

Agglomeration Economy Benefits of Public Transit Improvements

*Application of the Venables model to the Auckland Central
Connector and the Central Rail Loop*

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Two approaches to urban transport modelling:

Top Down (transport planners' approach)

- Start with exogenous population/jobs forecast
- Gives numbers of CBD commuters
- Then figure out how they will get there (mode choice)
- And figure out time savings from a PT innovation

Bottom Up (microeconomists' approach)

- model everything as choice+constraints based

Example: Modelling for CBA of Auckland Central Rail Loop

Auckland Transport's "Business Case"

- Stats NZ population etc forecasts
- Rail loop would "remove around 15million car kilometres from the network"
- then toss in 22,000 additional CBD workers from "placemaking" benefits

Criticised by Treasury: "no established theoretical base"

--> We will supply that theoretical base => no cars removed from the network!

Tony Venables' (2007) JTEP model

Powerful model: takes a little bit of theory a very long way (*too far...?*)

Identifies three key "market failures" affecting the city

- 1. Agglomeration Economies in the CBD (positive productivity externalities from larger CBD workforce)*
- 2. Tax wedge because commuting costs not tax deductible*
- 3. Congestion negative externalities in the commuting peak period*

[model not picked up in the literature....*why*]

Ask and answer these questions...

1. Why would anyone living (as most do) in the suburbs want to endure the hassle of commuting rather than work closer to home?

-- *because wages are higher in the CBD (from AEs)*

2. OK, so why doesn't everyone work in the CBD?

-- *because of those commuting costs*

3. Well, why doesn't everyone work and live in or near the CBD?

-- *because land prices adjust to soak up all the rents*

Agglomeration economies develop further when PT innovations lower CBD commuting costs

PT innovation makes commuting cheaper

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graph TD; A[PT innovation makes commuting cheaper] --> B[More workers are willing to commute]; B --> C[CBD employment increases]; C --> D[Agglomeration economies develop]; D --> E[Productivity increases]; E --> F[Wage premium in CBD rises]; F --> B;
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More workers are willing to commute

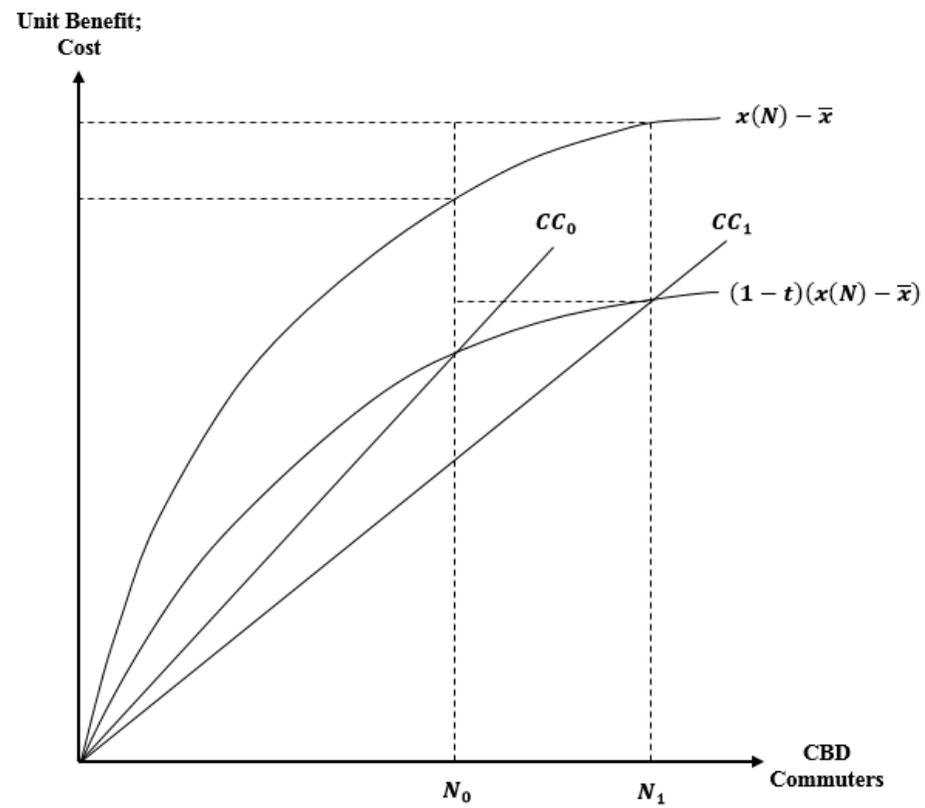
Wage premium in CBD rises

CBD employment increases

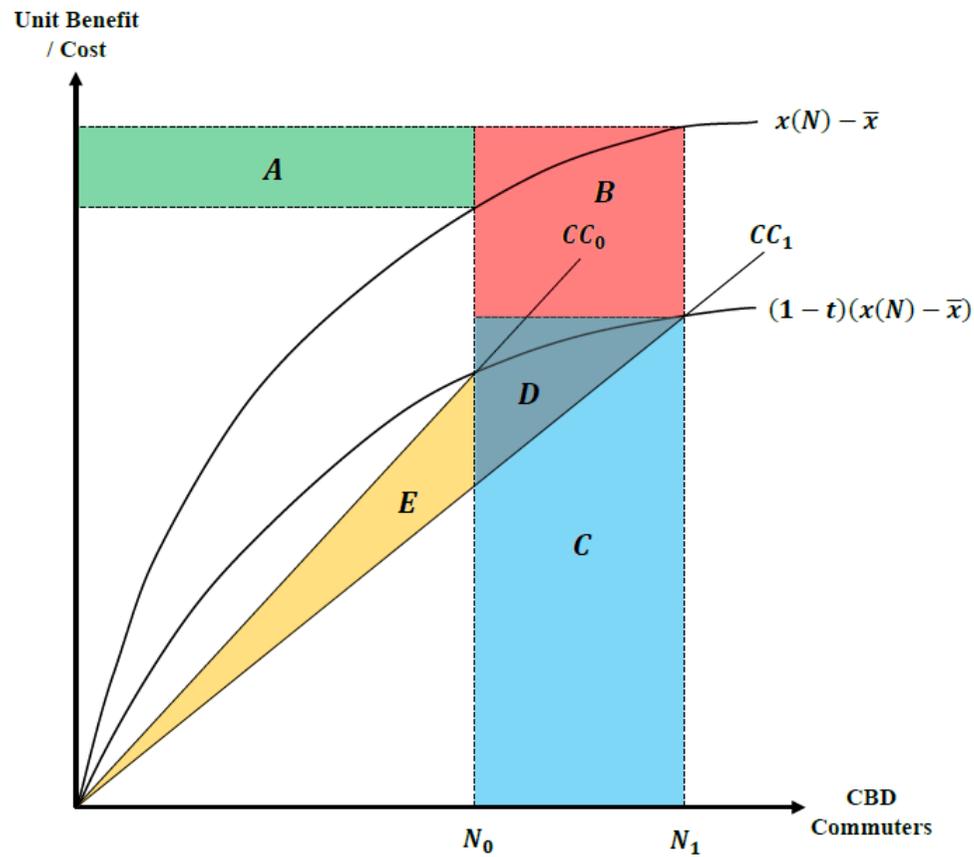
Productivity increases

Agglomeration economies develop

The basic model



The normative implications



Case Study 1: Central Connector

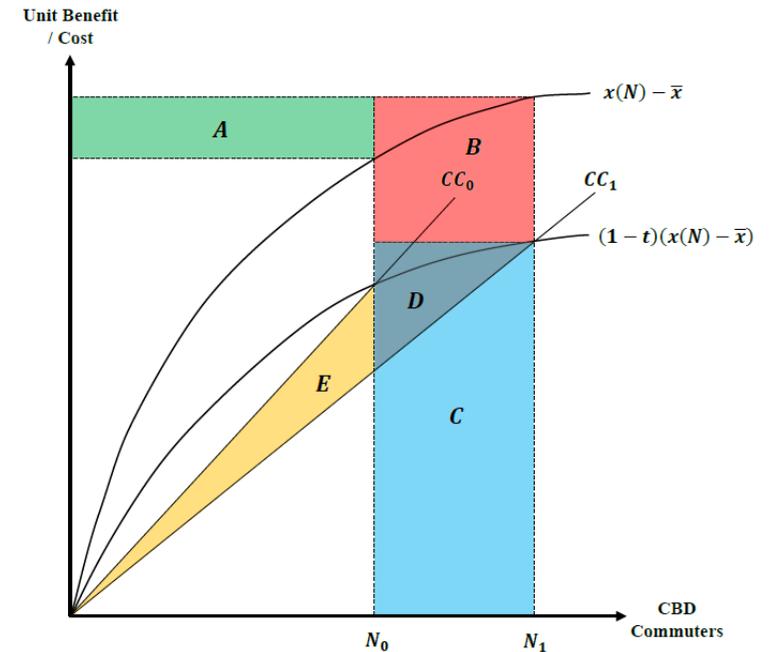
- The Central Connector is a system of inter-linked bus lanes along the Newmarket-CBD corridor, traversing Symonds Street
- It utilised existing roads, many with existing bus lanes, and Grafton Bridge
 - Led to shorter and faster PT trips
 - Led to slightly slower PV trips
- Total cost of ~\$28million NPV with a BCR of ~2



HAZLEDINE SPREADSHEET MODEL Version 6
(CENTRAL CONNECTOR) 261011

Implementing the Venables model for an improvement in Public Transit

	period 0 (base)	period 1 (after change)	graph- ical
value of additional output from existing commuters, \$millions/ year		0.17	A
value of additional tax revenues from new commuters, \$millions/ year		2.73	B
travel cost savings of existing commuters, \$millions/year		2.56	E
net benefit to new commuters, \$millions/year		0.14	D
net value additional output, indirectly affected commuters, \$millions/year		0.40	
total efficiency gains, \$millions/year		6.00	
travel cost of the marginal (nth) commuter, daily, \$	43.70	43.75	MTC
income tax rate	0.33	0.33	t
daily productivity (wage) premium, \$	65.22	65.29	
daily after tax net CBD premium, \$	43.70	43.75	
non-wage CBD worker utility factor	1.00		
		0.00	0
number of trips per work day	2.00		
number of workdays per year	230.00		
annual outside-option wage, \$	60000.00	60000.0	
CBD wage premium ratio	0.25	0.25	
directly affected CBD commuting workers, 000s, N	10.00	10.55	1.055
indirectly affected CBD commuting workers, 000s, U	70.00	70.06	
commuting mode share Public Transit	0.60	0.70	



Case Study 2: Central Rail Loop

Turns the downtown Britomart terminal into a transit stop/adds two more central train stops/loops back to the existing South/East/West light rail network

→ *More than doubles the number of trains per hour that can go through Britomart (trains every 5 minutes in peak periods)*

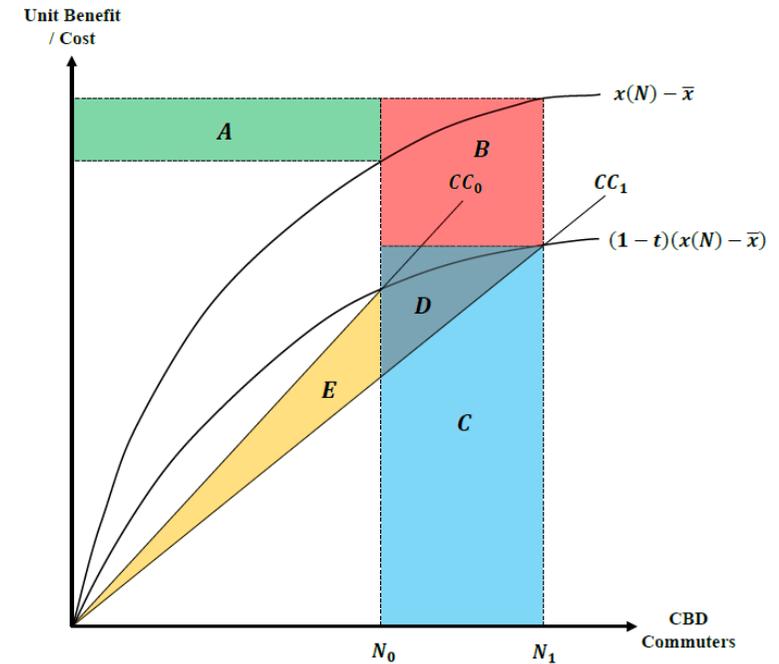


CRL route

CENTRAL RAIL LOOP MODEL 270315

Implementing the Venables model for an improvement in public transit

	period 0 (base)	period 1 (after change)	graphical
value of additional output from existing commuters, \$millions/year		13.42	A
value of additional tax revenues from new commuters, \$millions/year		46.16	B
travel cost savings of existing road commuters, \$millions/year		-1.18	E
net benefit to new road commuters, \$millions/year		0.01	D
net value additional output, unaffected road commuters, \$millions/year		0.00	
change in rail passengers' consumer surplus, \$millions/year		8.97	
total efficiency gains, \$millions/year		67.38	
travel cost of the marginal (nth) road commuter, daily, \$	40.2	40.50	MTC
income tax rate	0.33	0.33	t
daily productivity (wage) premium, \$	60	60.45	
daily after tax net CBD premium, \$	40.2	40.50	
non-wage CBD worker utility factor	1		
alternative commuters, 000s	32.95336518	32.95	
rail commuters, 000s	16.975976	25.95	
number of trips per work day	2		
number of workdays per year	250		
annual outside-option wage, \$	60000	60000.00	
CBD wage premium ratio	0.25	0.25	
directly affected CBD road-commuting workers, 000s, N	70	70.29	
unaffected CBD road-commuting workers, 000s, U	0	0.00	
total CBD commuters	119.9293412	129.19	



conclusions

Bottom-up approach gives significantly different predictions

And, significantly different sources of benefits

Not a CBA, but a useful component of a CBA

Limitations?