How are residential property values affected by the announcement, construction and operation of transport projects? A case study of rail projects in Sydney, Australia

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INTRODUCTION

- New public transport projects are expensive and long lived and their financing provides challenges for governments all over the world
  - led to interest in capturing increases in land values following increased accessibility for finance
  - But understanding when and by how much value uplift occurs is a pre-requisite to ‘capturing’ uplift
  - focus is on the unobserved value uplift as part of the residential price uplift that cannot be explained by the property or neighbourhood variables, nor by the improvement in accessibility
  - The modelling aims to identify the timing of value uplift – is it announcement, start of the building or start of the operation.

PROJECTS

Three projects are included in this study:

1. **Metro** Northwest project

2. **Light rail** extension from Dulwich Hill to the Inner West of Sydney (Dulwich project)

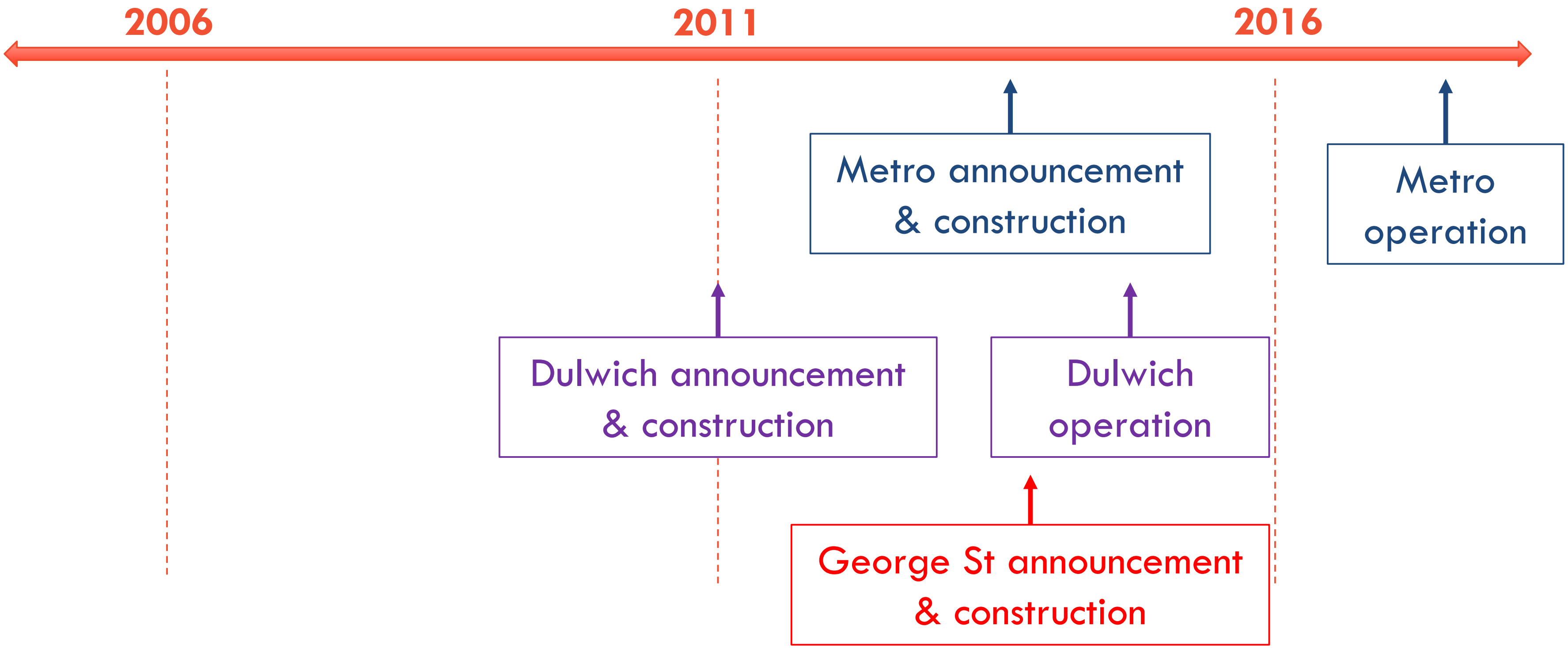
3. CBD and South East **Light Rail** in Sydney (George St project)

DATA DESCRIPTION

This study uses data from several sources in Sydney for years 2006, 2011 and 2016:

- Residential property sales: sale prices and property characteristics (e.g., number of bedrooms, parking)
- Census data by Statistical Area Level 1 (SA1): neighbourhood characteristics
- Network information: distance to important public transport services, and others (e.g., distance to beaches)

DATA DESCRIPTION



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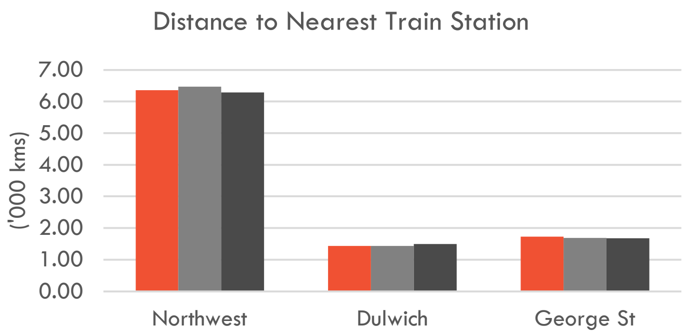
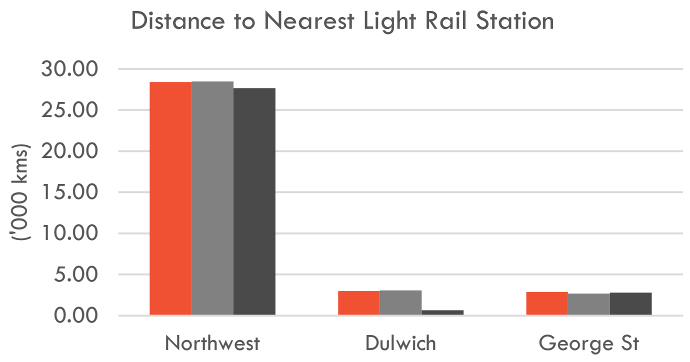
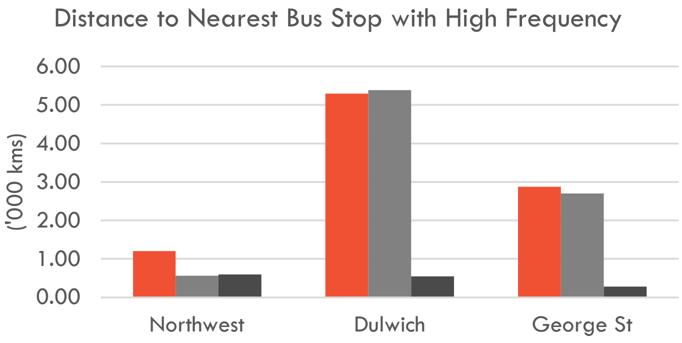
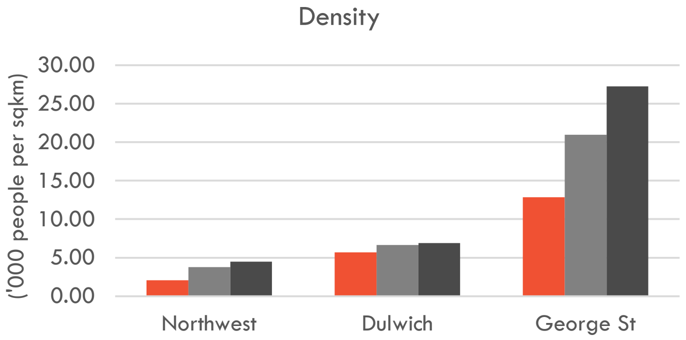








■ 2006 ■ 2011 ■ 2016

METHODOLOGY

- Multilevel models are estimated that take into account the dependence of the properties that belong to the same neighbourhood

- Dependent variable is the residential property sales price

- The explanatory variables are property attributes, neighbourhood attributes and accessibility attributes

- The modelling approach compares the treated or catchment area, defined as those properties directly affected by the public transport project, with a control area, which has similar characteristics to the catchment area, but is not affected by the project

METHODOLOGY

Catchment area is defined as the area within 800m of the stations (Mulley & Tsai, 2016; Yen et al., 2018)

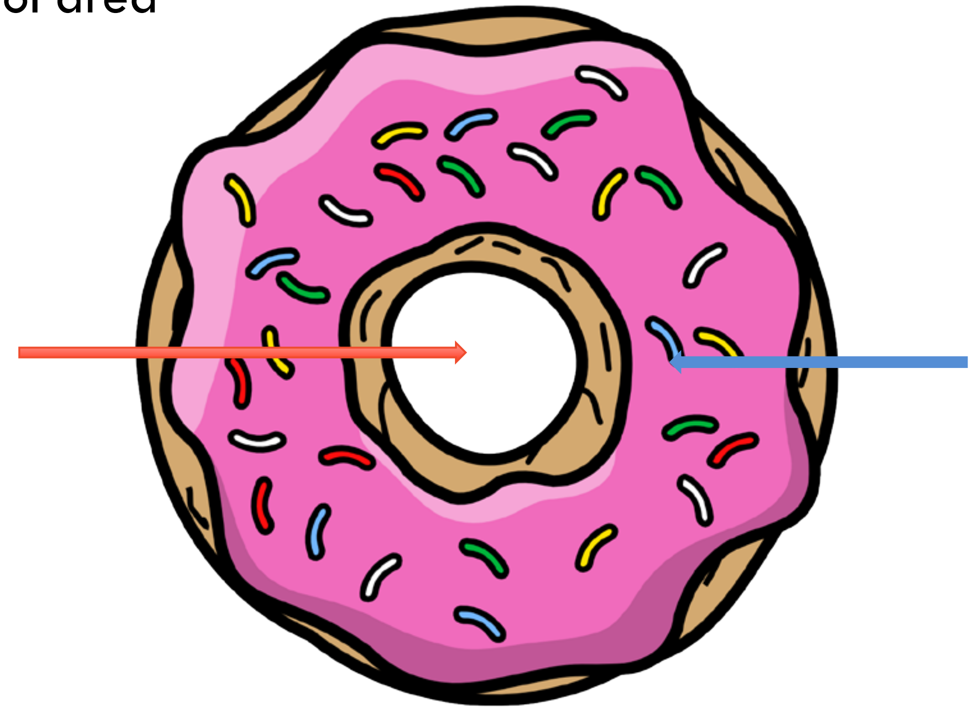
What about the **control area**?

1. Doughnut control area
2. Propensity score matching algorithm
   a. Nearest neighbour
   b. Optimal matching
   c. Genetic matching

METHODOLOGY

Doughnut control area

Catchment area



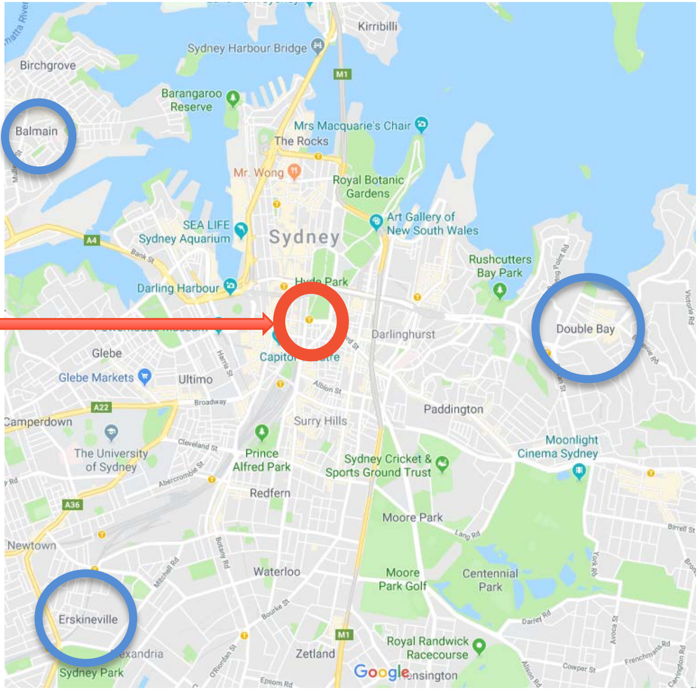
Doughnut is the control area, which is defined between 801m and 1600m from the station

METHODOLOGY

Propensity score matching

– Estimates a model to obtain a propensity score used to identify control area

Catchment area



Control areas are SA1 with similar characteristics to the catchment area according to the propensity score model

METHODOLOGY

Propensity score matching algorithm

a. **Nearest neighbour:** match is based on the closest propensity score to each treated observation

b. **Optimal matching:** similar to the above but it maximises the global match quality

c. **Genetic matching:** it also maximises the global match quality, but the method is different in that it minimises a weighted distance on covariate between treated and untreated cases

RESULTS

Number of households (SA1s) in the control and catchment areas for each project

	NW		Dulwich		George St	
	Control	Catchment	Control	Catchment	Control	Catchment
Doughnut control area	2355 (196)	873 (76)	2923 (191)	2083 (124)	5148 (268)	4173 (220)
Nearest neighbour	1462 (72)	873 (76)	2542 (118)	2083 (124)	3556 (148)	3796 (201)
Optimal Matching	1465 (76)	873 (76)	2641 (124)	2083 (124)	4972 (220)	4173 (220)
Genetic Matching	909 (56)	873 (76)	1295 (79)	2083 (124)	2011 (76)	4173 (220)

RESULTS

Value uplift induced by the **announcement** and **construction** relative to the base year (year 2006)

		Doughnut control area	Nearest neighbour (log)	Optimal matching	Genetic matching
Northwest (2016)	Within 400m	7.2%	-	-	-
	401-800m	8.4%	6.4%	4.9%	8.5%
Dulwich (2011)	Within 100m	-	-	-	-
	101-400m	5.9%	5.5%	3.6%	4.6%
	401-800m	4.1%	3.9%	-	3.2%
George St (2016)	Within 100m	18.9%	16.3%	18.5%	13.5%
	101-400m	7.5%	4.5%	7.8%	-
	401-800m	5.9%	5.8%	7.9%	-

Note: ‘-‘ represents those parameters not statistically different from zero with 95% confidence level

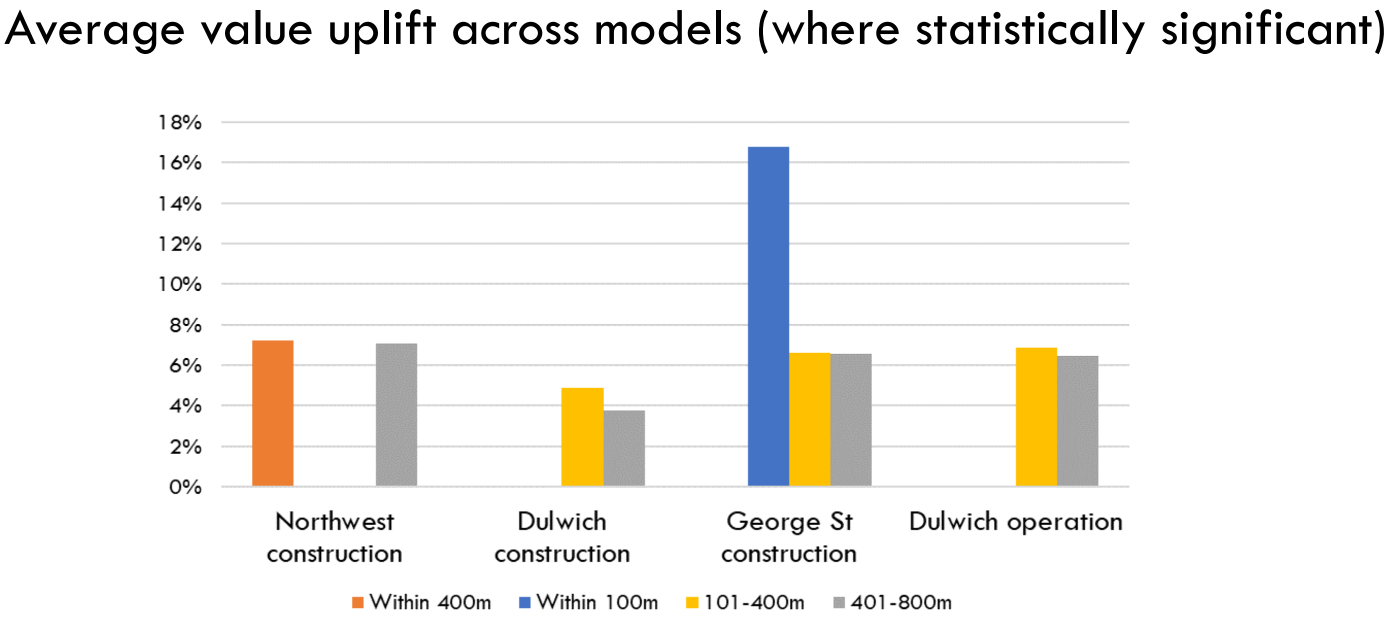
RESULTS

Value uplift induced by the **operation** of Dulwich project relative to the announcement and construction period (year 2011)

		Doughnut control area	Nearest neighbour (log)	Optimal matching	Genetic matching
Dulwich (2016)	Within 100m	-	-	-	-
	101-400m	-1.9%	4.7%	3.7%	1.3%
	401-800m	-	4.2%	6.1%	2.0%

Note: '-' represents those parameters not statistically different from zero with 95% confidence level

RESULTS – AVERAGE ACROSS PROJECTS AND MODELS



CONCLUSION

– This paper explores potential value uplift from three different public transport investments in the single context of Sydney, Australia using a common methodology

– The results show - despite controlling for location and method - quite different results for uplift

– In terms of timing, this paper shows uplift does vary over the periods concerned

CONCLUSION

- If the purpose of understanding land value uplift is to underpin a transparent value capture policy, this paper shows that such a task is not easy as predicting uplift appears to be dependent on more than **mode, context** and **method**

- For the future, research on control area definition needs more work. The fact that there is no ideal control area definition, as shown by this paper, is problematic

- Research needs to consider whether a more accessibility focussed control area matching might be an improvement given the way in which it is accessibility that drives the value uplift.

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RESULTS

	Y = ln (Price)	Doughnut control area	Nearest neighbour	Optimal matching	Genetic matching
George St project	R^2 (MVP)	0.821	0.815	0.802	0.817
	Number of households	8142	6639	8223	5519
	Number of SA1s	440	347	440	305
Northwest project	R^2 (MVP)	0.816	0.813	0.812	0.820
	Number of households	3204	2314	2324	1773
	Number of SA1s	223	148	152	132
Dulwich project	R^2 (MVP)	0.860	0.798	0.867	0.859
	Number of households	4500	4220	4397	3037
	Number of SA1s	280	241	247	202

- The total explained variance measure presented is the one proposed by LaHuis et al. (2014), which is referred to as R^2 (MVP).
- Given that the sample sizes are different for each model (given by the control area definition method), the R^2 are not directly comparable