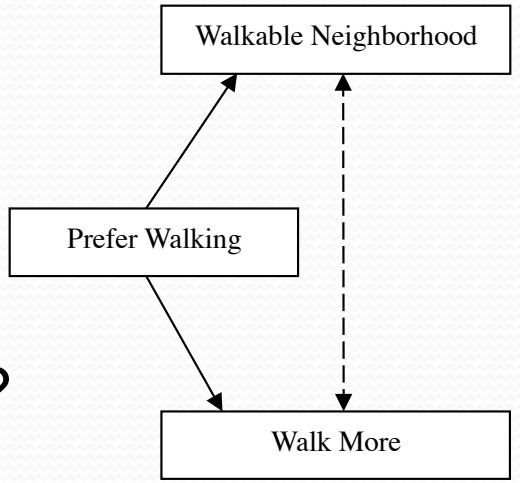
- Will these ambitious efforts bring about meaningful changes in travel behavior?

Introduction

- Empirical studies on the built environment (BE) and travel behavior
  - High accessibility, mixed-use, good transit and walking facility <--> less driving, more walking and transit taking

- Association ≠ causality

  Is this association
  - due to the BE itself?
  - due to travel and land use predispositions?



- Residential self-selection/sorting

Introduction

- Possible consequences of ignoring self-selection
  - Findings of Cao et al. (2009)
  - Overestimation of BE's effect on travel behavior
  - Exception: Pinjari et al. (2008) and Chatman (2009)

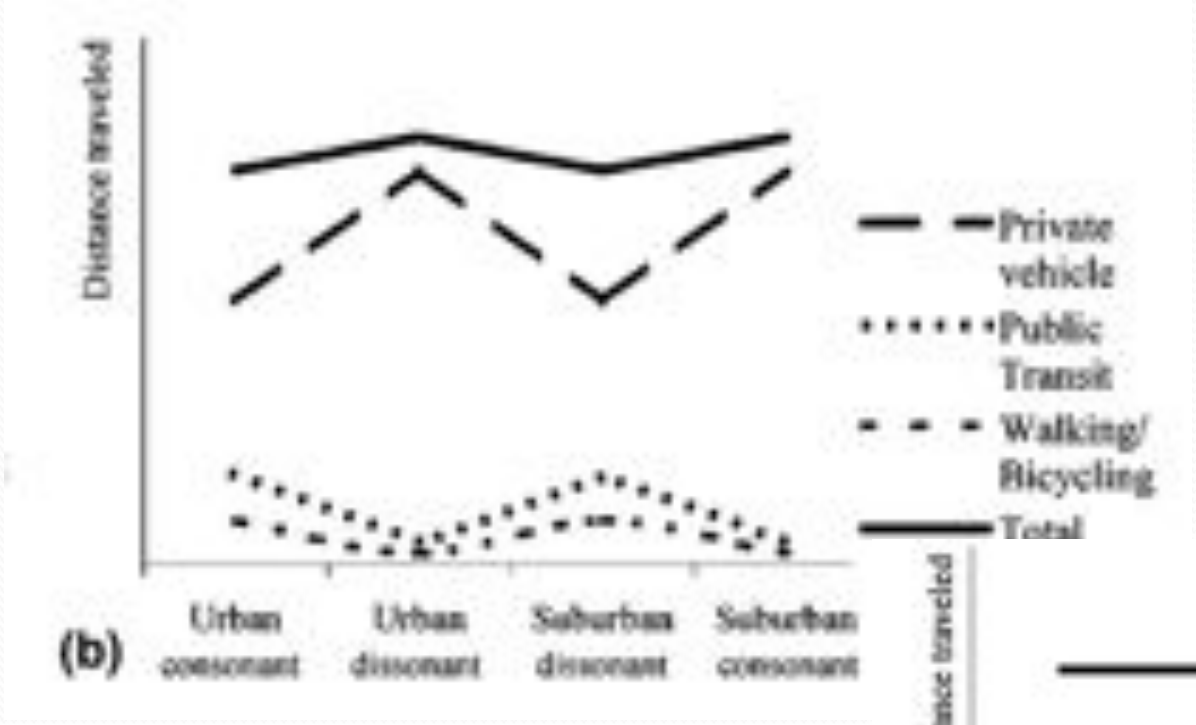
- Two competing implications
  - Overestimation will exaggerate BE's effect and may mislead land use policies (Boarnet and Crane, 2001; Handy et al., 2005).
  - If households can self-select, BE enables walking and transit due to the unmet demand of alternative development [TOD, Smart Growth, New Urbanism, Compact City alike] (Levine, 1999; Naess, 2009).

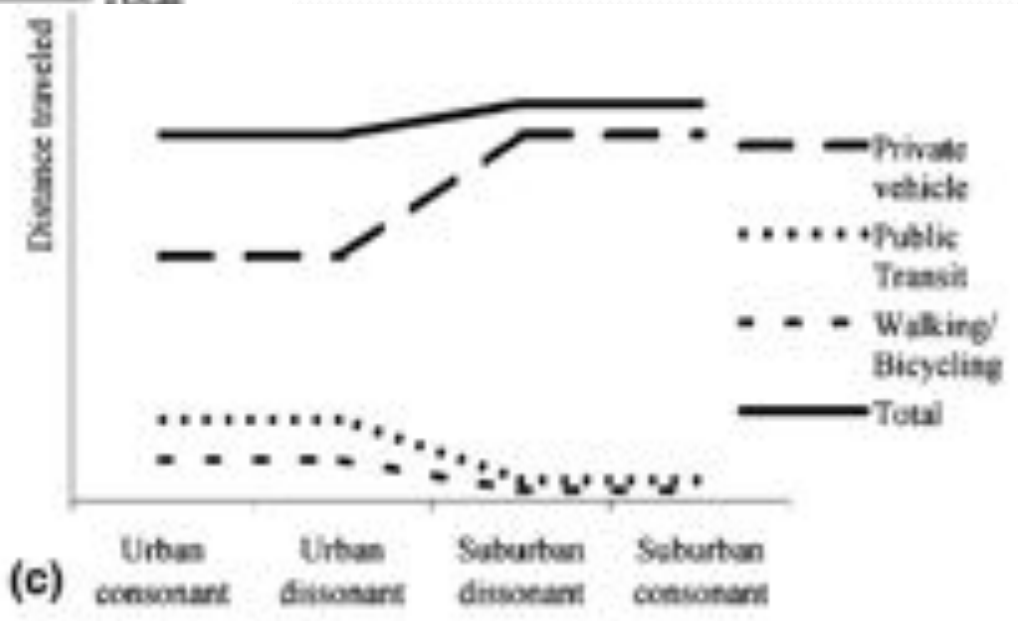
Introduction

- New insights on residential sorting impact on
  - Estimation of BE's effect on travel behavior
  - Prediction of land use policies on travel behavior

- The accuracy of estimation and prediction
  - The base level of modal use for households with different preferences
  - Elasticity of travel demand to BE
  - The share of the population with preference
  - The extent of match
  - The supply of alternative development
  - The share of households who can or are willing to move to alternative development [prediction]

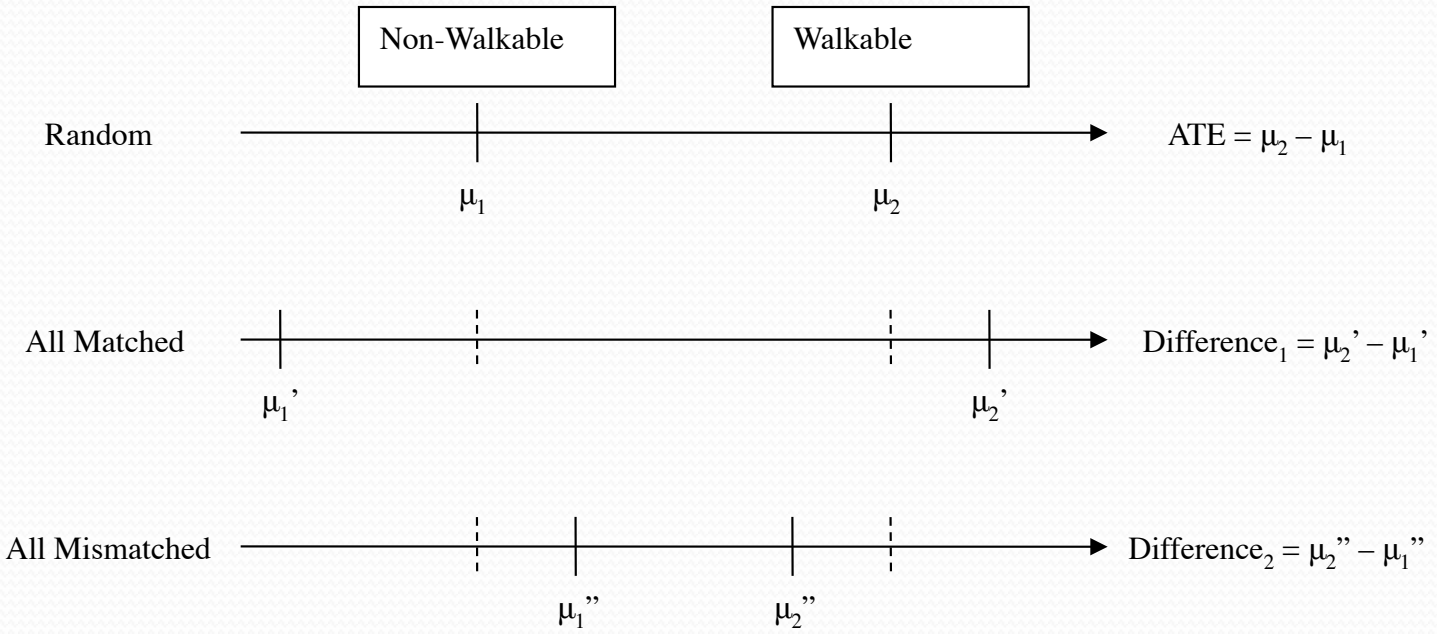
Schwanen and Mokhtarian 2005





Estimation – the extent of match

- Assume that the relationship between walking behavior and walkability is confounded by walking preference and the preference facilitates walking.

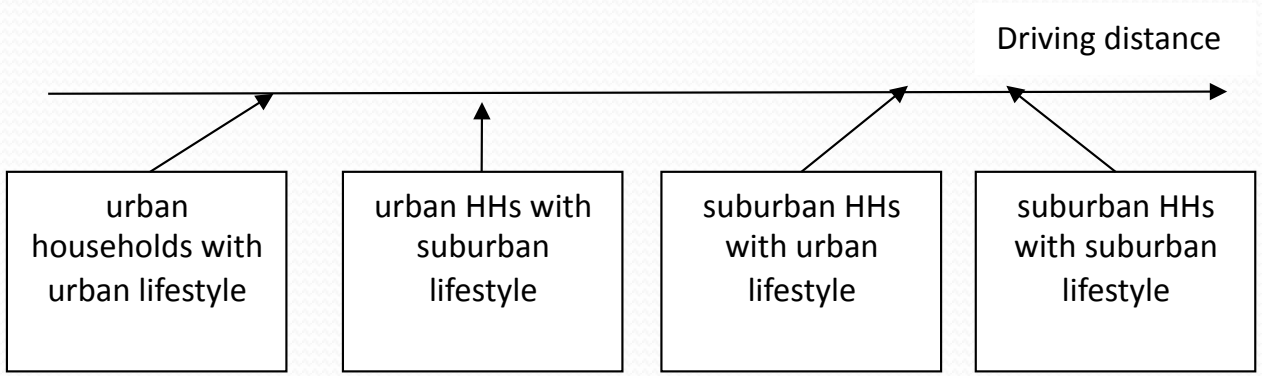


μ_1, μ_1', and μ_1" are observed mean walking behavior of people living in the non-walkable neighborhood;
μ_2, μ_2', and μ_2" are observed mean walking behavior of people living in the walkable neighborhood.

Prediction

- Scenario assumptions
  - Two types of neighborhoods: urban and suburban
  - Two types of lifestyle/preference: urban and suburban
  - The number of households (population) = 100
  - The share of the population with urban lifestyle = 50%
  - Supply = demand -> 50 urbanites vs. 50 suburbanites
  - The extent of match = 80% for each neighborhood
    - Urban households with urban lifestyle: 40 households
    - Urban households with suburban lifestyle: 10 households
    - Suburban households with urban lifestyle: 10 households
    - Suburban households with suburban lifestyle: 40 households

- Scenario assumptions
  - Different base levels and elasticities of travel demand (Schwanen and Mokhtarian 2005)
    - Urban households with urban lifestyle: 100 miles per week
    - Suburban households with suburban lifestyle: 200 miles
    - Suburban households with urban lifestyle: 200 miles
    - Urban households with suburban lifestyle: 100-200 miles



Prediction

- Five houses are converted from suburban housing to urban housing
- Urban households with suburban lifestyle = 200 miles
- The share of mismatched suburban households which move to alternative development ranges from 100% to 0%.

	Share [a]		Matched urban households	Mismatched urban households	Mismatched suburban households	Matched suburban households	Observed effect	Total miles driven [b]	Overprediction
1		Preference Current neighborhoods	Urban Urban	Suburban Urban	Urban Suburban	Suburban Suburban			
2	Sample	Number of households Miles driven	40 100	10 200	10 200	40 200	80 [d]	16000	
3	100%	Number of households_1 Miles driven_1	45 [c] 100	10 200	5 [c] 200	40 200	100 [e]	15500	-20 [f]
4	80%	Number of households_2 Miles driven_2	44 100	11 200	6 200	39 200	80 [e]	15600	0 [f]
5	60%	Number of households_3 Miles driven_3	43 100	12 200	7 200	38 200	60 [e]	15700	20 [f]
6	40%	Number of households_4 Miles driven_4	42 100	13 200	8 200	37 200	40 [e]	15800	40 [f]
7	20%	Number of households_5 Miles driven_5	41 100	14 200	9 200	36 200	20 [e]	15900	60 [f]
8	0	Number of households_6 Miles driven_6	40 100	15 200	10 200	35 200	0 [e]	16000	80 [f]

Prediction

- Elasticity of travel demand: Mismatched urban households
- Supply of alternative development
- Observed effect vs. causal effect

Dissonant Households [a]	Distance [b]	Share [c]					
		100%	80%	60%	40%	20%	0
(10, 8) Oversupply of urban housing	200	-32	-12	8	28	48	68
	190	-30	-12	6	24	42	60
	180	-28	-12	4	20	36	52
	170	-26	-12	2	16	30	44
	160	-24	-12	0	12	24	36
	150	-22	-12	-2	8	18	28
	140	-20	-12	-4	4	12	20
	130	-18	-12	-6	0	6	12
	120	-16	-12	-8	-4	0	4
	110	-14	-12	-10	-8	-6	-4
	100	-12	-12	-12	-12	-12	-12
(10, 10)	200	-20	0	20	40	60	80
	190	-18	0	18	36	54	72
	180	-16	0	16	32	48	64
	170	-14	0	14	28	42	56
	160	-12	0	12	24	36	48
	150	-10	0	10	20	30	40
	140	-8	0	8	16	24	32
	130	-6	0	6	12	18	24
	120	-4	0	4	8	12	16
	110	-2	0	2	4	6	8
	100	0	0	0	0	0	0
(10, 12) Undersupply of urban housing	200	-8	12	32	52	72	92
	190	-6	12	30	48	66	84
	180	-4	12	28	44	60	76
	170	-2	12	26	40	54	68
	160	0	12	24	36	48	60
	150	2	12	22	32	42	52
	140	4	12	20	28	36	44
	130	6	12	18	24	30	36
	120	8	12	16	20	24	28
	110	10	12	14	16	18	20
	100	12	12	12	12	12	12

Conclusions: estimation and prediction

	Overprediction	
	Observed impact	**Causal Effect**
The extent to which alternative development is undersupplied	+ / +	0 / 0
The gap in driving distance between matched and mismatched urban households	+ / +	0 / +
The share of mismatched suburban households that move to alternative development to match their preferences	- / -	- / -

- Notes: “+/+” = “the likelihood of overprediction/the size of overprediction”. “+” denotes a positive relationship; “-” refers to a negative relationship; “0” means that no connection was found.

Recommendations

- Assumptions vs. empirical evidence
- Empirical studies on
  - The share of the population with preference
  - The extent of mismatch
  - The base level of modal use
  - Elasticity of travel demand
  - The supply of alternative development
  - The share of households which move to alternative development

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