Could "New Urbanism" Policies Reduce Car Dependency in Cities? Evidence from Old Urbanism

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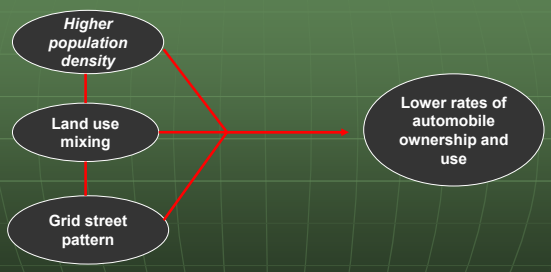
Outline

- Research questions
- Facts about Montreal
- Review of literature
- Methodology
- Results and discussion

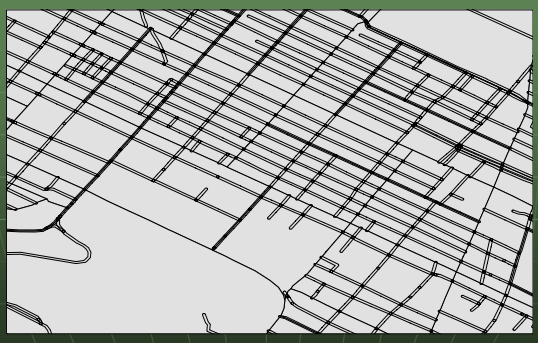
Research Questions

- Do households living:
  - at higher densities,
  - or close to a large retail area,
  - or on a grid street pattern
  - **own less cars**?
- Do households working downtown or living closer to it **own less cars**?

New Urbanism

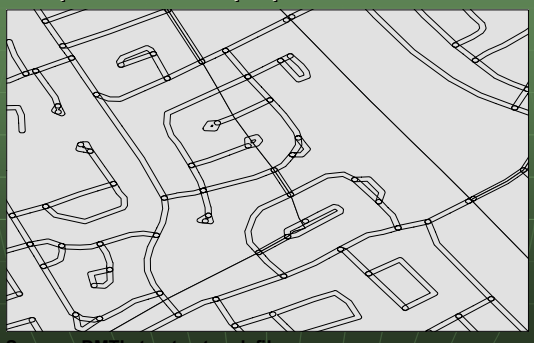


Grid Street Pattern



Source: DMTI street network file

Loops and Lollipops Street Pattern



Source: DMTI street network file

Macro-Level Urban Form

- The macro-level structure of a metropolitan area refers to:
  - its overall size and population density
  - the spatial distribution of jobs, housing, commercial & recreational facilities

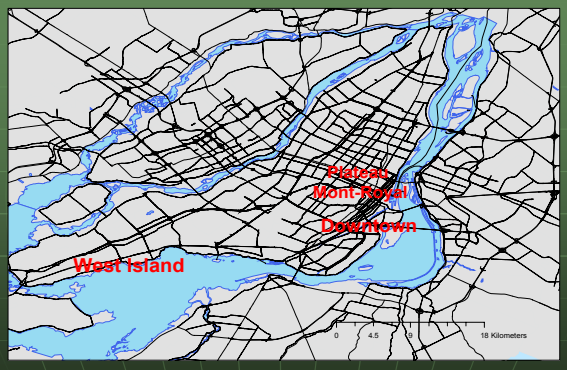
Importance of CBD Job Concentration

- CBD has single highest concentration of jobs & is the most accessible location.
- This gives it the highest frequency, speed & coverage of transit.

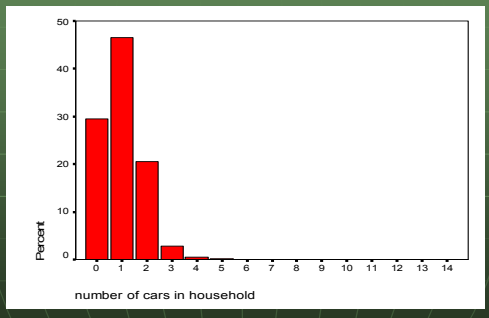
Facts About Island of Montreal

- Population (2001) 1,812,723
- Area of island 500 sq km
- Gross population density 3,625 persons/sq km
- CMA population (2001) 3,426,350

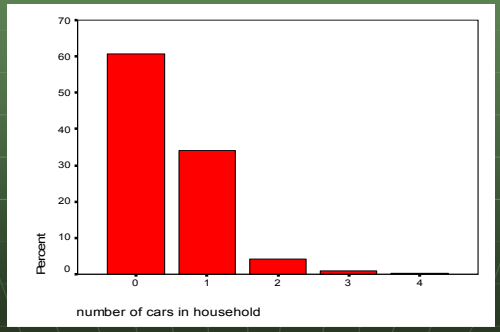
Map of Montreal



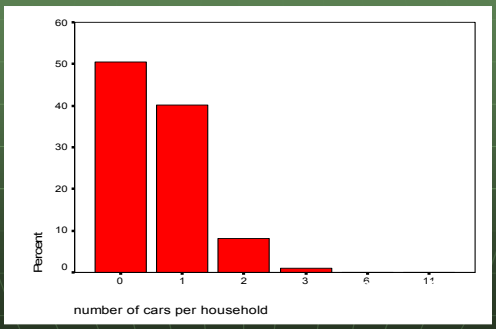
Household Auto Ownership: Island of Montreal



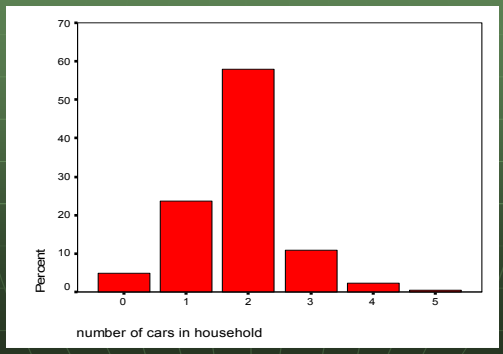
Household Auto Ownership Levels: Downtown



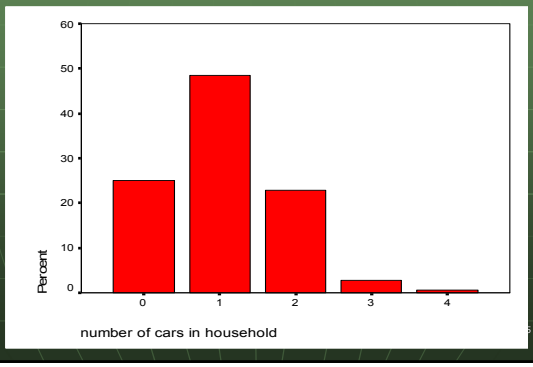
Household Auto Ownership Level: Plateau Mont-Royal (inner city duplex/triplex, gentrifying)



Household Auto Ownership Levels: Kirkland (suburban, middle income)



Household Auto Ownership Levels: Westmount (upper & middle income, inner city)



Literature Review: studies supporting New Urbanism

- Newman & Kenworthy. *Cities and Automobile Dependence: An International Sourcebook (1989, 1999).*
- *compared transport energy consumption in 32 large cities in Europe, Asia, Australia, USA & Canada.*
- *Finding: cities with higher population densities have lower energy use & automobile dependency.*

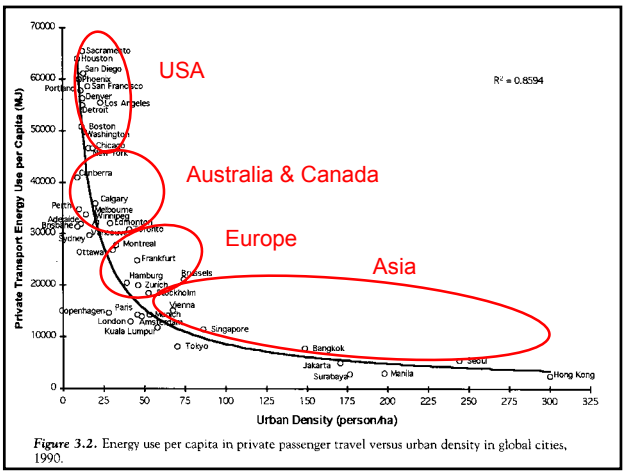
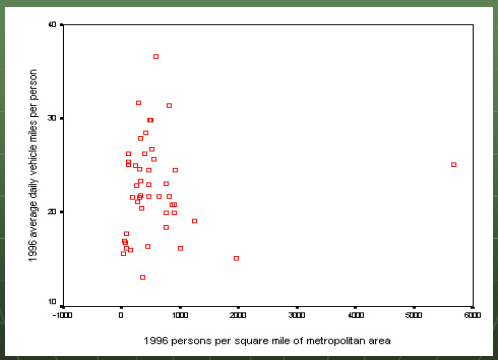


Figure 3.2. Energy use per capita in private passenger travel versus urban density in global cities, 1990.

VMT vs. Density for 46 US Cities (1996)



Source:Characteristics of Urban Travel Demand, TCRP Report 73. Transportation Research Board, Washington, DC, 2002

Major Criticisms

- Most regressions fail to account for other important factors that influence travel (e.g. income, number of children, fuel cost & employment status).
- See: Gordon & Richardson (1989), Gomez-Ibanez (1991), Handy (1996), Schimek (1996).

Other Important Determinants of Transportation Mode Choice

- weak link between neighborhood urban form and travel behavior
  - Schimek(1996), Miller & Ibrahim (1998), Cervero & Kockelman (1997)
- household income & size, transit availability, & distance to CBD were much more important
  - Ibid
- most of the small effect of density on VKT was through its effect on automobile ownership
  - Schimek (1996)

Data Sources

- O-D survey for Montreal CMA (1998), Agence Métropolitaine de Transport
- Median household income data by CT (1996), StatsCan.
- Street network (1996), DMTI
- Island of Montreal land use (1998)
- Electronic metro stop data (1996), SUIRS

Limitations of Data

- Distance measures: CT centroid-to-centroid road distances only approximate actual distances for most households.
- Household income: survey didn't ask respondent's income, so median CT household income was used.

Methodology

- GIS: to compute variables & classify street patterns
- MS Access: query tool to define variables
- Statistical method: multinomial logit regression

Statistical Models

- Ordinary least squares vs. multinomial logit
- OLS inappropriate for an ordinal dependent variable with few values, e.g. 0, 1, 2, because it can estimate the # of vehicles a household owns to be:
  - negative (e.g. –0.2 cars)
  - fractional (e.g. 1.6 cars)

Multinomial Logit Model

- Estimates how each independent variable affects household's probability (& odds) of owning a given # of cars.

Ownership Odds Estimated

- Pr (0 cars) / Pr (1 car)
- Pr (2 cars) / Pr (1 car)
- Δ odds = exp(reg coeff * Δ indep. var.)
- Pr(k cars)/Pr(1 car)

Micro-Level Urban Form Variables

Variable	Coeff.	Stan'd Error	t = Coeff/ St. Error	Not signif. at alpha=.05	exp(b* Δx)	Δx
	Probability of owning no cars rather than one					
Constant	1.09	0.06	16.79			
Pop from 750 to 4K/sq km	-0.13	0.08	-1.76	NS	0.87	1
Pop from 12K to 38K/sq km	0.31	0.04	8.55		**1.36**	1
Km to retail cluster	-0.05	0.01	-3.30		**0.95**	1
Grid street pattern in n'hood	0.19	0.04	5.26		**1.21**	1
	Probability of owning two cars rather than one					
Constant	-3.27	0.07	-46.22			
Pop from 750 to 4K/sq km	0.28	0.06	4.78		**1.33**	1
Pop from 12K to 38K/sq km	-0.27	0.05	-5.59		**0.76**	1
Km to retail cluster	-0.02	0.01	-1.74	NS	0.98	1
Grid street pattern in n'hood	-0.17	0.04	-4.39		**0.85**	1

N=33,070
R-sqr=0.22

Interpretation

- Denser areas have lower auto ownership.
- But it takes a large increase in density to reduce the number of vehicles a household owns.
- Areas with a grid street pattern own fewer cars.
- Proximity to a large retail street doesn't affect auto ownership.

Macro-Level Urban Form Variables

Variable	Coeff.	Stan'd Error	t = Coeff/ St. Error	Not signif. at alpha= .05	exp(b *Δx)	Δx
	Prob'ty of owning no cars rather than one					
Km to CBD	-0.03	0.00	-8.90		**0.85**	5
Employed in CBD	0.13	0.05	2.74		**1.14**	1
Employed near Metro station	0.16	0.24	0.66	NS	**1.17**	1
	Prob'ty of owning two cars rather than one					
Km to CBD	0.03	0.00	8.28		**1.15**	5
Employed in CBD	-0.36	0.04	-8.17		**0.70**	1
Employed near Metro station	-0.24	0.21	-1.12	NS	0.79	1

Interpretation

- Households closer to CBD own fewer vehicles.
- Centrality has more effect than population density.
- Having a CBD worker in the household reduces the likelihood of owning two or more vehicles.

Interpretation (2)

- The impact of working downtown is greater on the decision to own 2+ vehicles vs. 1, than on owning 0 vs. 1.

Socioeconomic & Demographic Variables

Variable	Coeff.	Stan'd Error	t = Coeff/ St. Error	Not signif. at alpha=.05	exp(b*Δx)	Δx
	Probability of owning no cars rather than one					
# full-time workers	-1.45	0.03	-48.26		0.23	1
# part-time workers	-0.96	0.05	-19.11		0.38	1
# adults not in work force	-0.64	0.02	-25.98		0.53	1
# over 75 years old	-0.07	0.02	-3.56		0.93	1
# children	-0.29	0.04	-6.57		0.74	1
median income of CT under $25000	0.44	0.04	12.44		1.55	1
median income of CT over $50000	-0.57	0.07	-8.20		0.57	1
	Probability of owning two cars rather than one					
# full-time workers	1.37	0.03	51.79		3.92	1
# part-time workers	1.04	0.05	22.66		2.83	1
# adults not in work force	0.72	0.02	30.44		2.05	1
# over 75 years old	0.12	0.02	7.70		1.13	1
# children	0.17	0.08	2.26		1.19	1
median income of CT under $25000	-0.21	0.05	-4.59		0.81	1
median income of CT over $50000	0.58	0.05	11.11		1.78	1

Interpretation

- Employment status, household size & income are much more important determinants of household automobile ownership levels than urban form.
- The number of workers increases the odds of owning more vehicles (especially two or more) enormously.

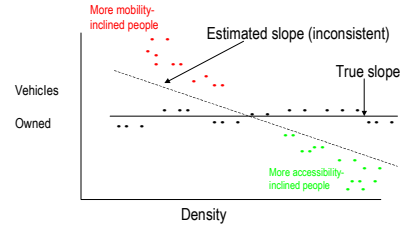
Interpretation (2)

- Importance of employment status reinforces the importance of employment location in driving auto ownership decisions.
- 80% of jobs in Montreal CMA are scattered outside the CBD.

Spatial interpretation caveats

- Simultaneity bias: refers to the reality that many people jointly determine how many vehicles to own and where to live.
- I.e. people who don't want to drive are likely to choose locations where they don't have to, and vice versa.

Illustration of self-selection bias



THANK YOU