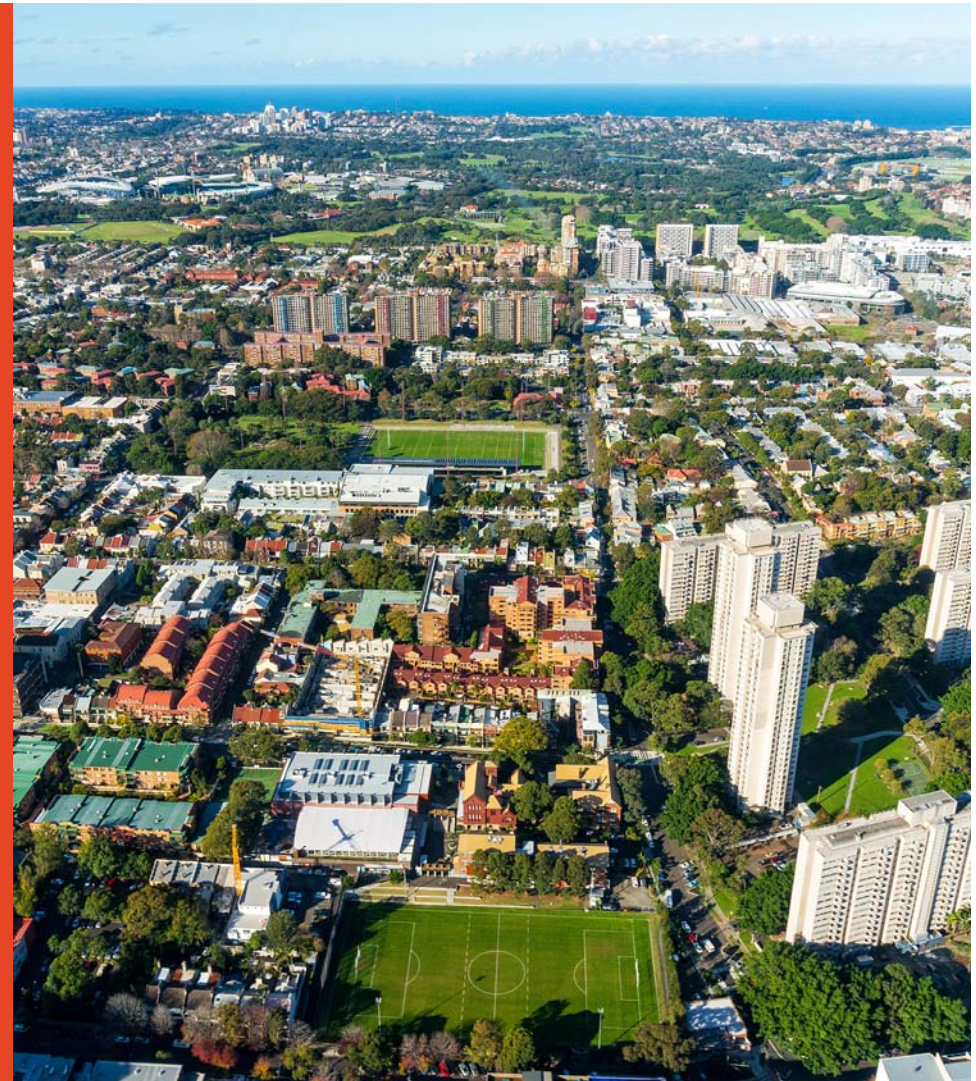


# **Are respondents aware of the process strategies used in decision-making? Modelling business location decisions using multiple stated process strategies**

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TRANSW Symposium



# INTRODUCTION

- Discrete choice studies are increasingly used in urban planning to understand preferences and to make informed decisions based on its outcomes
- Traditional discrete choice modelling approaches have evolved in a setting in which some very specific behavioural **assumptions** are made in specifying choice-making
- These assumptions have given rise to the study of alternative process strategies in decision-making



# INTRODUCTION

- Process strategies can be either directly asked to respondents (stated) or inferred through the models, although typically is limited to a very few process rules such as ANA
- This research aims to look at **stated value learning** (VL), **majority of confirming dimensions** (MCD) and **attribute non-attendance** (ANA), in addition to the traditional approach which is referred to as linear in the parameters additive in the attributes (LPAA)
- Stated ANA has been studied in the literature but, to the best of our knowledge, this is the first study to incorporate stated VL and MCD together with ANA.



# INTRODUCTION

- The interest of this research is in understanding the decisions made by businesses on where to locate or relocate
- This has been typically given less consideration than residential location in integrated transport and land use modelling systems and usually not considered in cost-benefit analysis



# MAIN DRIVERS

Category	Attributes
Accessibility	Public transport service frequency in peak to anywhere
	Walking time to the closest rail station
	50% of your clients are accessible within X minutes
	Distance from your current business location
Office Profile	Rental space cost (\$ per square metre)
	Amount of office space (square metres)
	Lease commitment (years)
Location Profile	Number of businesses offering the same or similar products and/or services in the local area*

\*Local area was defined as a catchment area that is 5 kms in radius around your current business location (where you operate).



## DISCRETE CHOICE EXPERIMENT

- We designed an online survey
- Respondents were selected who were involved in the business location decisions of an organisation (sometimes as an adviser and not an employee)
- We included questions about the respondent's industry, the role of the respondent, their business' attitudes towards the physical and economic infrastructure, and the choice experiment
- Each respondent was faced with four choice sets
- Data was collected from small, medium and large businesses located within the Greater Sydney Metropolitan Area (GSMA)



## STATED CHOICE EXPERIMENT

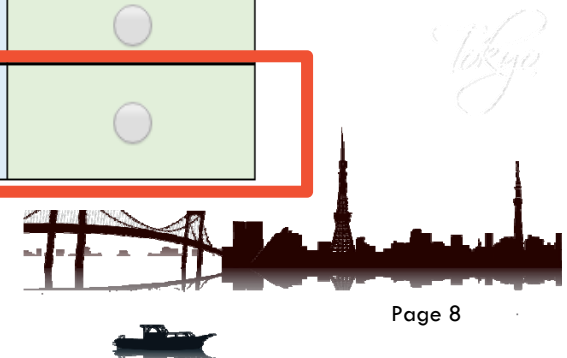
Features	Current location	Location 1	Location 2
Public transport service frequency in peak to anywhere	15 mins	15 mins	60 mins
Walking time to the closest rail station	10 mins	45 mins	25 mins
50% of your clients are accessible within	50 mins	38 mins	50 mins
Rental space cost (\$ per square metre)	\$100	\$125	\$75
Amount of office space (square metres)	100m <sup>2</sup>	125m <sup>2</sup>	50m <sup>2</sup>
Lease commitment (years)	5	20	20
Number of businesses offering the same or similar products and/or services in the local area	11-20	15	4
Distance from your current business location	-	30 kms	30 kms
Q1. Which alternative would be <b>most attractive (i.e. preferred)</b> as a business location?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>





## STATED CHOICE EXPERIMENT

Features	Current location	Location 1	Location 2
Public transport service frequency in peak to anywhere	15 mins	30 mins	15 mins
Walking time to the closest rail station	10 mins	45 mins	25 mins
50% of your clients are accessible within	50 mins	63 mins	50 mins
Rental space cost (\$ per square metre)	\$100	\$50	\$150
Amount of office space (square metres)	100m <sup>2</sup>	125m <sup>2</sup>	50m <sup>2</sup>
Lease commitment (years)	5	5	15
Number of businesses offering the same or similar products and/or services in the local area	11-20	8	15
Distance from your current business location	-	15 kms	7 kms
Q1. Which alternative would be <b>most attractive (i.e. preferred)</b> as a business location?	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q2. If your current location was not available anymore, which alternative would you select?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



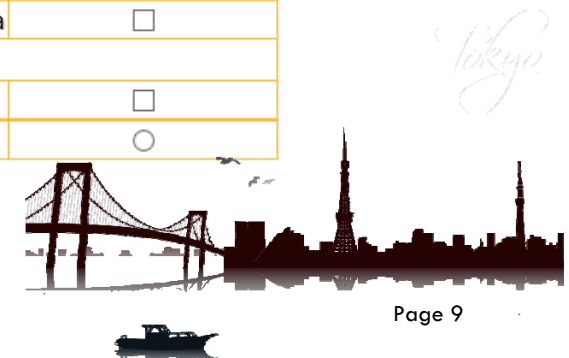


## STATED CHOICE EXPERIMENT - ANA

Please indicate which attribute(s) you ignored when assessing the choice scenarios in previous screens in Choice Task 1.

*Please select all that apply.*

	Select all you ignored
<b>Accessibility</b>	
Public transport service frequency in peak to anywhere	<input type="checkbox"/>
Walking time to the closest rail station	<input type="checkbox"/>
50% of your clients are accessible within	<input type="checkbox"/>
<b>Office Profile</b>	
Rental space cost (\$ per square metre)	<input type="checkbox"/>
Amount of office space (square metres)	<input type="checkbox"/>
Lease commitment (years)	<input type="checkbox"/>
<b>Location Profile</b>	
Number of businesses offering the same or similar products and/or services in the local area	<input type="checkbox"/>
<b>Other</b>	
Distance from your current business location	<input type="checkbox"/>
<i>I did not ignore any features</i>	<input type="radio"/>



## STATED CHOICE EXPERIMENT – VALUE LEARNING

Q1. Did the characteristics of the alternatives that you saw in the earlier choice tasks influence your decisions in the following ones?

☐ Yes

☐ No



## STATED CHOICE EXPERIMENT – MCD and LPAA

Q2. What made you choose one alternative? (Please select all that apply)

- ☐ I chose the **first** alternative whose characteristics satisfied my requirements (ignoring the remaining alternatives).
- ☐ I eliminated alternatives that failed to meet my requirements, starting with the most important characteristics.
- ☐ I compared the alternatives' characteristics considering that some characteristics are more important to me than others
- ☐ I chose the alternative that has the highest number of best performing characteristics (relative to the other alternatives).
- ☐ Others. Please specify.



## STATED CHOICE EXPERIMENT – LPAA

Q2. What made you choose one alternative? (Please select all that apply)

- ☐ I chose the **first** alternative whose characteristics satisfied my requirements (ignoring the remaining alternatives).
- ☐ I eliminated alternatives that failed to meet my requirements, starting with the most important characteristics.
- ☒ I compared the alternatives' characteristics considering that some characteristics are more important to me than others
- ☐ I chose the alternative that has the highest number of best performing characteristics (relative to the other alternatives).
- ☐ Others. Please specify.



## STATED CHOICE EXPERIMENT – MCD

Q2. What made you choose one alternative? (Please select all that apply)

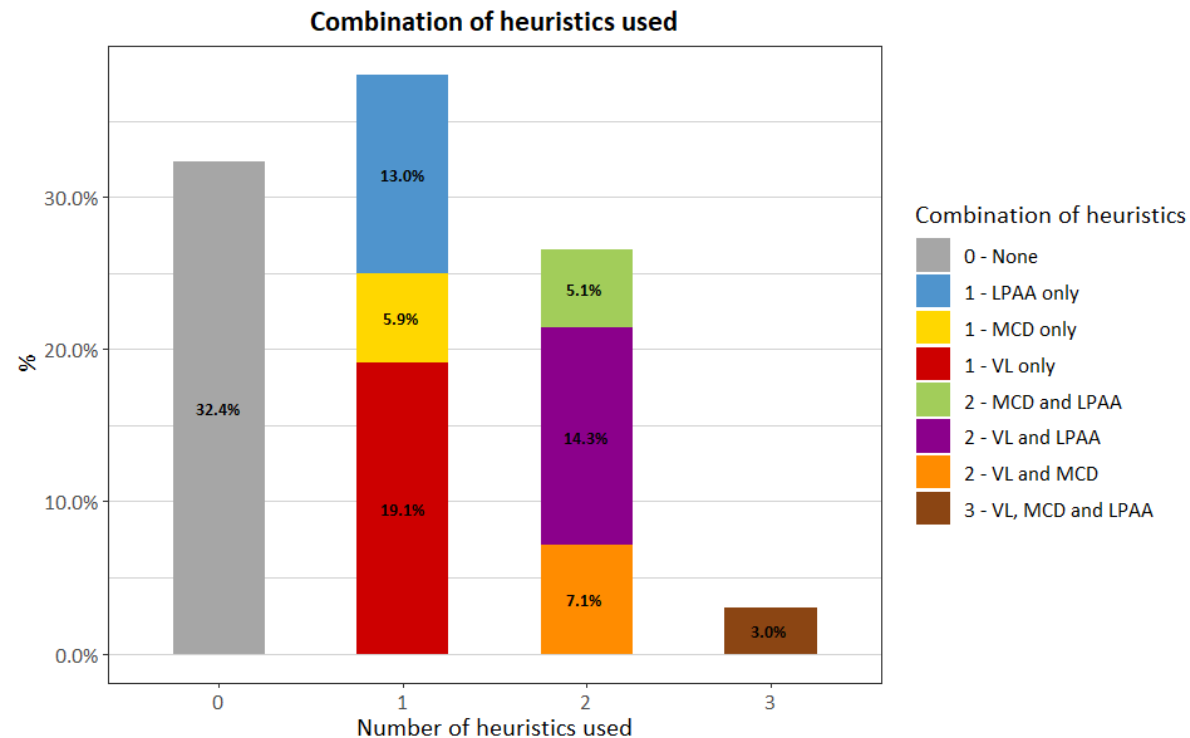
- ☐ I chose the **first** alternative whose characteristics satisfied my requirements (ignoring the remaining alternatives).
- ☐ I eliminated alternatives that failed to meet my requirements, starting with the most important characteristics.
- ☐ I compared the alternatives' characteristics considering that some characteristics are more important to me than others
- ☒ I chose the alternative that has the highest number of best performing characteristics (relative to the other alternatives).
- ☐ Others. Please specify.



## DESCRIPTIVE PROFILE OF RESPONDENTS

Our final sample size has 159 businesses, with a total of 1,051 observations for choice modelling

Did respondents say they used more than one process strategy at the same time?



# METHODOLOGY

Models estimated (with and without ANA):

1. **LPAA**, where it is assumed every individual uses LPAA. This model was estimated with and without ANA.
2. **Stated multiple heuristics (StVL-StMCD)**, where it is assumed that individuals use the heuristics they said they used. This model was estimated with and without ANA.
3. **Inferred multiple heuristics (InfVL-InfMCD)**, where it is assumed that everyone might use all heuristics regardless of what they said. This model was estimated with and without ANA.
4. **Stated VL and Inferred MCD (StVL-InfMCD)**
5. **Inferred VL and Stated MCD (InfVL-StMCD)**





# METHODOLOGY

## LPAA model

$$U_i^{\text{LPAA}} = \beta_{0,i} + \beta_1 \cdot x_{1,i} + \dots + \beta_m \cdot x_{m,i} + \dots + \eta_{iq} + \varepsilon_i$$

$\beta_{0,i}$  is the alternative specific constant of alternative  $i$ ;

$\beta_m$  is the parameter estimate associated with attribute  $m$ ;

$x_{m,i}$  is the level of attribute  $m$  for alternative  $i$ ;

$\eta_{iq}$  is a component of the error term that varies across individuals but is the same within an individual  $q$ ;

$\varepsilon_i$  is the random error term



# METHODOLOGY

## Stated multiple heuristics model (StVL-StMCD)

$$U_i^{\text{StVL-StMCD}} = \beta_{0,i} + f(\cdot)_{\text{LPAA},i} + d_{\text{VL}} \delta_{\text{VL}} f(\cdot)_{\text{VL},i} + d_{\text{MCD}} \delta_{\text{MCD}} f(\cdot)_{\text{MCD},i} + \eta_{i,q} + \varepsilon_i$$

$d$  represents a dummy variable which is equal to 1 if the individual said they used VL/MCD, and 0 otherwise  
 $\delta$  represents a weight for each heuristic

$$f(\cdot)_{\text{LPAA},i} = \beta_1 \cdot x_{1,i} + \dots + \beta_m \cdot x_{m,i}$$

$$f(\cdot)_{\text{VL},i} = -\left\{ \ln\left(1 + \exp\left(\beta_1 \cdot x_{1,i} - \beta_1 \cdot x_{1,\text{REF}}\right)\right) + \dots + \ln\left(1 + \exp\left(\beta_m \cdot x_{m,i} - \beta_m \cdot x_{m,\text{REF}}\right)\right) \right\}$$

$$f(\cdot)_{\text{MCD},i} = \beta_{\text{MCD}} \cdot x_{\text{MCDscore},i}$$

represents the number of best performing attributes of alternative  $i$  (relative to the other alternatives)

represents the 'best' level of attribute  $m$  the individual has seen throughout the experiment in their chosen alternatives



# METHODOLOGY

## Inferred multiple heuristics (InfVL-InfMCD)

$$U_i^{\text{InfVL-InfMCD}} = \beta_{0,i} + f(\cdot)_{\text{LPAA},i} + \delta_{\text{VL}} f(\cdot)_{\text{VL},i} + \delta_{\text{MCD}} f(\cdot)_{\text{MCD},i} + \eta_{i,q} + \varepsilon_i$$

## Inferred VL and stated MCD (InfVL-StMCD)

$$U_i^{\text{StVL-InfMCD}} = \beta_{0,i} + f(\cdot)_{\text{LPAA},i} + \delta_{\text{VL}} f(\cdot)_{\text{VL},i} + d_{\text{MCD}} \delta_{\text{MCD}} f(\cdot)_{\text{MCD},i} + \eta_{i,q} + \varepsilon_i$$

## Stated VL and inferred MCD (StVL-InfMCD)

$$U_i^{\text{StVL-InfMCD}} = \beta_{0,i} + f(\cdot)_{\text{LPAA},i} + d_{\text{VL}} \delta_{\text{VL}} f(\cdot)_{\text{VL},i} + \delta_{\text{MCD}} f(\cdot)_{\text{MCD},i} + \eta_{i,q} + \varepsilon_i$$

## RESULTS: WITH OR WITHOUT ANA?

	M1: LPAA without ANA	M2: LPAA with ANA	M3: StVL- StMCD without ANA	M4: StVL- StMCD with ANA
<b>Log-likelihood</b>	-705.23	-685.39	-702.76	-684.12
<b>AIC/n</b>	0.151	0.147	0.151	0.147
<b>Parameters' significance level</b>	Rent is not significant	All attributes are significant	Rent is not significant	All attributes are significant

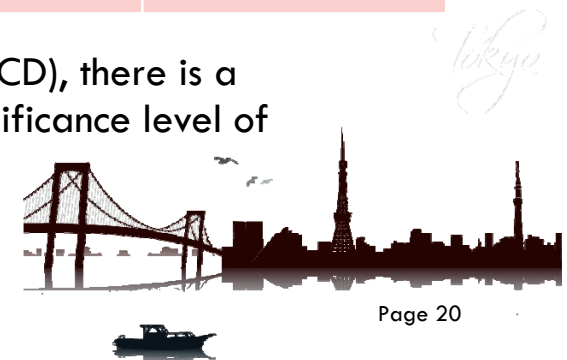
- Adding ANA improved the model in terms of goodness to fit and also in terms of parameter significance level, as we expect rent to be important for at least some of the respondents.



## RESULTS: STATED OR INFERRED MULTIPLE HERUISTICS?

	M4: StVL-StMCD with ANA	M6: InfVL- InfMCD with ANA	M7: InfVL- StMCD with ANA	M8: StVL- InfMCD with ANA
<b>Log-likelihood</b>	-684.12	-666.10	-684.38	-667.63
<b>AIC/n</b>	0.147	0.143	0.147	0.144
<b>Parameters' significance level</b>	All attributes are significant	Time to train station, rent and lease is not significant	All attributes are significant	Time to train station, rent and lease is not significant

- This finding suggests that when inferring VL and MCD (particularly MCD), there is a statistically significant effect on the parameter estimates and the significance level of otherwise important attributes.



## WILLINGNESS TO PAY ESTIMATES

### Median willingness to pay estimates (AUD\$)

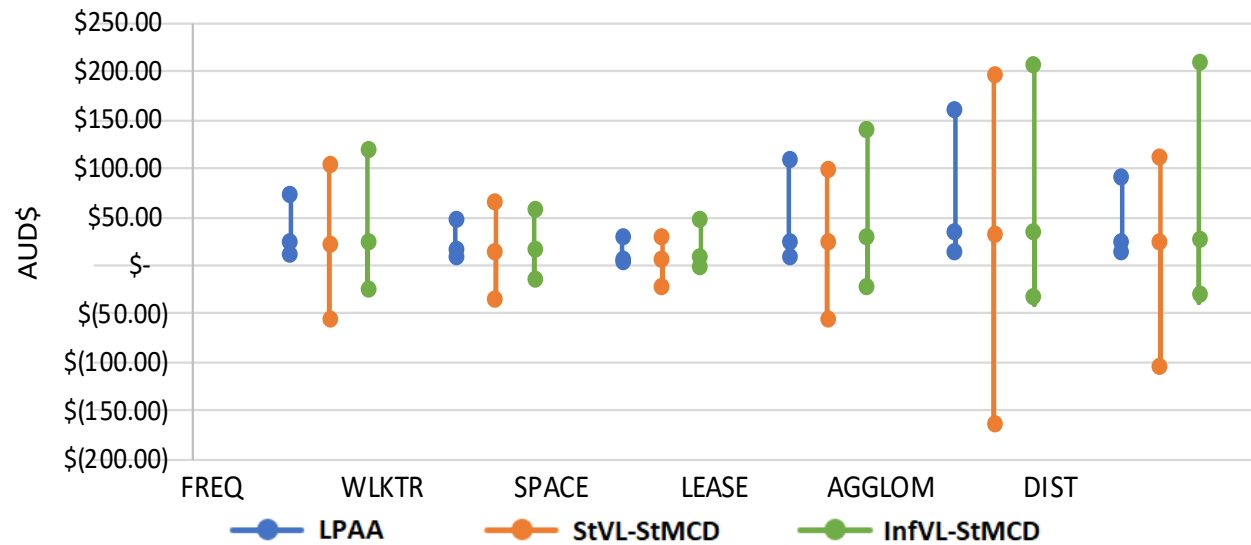
How much a respondent is willing to pay (AUD\$) relative to rental price per square metre for	LPAA with ANA	StVL-StMCD with ANA	InfVL-StMCD with ANA
A decrease in public transport headway by 1 minute	\$22.06	\$21.57	\$22.80
A decrease in walking time to the closest rail station by 1 minute	\$15.34	\$13.94	\$14.42
An increase in the amount of office space by 10 square metres	\$6.35	\$6.22	\$6.84
A decrease in the lease commitment by 1 year	\$24.02	\$23.72	\$26.94
A decrease in agglomeration by 1 business around their local area	\$34.33	\$30.10	\$32.29
A decrease in the distance to a current location by 1 kms	\$22.83	\$24.14	\$26.02

*WUOL*



# WILLINGNESS TO PAY ESTIMATES

Median willingness to pay estimates (AUD\$) with confidence intervals





## CONCLUSION

- This paper investigates the behavioural and welfare implications of incorporating multiple process strategies in choice models through the inclusion of additional information provided by respondents on how they processed the choice tasks shown to them in the stated choice experiment
- The results showed that ANA was statistically significant when eliciting preferences, suggesting that individuals are aware of the attributes they are ignoring



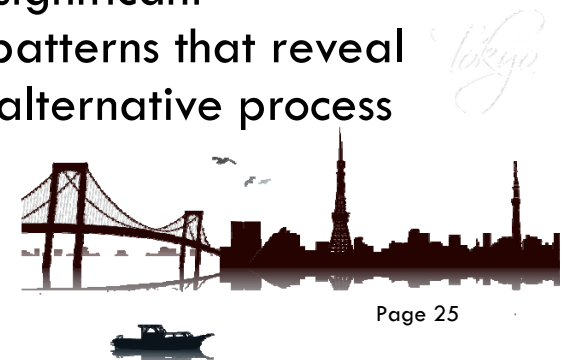
## CONCLUSION

- The results show an improvement in the parameters' significance level when considering individuals use the heuristics they said they had used (stated multiple heuristics) instead of inferring them (inferred multiple heuristics)
- When comparing the results of using stated or inferred ANA, the model results were similar. This is an interesting result which shows that assuming everyone might use MCD significantly biases the results, but assuming everyone might use VL (despite their responses) does not have such a strong influence on the model results
- The three preferred models in terms of goodness of fit and parameter significance levels were the LPAA, StVL-StMCD, and InfVL-StMCD.



## CONCLUSION

- The WTP estimates derived from the LPAA model were statistically equivalent to the ones derived from the Stated multiple heuristics model
- However, the median WTP for all the attributes was slightly lower in the multiple heuristics models and the confidence intervals were higher than in the LPAA model
- This suggests that even though there are no statistically significant differences between the two models, there are certain patterns that reveal an important influence associated with including stated alternative process strategies



## CONCLUSION

- This paper presents interesting findings that suggest that asking respondents for additional information on the process strategies used and including these responses in the models, provides a way of building our understanding of decision-making in the context of business location decisions
- The results provide new insights that can be used in cost-benefit analyses when assessing transport projects, which traditionally do not consider business location impacts



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