Static vs. Dynamic Travel Time Skims for Disaggregate Mode Choice Model Estimation

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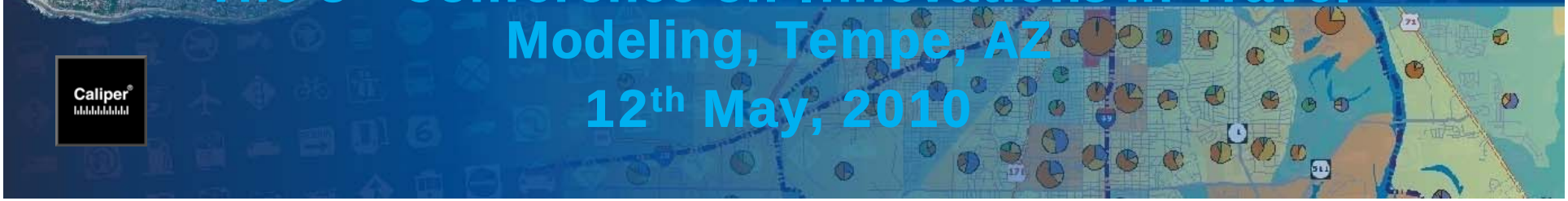

Outline

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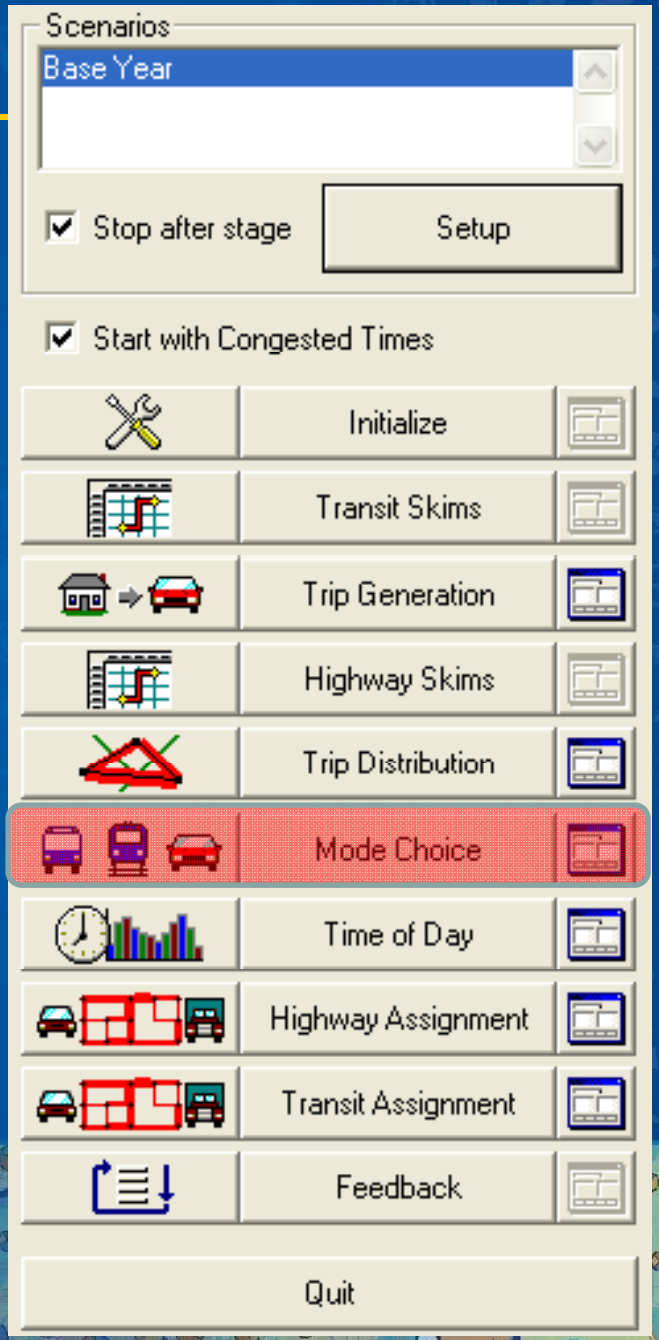
Introduction

- **Mode choice models**
  - **Critical planning step**
  - **Often based on choice models**
    - **Utilities: functions of impedances, costs, transfers, etc.**
  - **Should require estimation from disaggregate data**
    - **Estimation software: Biogeme, ALOGIT, TransCAD, etc.**



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Motivation

- Errors in variables can be fatal in choice models
  - e.g. Kuchenhoff (1995)
- Estimation traditionally based on static travel time skims
  - One average travel time for extended periods
    - e.g. AM peak, PM peak, mid-day, night
  - Ignores within-period, trip departure time effects
- This presentation: replace static travel times with realistic, dynamic estimates

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Methodology

1. Estimate mode choice model with static skims
2. Run dynamic traffic assignment (DTA)
3. Calculate dynamic skims from DTA output
4. Tag skims to survey based on departure time
5. Re-estimate mode choice model
6. Compare parameter estimates and statistics

Estimation Software: TransCAD 5.0

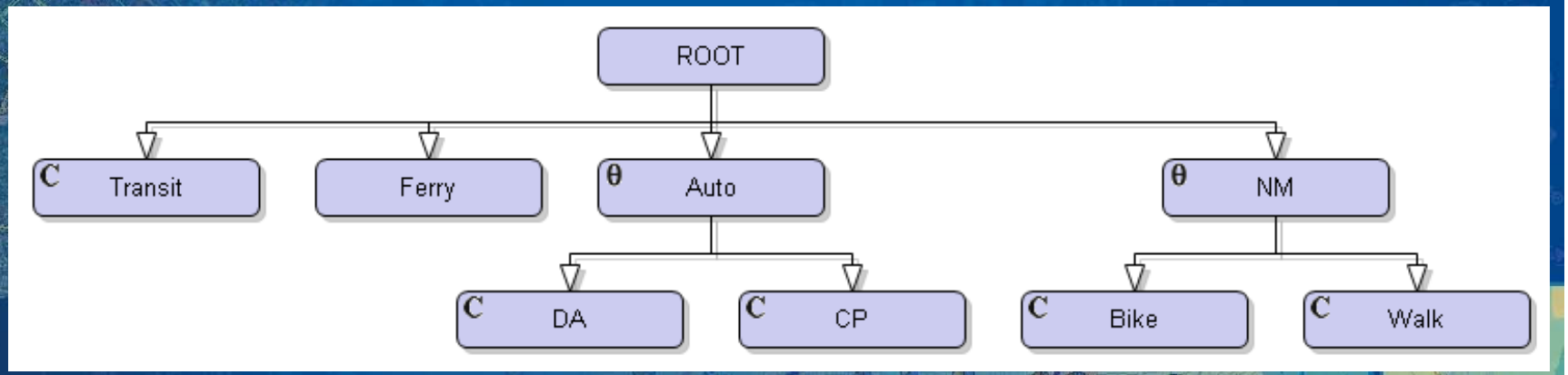
- **Allows intuitive model building**
  - Multinomial Logit (MNL), Nested Logit (NL)
- **Combines, tags data from multiple sources**
  - Surveys, skim matrices, zone layers, etc.
- **Helps identify multiple NL solutions**
  - Systematically searches nest parameter space
    - Necessary because of non-uniqueness of NL
    - Koppelman & Bhat (2006), Balakrishna et al. (2009)

DTA Model

- **Analytical DTA in TransCAD 5.0**
  - **Caliper Corp. (2010), Gao et al. (2007), Janson & Robles (1995)**
  - **Designed for large regional models**
  - **Models spillbacks and incidents**
  - **Has no extra network data requirements**
    - **Time-varying origin-destination demand**
    - **Link storage capacity**

Victoria Case Study

- **Travel survey**
  - Home-based work (HBW) trips
  - 1309 survey records
  - Two-hour AM peak
- **Modes:**
  - Motorized: Drive Alone, Carpool, Transit, Ferry
  - Non-Motorized (Bike, Walk)



Utility Specification

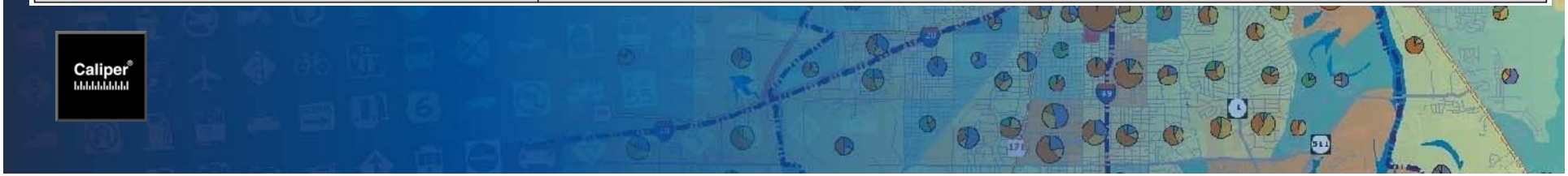
Coefficient	DA	CP	Bike	Walk	Transit	Ferry
ASC_DA	1					
ASC_CP		1				
ASC_Bike			1			
ASC_Walk				1		
ASC_Transit					1	
ASC_Ferry						Base
B_Distance			Dist	Dist		
B_Ped			Ped	Ped	Ped	
B_IVTT	Auto_IVTT	Auto_IVTT			Bus_IVTT	
B_Park	Park_Cost	Park_Cost				

Skim Comparisons

- **Dynamic Traffic Assignment**
  - Demand profile with 15-minute intervals
- **Static vs. dynamic skims (weighted by demand)**
  - Static: mean = 30.93 min, stdev = 27.84 min
  - Dynamic: mean = 32.47 min, stdev = 29.31 min
  - $R^2 = 0.27$

Estimation: Static Travel Time Skims

Parameter	Estimate	t statistic
B_Ped	0.6391	4.54
B_IVTT	-0.0049	-0.43
B_Distance	-0.2053	-5.97
B_Park	-0.2376	-10.07
ASC (Transit)	4.8620	4.67
ASC(DA)	7.3248	7.17
ASC(CP)	5.8049	4.38
ASC(Bike)	5.9994	5.66
ASC(Walk)	5.8280	5.35
Theta(Auto)	0.5973 (starting = 0.6)	-3.13
Theta(NM)	0.3659 (starting = 0.2)	-8.87
Log-Likelihood at Zero		-2161.33
Log-Likelihood at End		-1140.67
Rho^2		0.4722
Adjusted Rho^2		0.4671

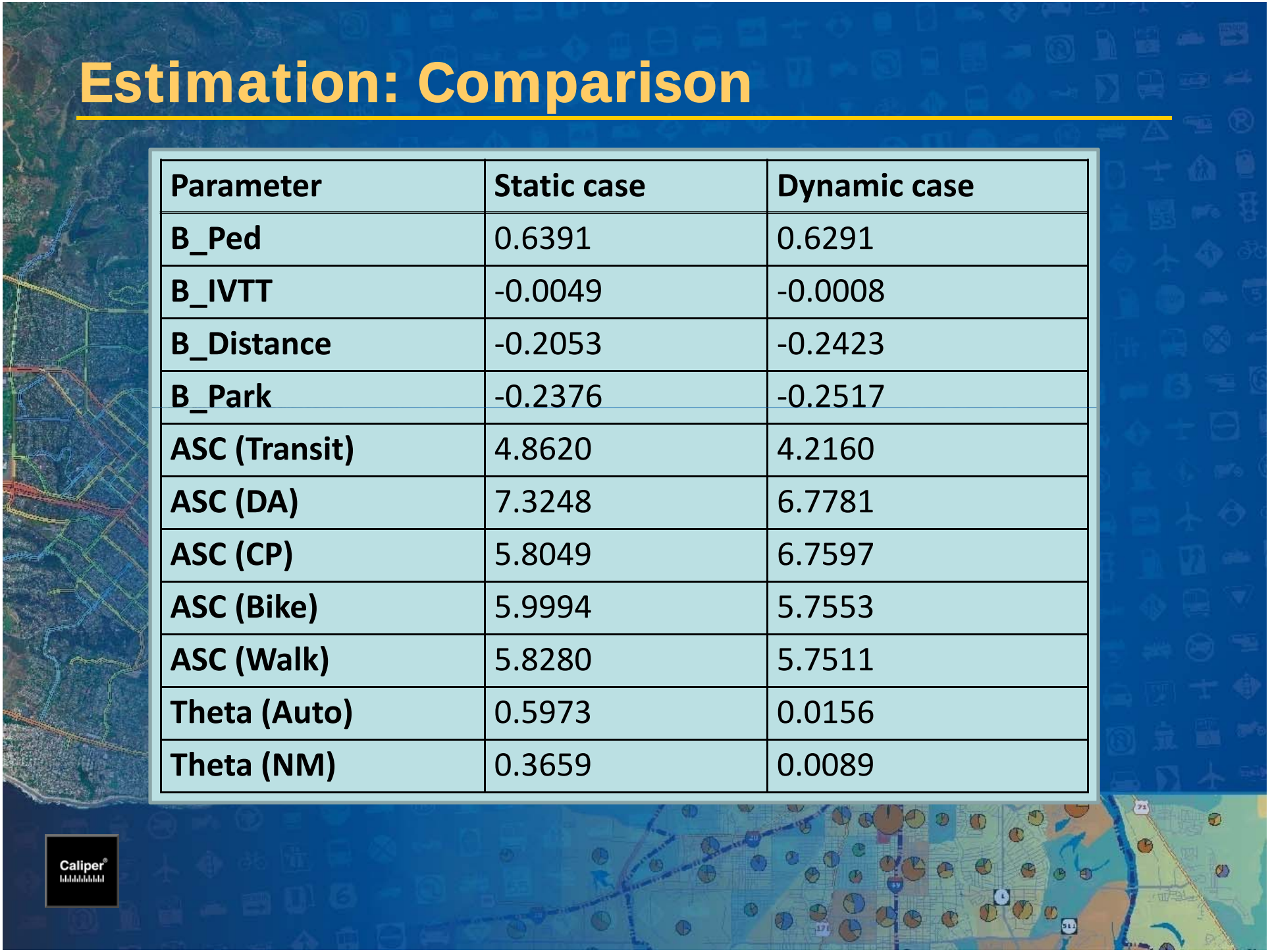


Estimation: Dynamic Travel Time Skims

Parameter	Estimate	t statistic
B_Ped	0.6291	4.17
B_IVTT	-0.0008	-0.38
B_Distance	-0.2423	-12.37
B_Park	-0.2517	-8.82
ASC (Transit)	4.2160	5.22
ASC(DA)	6.7781	7.66
ASC(CP)	6.7597	7.64
ASC(Bike)	5.7553	6.26
ASC(Walk)	5.7511	6.26
Theta(Auto)	0.0156 (starting = 0.001)	-1349.07
Theta(NM)	0.0089 (starting = 0.001)	-1853.45
Log-Likelihood at Zero		-2161.33
Log-Likelihood at End		-1226.54
Rho^2		0.4325
Adjusted Rho^2		0.4274

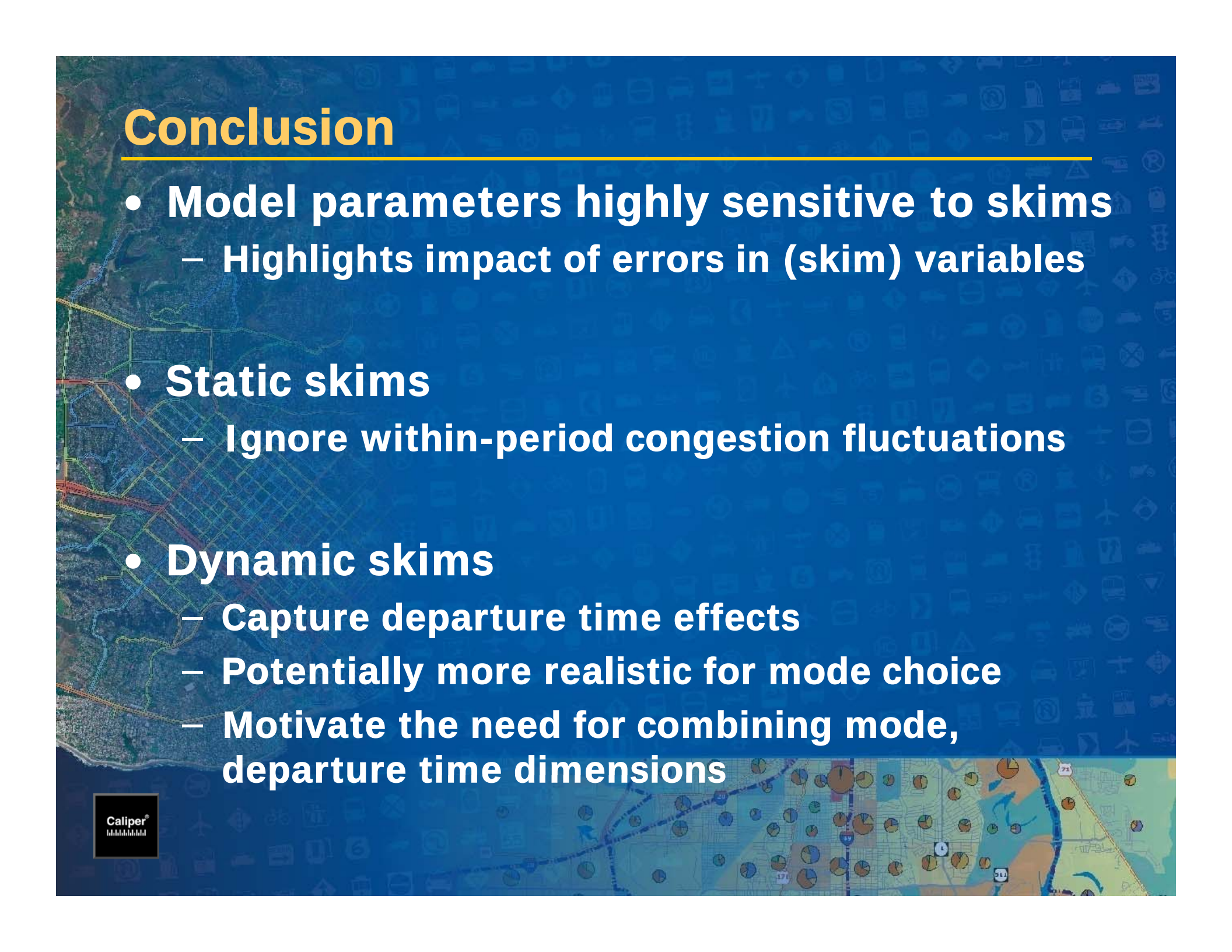
Estimation: Comparison

Parameter	Static case	Dynamic case
B_Ped	0.6391	0.6291
B_IVTT	-0.0049	-0.0008
B_Distance	-0.2053	-0.2423
B_Park	-0.2376	-0.2517
ASC (Transit)	4.8620	4.2160
ASC (DA)	7.3248	6.7781
ASC (CP)	5.8049	6.7597
ASC (Bike)	5.9994	5.7553
ASC (Walk)	5.8280	5.7511
Theta (Auto)	0.5973	0.0156
Theta (NM)	0.3659	0.0089



Conclusion

- **Model parameters highly sensitive to skims**
  - Highlights impact of errors in (skim) variables
- **Static skims**
  - Ignore within-period congestion fluctuations
- **Dynamic skims**
  - Capture departure time effects
  - Potentially more realistic for mode choice
  - Motivate the need for combining mode, departure time dimensions



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