

Partners: DfT,
DoH, DCLG,
WWCW

How commuting influences personal wellbeing over time

Ben Clark, Kiron Chatterjee, Adrian Davis, Adam
Martin

Panel data

- Numerous UK panel datasets
 - e.g. BHPS and Understanding Society
- Other international examples
 - e.g. German Socio-Economic Panel
 - U.S. Panel Study of Income Dynamics
- Key features of the data
 - Large sample sizes
 - The same individuals followed for long time periods
 - Individuals are nested in households
 - Wide ranging variables on multiple aspects of life
 - Nationally representative
 - Geographic identifiers for linkage to other data

Research opportunities

- Many existing studies have used primary data
 - Secondary data appears to be an underutilised resource
- Can support more advanced analytical techniques which are necessary for dealing with endogeneity or confounding
 - Fixed effects models (assuming that unobserved heterogeneity is constant over time)
 - Exogenous shocks
- Large samples of individuals who used relatively underused travel modes, e.g. bus and bike
- Of course, there are also limitations and disadvantages!

Martin et al. 2014

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Does active commuting improve psychological wellbeing? Longitudinal evidence from eighteen waves of the British Household Panel Survey



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ABSTRACT

Objective. The aim of this study is to explore the relationship between active travel and psychological wellbeing.

Method. This study used data on 17,985 adult commuters in eighteen waves of the British Household Panel Survey (1991/2–2008/9). Fixed effects regression models were used to investigate how (i.) travel mode choice, (ii.) commuting time, and (iii.) switching to active travel impacted on overall psychological wellbeing and how (iv.) travel mode choice impacted on specific psychological symptoms included in the General Health Questionnaire.

Results. After accounting for changes in individual-level socioeconomic characteristics and potential confounding variables relating to work, residence and health, significant associations were observed between overall psychological wellbeing (on a 36-point Likert scale) and (i.) active travel (0.185, 95% CI: 0.048 to 0.321) and public transport (0.195, 95% CI: 0.035 to 0.355) when compared to car travel, (ii.) time spent (per 10 minute change) walking (0.083, 95% CI: 0.003 to 0.163) and driving (−0.033, 95% CI: −0.064 to −0.001), and (iii.) switching from car travel to active travel (0.479, 95% CI: 0.199 to 0.758). Active travel was also associated with reductions in the odds of experiencing two specific psychological symptoms when compared to car travel.

Conclusion. The positive psychological wellbeing effects identified in this study should be considered in cost-benefit assessments of interventions seeking to promote active travel.

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Introduction

Regular, moderate-intensity physical activity can contribute to reductions in the risk of over twenty chronic health conditions (Biddle and Mutrie, 2007; Humphreys et al., 2014; WHO, 2010). Whilst frequent physical activity is predictive of higher psychological wellbeing (Anokye et al., 2012; Bize et al., 2007; Cerin et al., 2009; Hamer et al., 2009; Teychenne et al., 2008), an increasingly important indicator used by Governments at the national level (Blanchflower and Oswald

2010) and in activity-based travel demand models (Ettema et al., 2010). These models focus not only on individual trips, where time savings alone are important, but seek to better understand how time is allocated across all trips and activities, allowing the impact on wellbeing of various interrelated factors such as travel patterns, urban form, and time use to be examined concurrently (Abou-Zeid and Ben-Akiva, 2012; Bhat and Koppelman, 1999; Bowman and Ben-Akiva, 2001; McFadden et al., 1977; Pinjari et al., 2011; Sallis et al., 2004).

Studies that examine the impact on wellbeing of active travel for res-

Martin et al. 2014

- Impact of commuting behaviour on wellbeing (mental distress) using individual-level fixed effects analyses
 - 18,000 commuters
 - 18 years of data since 1990/1
- Compared to driving, wellbeing was higher when using active travel or public transport
- Wellbeing increased with travel time for walkers, but decreased for drivers
 - Travel mode choice was more important than travel time
- Use of active travel reduced the likelihood of two specific psychological symptoms
 - Being unable to concentrate and constantly under strain

Outline

1. Data set and measures
2. Cross-sectional associations between commuting and wellbeing
3. Frequency of changes to commuting mode and duration
4. Effects of changing commute mode / duration on personal wellbeing
 - i. Short run
 - ii. Long run
5. Take home messages

Data set

- Understanding Society
 - 6-wave sample of English workers 2009-2015 (n~26,000)
- Analysis methods
 - Cross-sectional analysis (path models)
 - **Longitudinal analysis (panel models)**



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Measures

Commuting

Commute duration

About how much time does it usually take for you to get to work each day, door to door (in minutes)?

Commute mode

And how do you usually get to your place of work?

Personal wellbeing

Life satisfaction

How dissatisfied or satisfied are you with your life overall?

Strain

Have you recently felt constantly under strain?

Sat with leisure time availability

How dissatisfied or satisfied are you with the amount of leisure time you have?

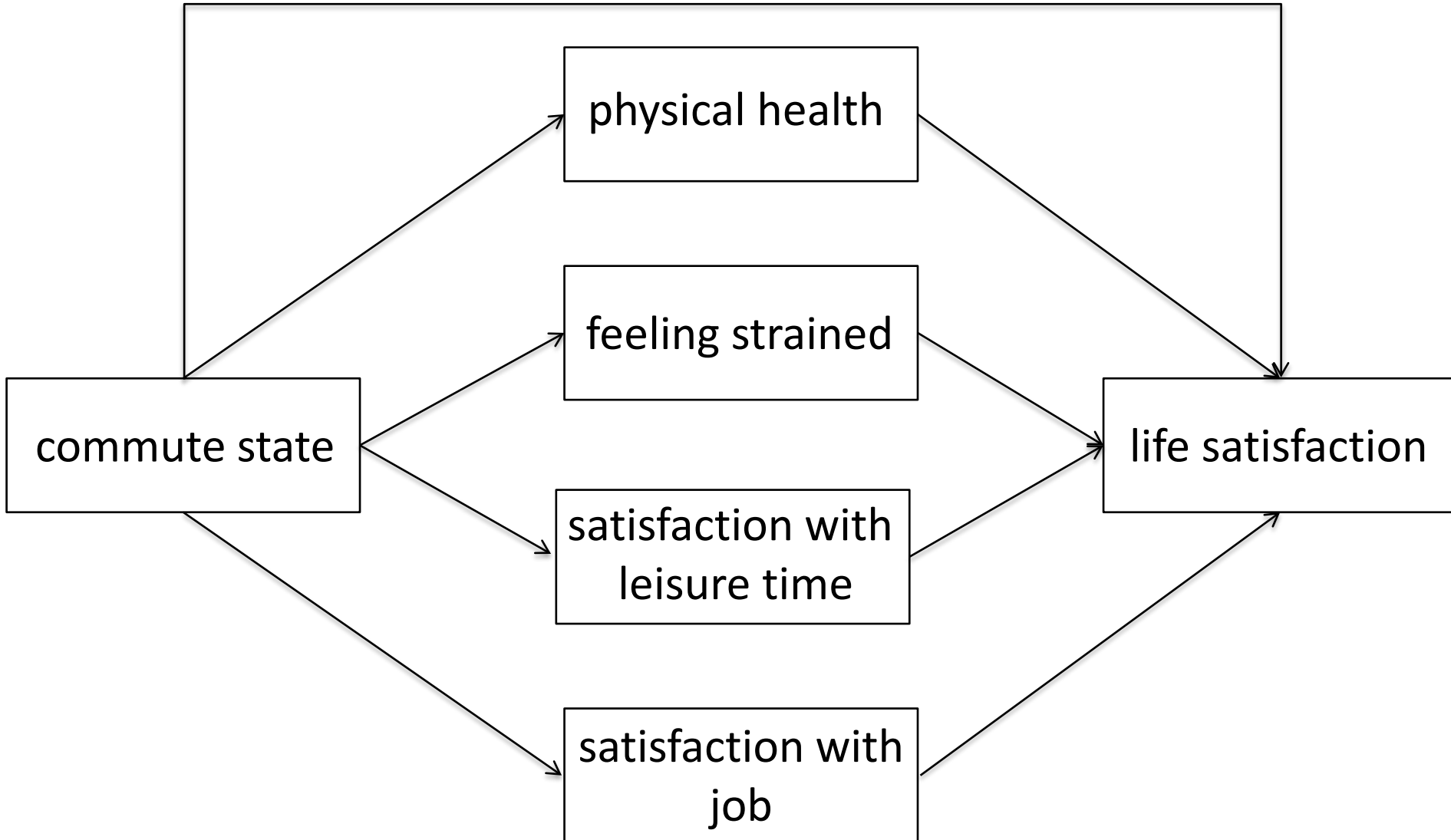
Job satisfaction

How satisfied or dissatisfied you are with your present job overall?

Self reported health

In general would you say your health is [good to poor]?

Theorised Relationships



Cross-sectional associations

Sample characteristics (wave 2)

Commute mode	Freq	%	Mean 1-way commute time (mins)
Car driver	10,460	62	24
Bus	1,136	7	40
Rail / metro	1,288	8	60
Cycle	578	3	21
Walk	2,121	13	16
Other	1,258	7	22
Total	16,841	100	27

Cross-sectional associations

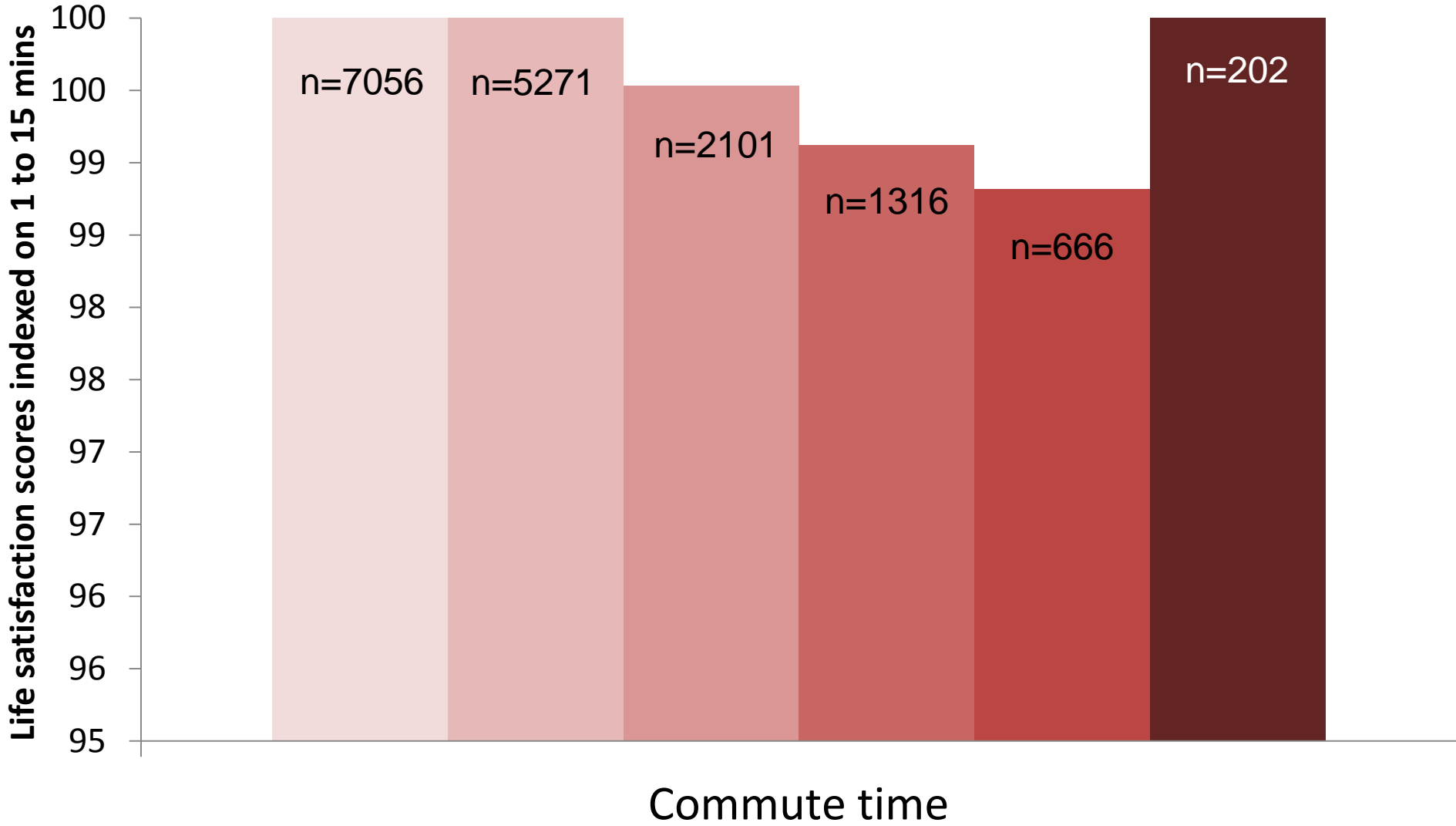
Do people with longer duration commutes report different personal wellbeing scores compared to people with shorter duration commutes?

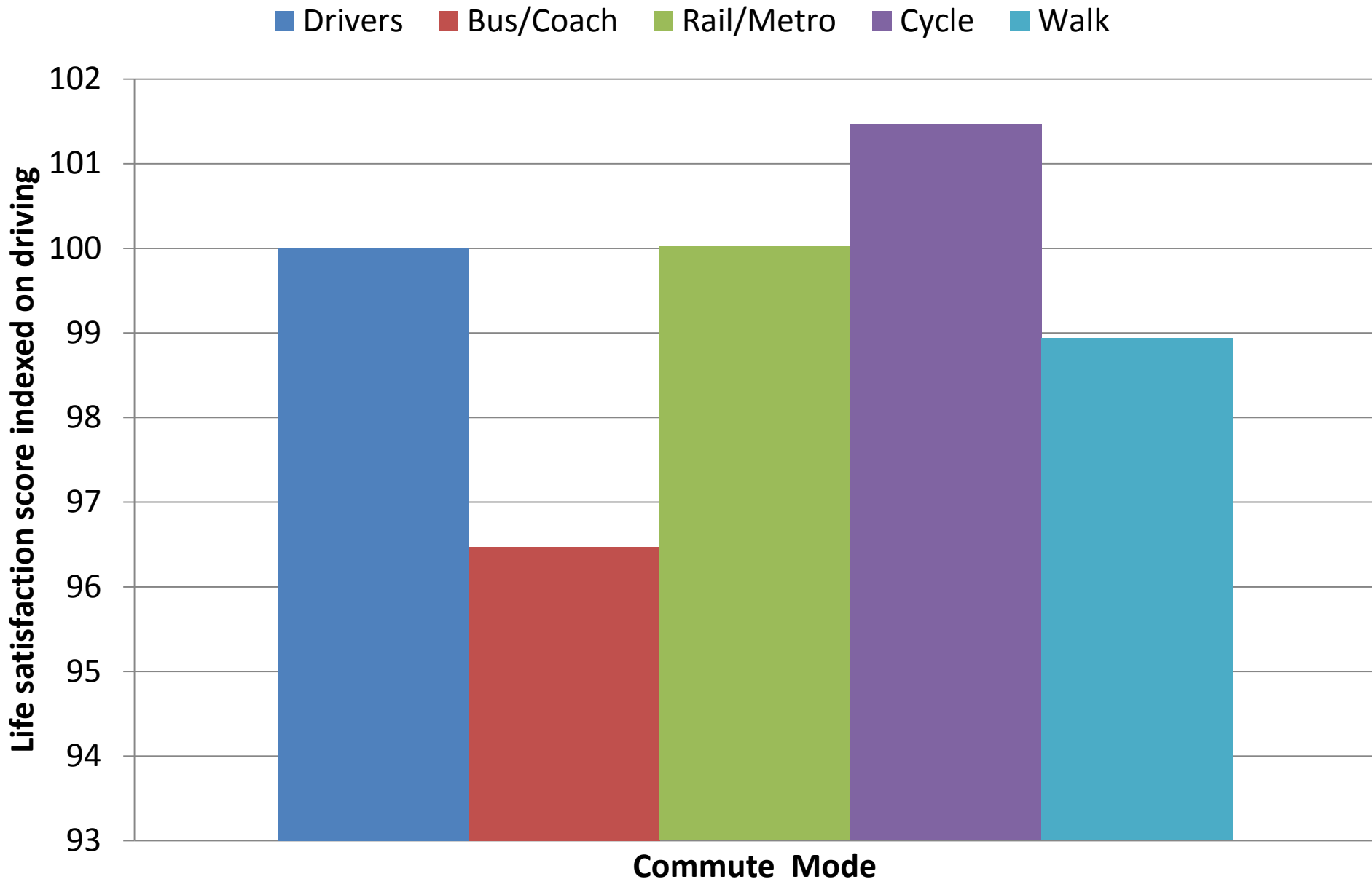
Yes

Do people that commute by different modes report different personal wellbeing scores?

Yes

1 to 15 mins 16 to 30 mins 31 to 45 mins
46 to 60 mins 61 to 90 mins 91 to 179 mins

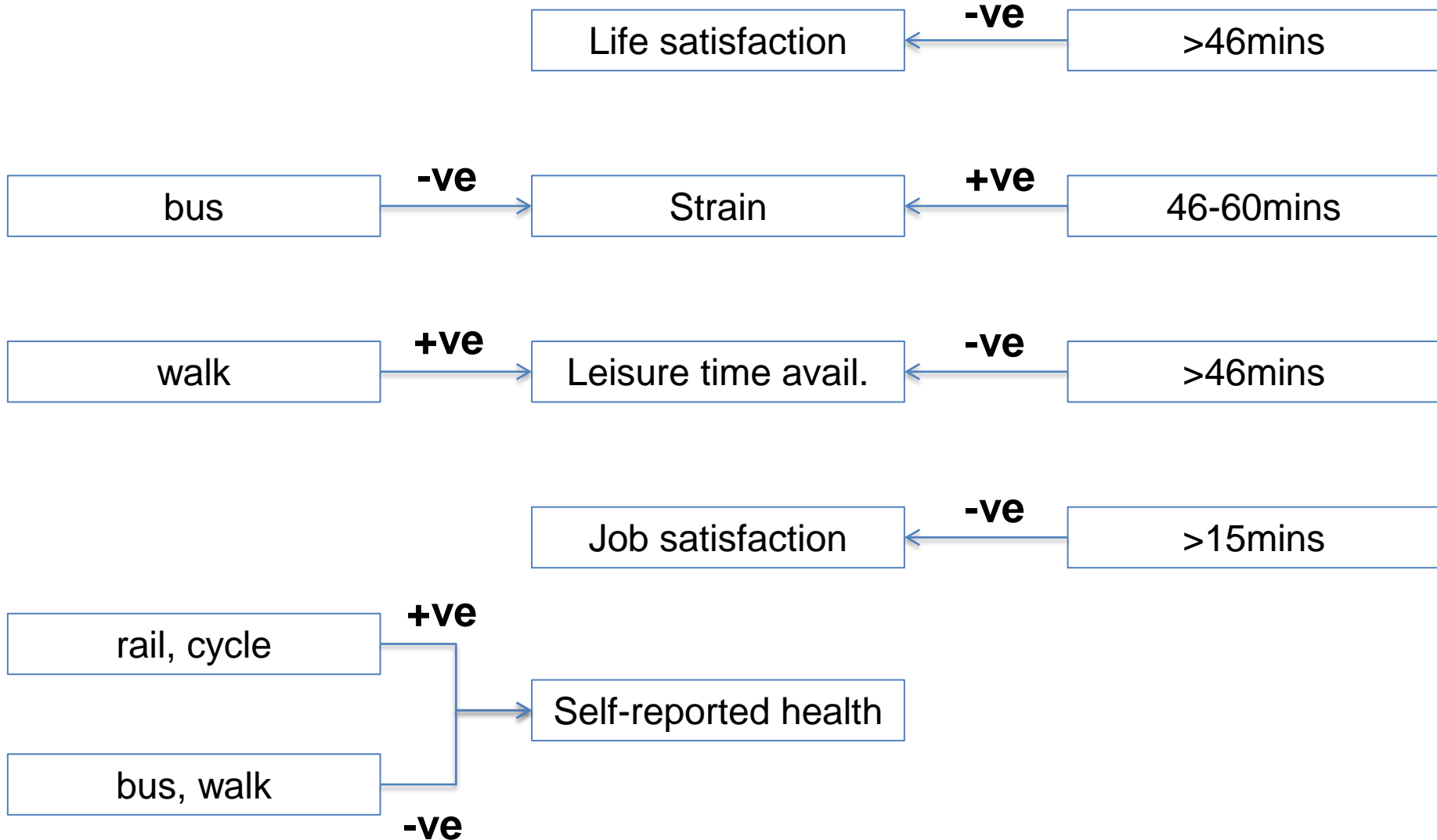




**Commute mode
[ref drive]**

Personal Wellbeing

**Commute duration
[ref 1-15mins]**



6-wave panel analysis

Benefits

- Examine variation in wellbeing scores *within individuals* over 6 observations
 - Eliminates spurious *between individual* associations with commuting arising from unobserved personal characteristics
- Identify what happens to personal wellbeing when the commuting situation *changes over time*
 - Short run: from one wave to the next (12 months)
 - Long run: Over a period of up to 6 years

Questions – Part 1

1. How frequent are changes to the **origin / destination** of the commute from one observation to the next?

Change in OD of the commute

	Freq	%
Changed employer / workplace	9,803	14
Moved to a new local area	5,571	8
Changed origin or destination	14,231	20
Total observations	70,249	100



Questions – Part 1

1. How frequent are changes to the **origin / destination** of the commute from one observation to the next?
2. How frequent are changes to **commute mode** from one observation to the next?

Change in commute mode

- 18% of observations involved a change in commute mode
- 12,443 out of 70,249 observations

	Base year mode								
Following obs mode	drive	bus	rail	cycle	walk	other	wfh	Total	Changed to
drive	35,956	459	420	305	901	1,124	1,036	40,201	4,245
bus	254	2,889	310	58	348	270	36	4,165	1,276
rail	481	299	4,053	68	148	137	151	5,337	1,284
cycle	258	71	59	1,504	184	80	24	2,180	676
walk	726	318	128	169	5,402	320	142	7,205	1,803
other	821	269	115	87	308	2,258	94	3,952	1,694
wfh	1,003	47	147	33	138	97	3,380	4,845	1,465
Prev year miss								2,364	
Total	39,499	4,352	5,232	2,224	7,429	4,286	4,863	70,249	12,443
Changed from	3,543	1,463	1,179	720	2,027	2,028	1,483		

Change in commute mode

Driving is:

- the most stable (unchanging) commute mode
- the most commonly preferred alternative commute mode

	Base year mode						
Following obs mode	drive	bus	rail	cycle	walk	other	wfh
drive	91.0%	10.5%	8.0%	13.7%	12.1%	26.2%	21.3%
bus	0.6%	66.4%	5.9%	2.6%	4.7%	6.3%	0.7%
rail	1.2%	6.9%	77.5%	3.1%	2.0%	3.2%	3.1%
cycle	0.7%	1.6%	1.1%	67.6%	2.5%	1.9%	0.5%
walk	1.8%	7.3%	2.4%	7.6%	72.7%	7.5%	2.9%
other	2.1%	6.2%	2.2%	3.9%	4.1%	52.7%	1.9%
wfh	2.5%	1.1%	2.8%	1.5%	1.9%	2.3%	69.5%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Changing from	9.0%	33.6%	22.5%	32.4%	27.3%	47.3%	30.5%

Questions – Part 1

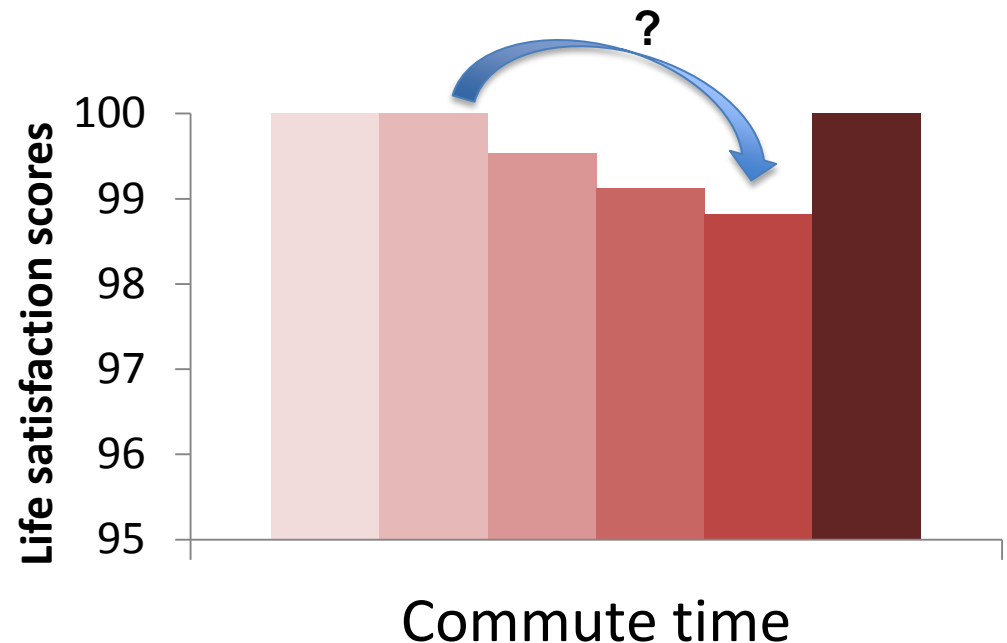
1. How frequent are changes to the **origin / destination** of the commute from one observation to the next?
2. How frequent are changes to **commute mode** from one observation to the next?
3. To what extent do **one-way commute durations** change from one observation to the next?

Change in commute duration

Change in commute duration for:	Mean wave to wave change (mins)	SD (mins)
Full sample	8.8	18.6
Those that changed OD	16.3	23.4
Those that changed mode & OD	22.6	30.1
Those with no change to OD / mode	6.0	15.6

Questions – Part 2

4. What is the effect of *changing* commute mode on personal wellbeing?
5. What is the effect of *changing* commute duration on personal wellbeing?



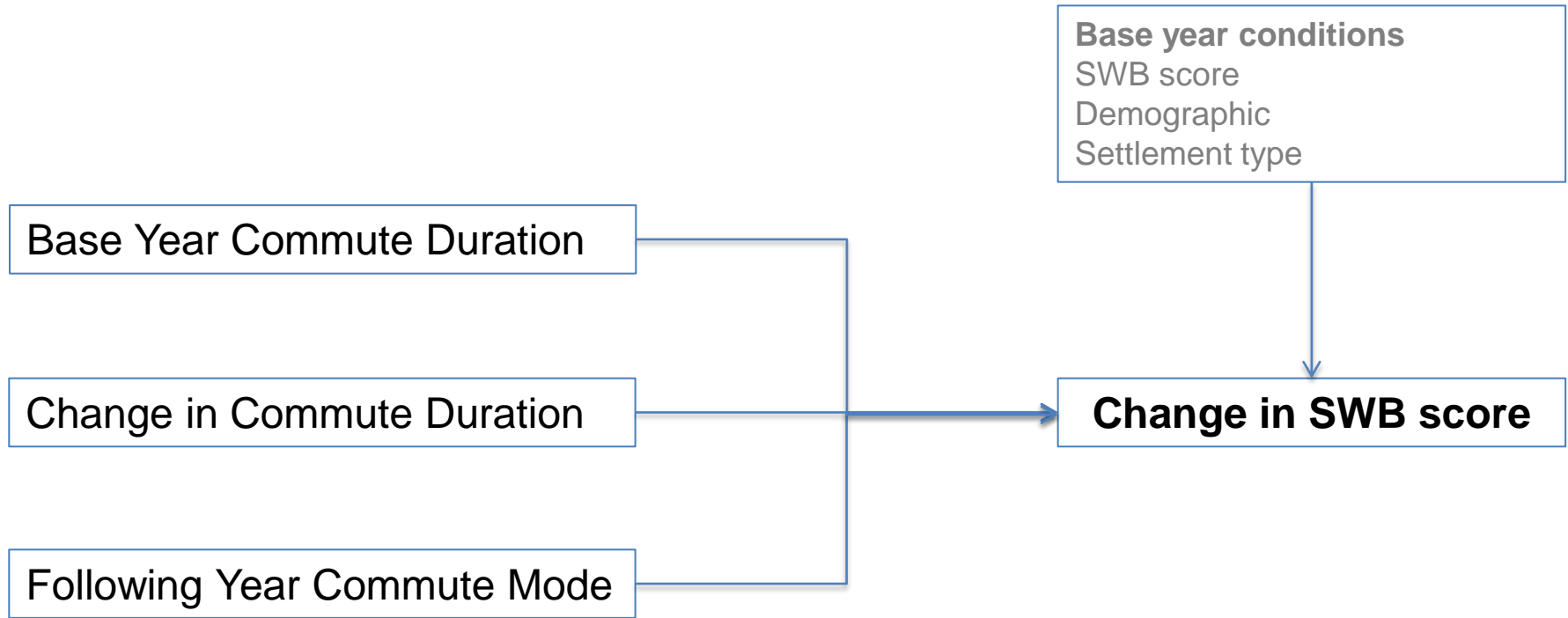
Panel modelling approach

Conditional change score models

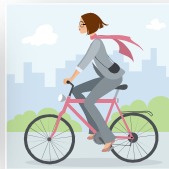
- designed to indicate how wellbeing changes when individuals change commute mode or duration **from one wave to the next**

Short Run Effects
(within a 12 month period)

Change score models (wave i to wave i+1)



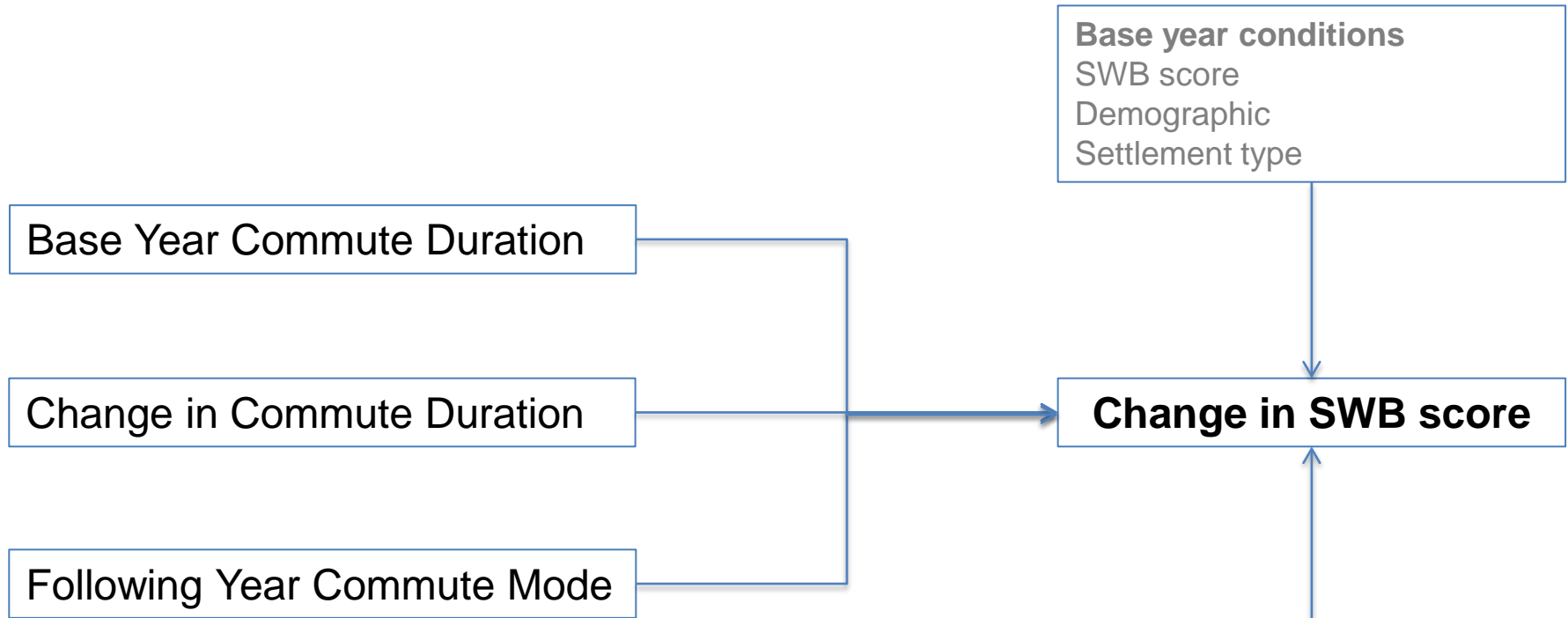
Base year modal subgroup



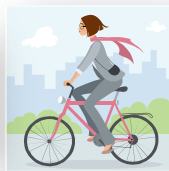
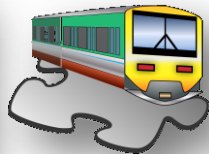
Control variables

- **Income**
 - **Management job**
- } compensators for commuting
- Age
 - Gender
 - Ethnicity
 - Education level
 - Live with a partner
 - Live with children
 - Working hours
 - Temporary job
 - Belong to a religion
 - Long standing health condition

Change score models (wave i to wave i+1)



Base year modal subgroup



What is the effect of ***changing*** commute mode on personal wellbeing?

What is the effect of ***changing*** commute mode on personal wellbeing?

Change in:	Drive to
Life satisfaction	rail -ve
Sat with leisure time	cycle +ve walk +ve
Job satisfaction	walk +ve
Strain	cycle -ve walk -ve
SR health	cycle +ve

What is the effect of ***changing*** commute mode on personal wellbeing?

Change in:	Drive to	Bus to
Life satisfaction	rail -ve	
Sat with leisure time	cycle +ve walk +ve	
Job satisfaction	walk +ve	
Strain	cycle -ve walk -ve	drive +ve
SR health	cycle +ve	

What is the effect of ***changing*** commute mode on personal wellbeing?

Change in:	Drive to	Bus to	Rail to
Life satisfaction	rail -ve		
Sat with leisure time	cycle +ve walk +ve		
Job satisfaction	walk +ve		drive +ve
Strain	cycle -ve walk -ve	drive +ve	
SR health	cycle +ve		

What is the effect of ***changing*** commute mode on personal wellbeing?

Change in:	Drive to	Bus to	Rail to	Cycle to
Life satisfaction	rail -ve			
Sat with leisure time	cycle +ve walk +ve			
Job satisfaction	walk +ve		drive +ve	
Strain	cycle -ve walk -ve	drive +ve		rail +ve
SR health	cycle +ve			

What is the effect of *changing* commute mode on personal wellbeing?

Change in:	Drive to	Bus to	Rail to	Cycle to	Walk to
Life satisfaction	rail -ve				drive +ve
Sat with leisure time	cycle +ve walk +ve				
Job satisfaction	walk +ve		drive +ve		drive +ve
Strain	cycle -ve walk -ve	drive +ve		rail +ve	bus +ve
SR health	cycle +ve				

What is the effect of *changing* commute mode on personal wellbeing?

Change in:	Drive to	Bus to	Rail to	Cycle to	Walk to
Life satisfaction	rail -ve				drive +ve
Sat with leisure time	cycle +ve walk +ve				
Job satisfaction	walk +ve		drive +ve		drive +ve
Strain	cycle -ve walk -ve	drive +ve		rail +ve	bus +ve
SR health	cycle +ve				

Commute mode: Summary

What is the effect of *changing commute mode* on personal wellbeing?

Key observations:

- Switches from driving to walking / cycling are linked to:
 - An uplift in sat. with leisure time availability
 - An uplift in job satisfaction
 - A reduction in strain
 - An uplift in SR-health for cycling
- The modal switches are not symmetrical e.g.
 - Switching from walking to driving is also linked to an uplift in job satisfaction

What are the effects of **longer / lengthening commute durations** on personal wellbeing?

What are the effects of **longer / lengthening commute durations** on personal wellbeing?

	Drive		Bus		Rail		Cycle		Walk	
Change in:	Base year	Change	Base year	Change	Base year	Change	Base year	Change	Base year	Change
Life satisfaction				-ve						
Sat with leisure time	-ve	-ve	-ve	-ve	-ve	-ve			-ve	
Job satisfaction	-ve	-ve							-ve	
Strain	+ve									
SR health							+ve			

What are the effects of **longer / lengthening commute durations** on personal wellbeing?

	Drive		Bus		Rail		Cycle		Walk	
Change in:	Base year	Change	Base year	Change	Base year	Change	Base year	Change	Base year	Change
Life satisfaction				-ve						
Sat with leisure time	-ve	-ve	-ve	-ve	-ve	-ve			-ve	
Job satisfaction	-ve	-ve							-ve	
Strain	+ve									
SR health							+ve			

What are the effects of **longer / lengthening commute durations** on personal wellbeing?

	Drive		Bus		Rail		Cycle		Walk	
Change in:	Base year	Change	Base year	Change	Base year	Change	Base year	Change	Base year	Change
Life satisfaction				-ve						
Sat with leisure time	-ve	-ve	-ve	-ve	-ve	-ve			-ve	
Job satisfaction	-ve	-ve							-ve	
Strain	+ve									
SR health							+ve			

Commute duration:

Key observations

For drivers

Lengthening commutes / longer duration base year commutes are linked to:

- Reduced satisfaction with leisure time availability
- Reduced job satisfaction
- Increased strain (base year effect)

For users of motorised mode (drive, bus, rail)

Lengthening commutes / longer duration base year commutes are linked to:

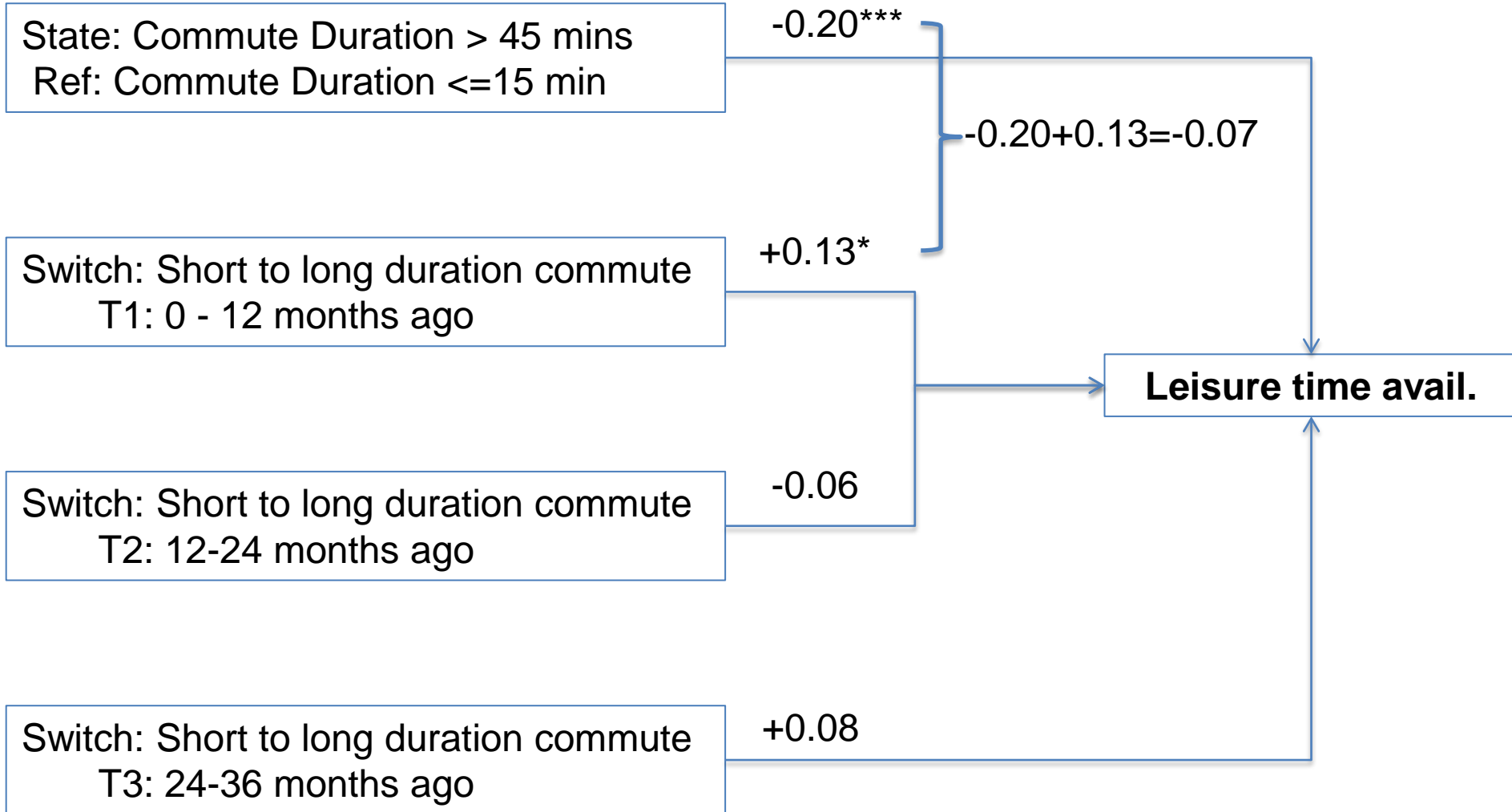
- Reduced satisfaction with leisure time availability

Outline

1. Data set and measures
2. Cross-sectional associations between commuting and wellbeing
3. Frequency of changes to commuting state
4. Effects of changing commuting state on personal wellbeing
 - i. Short run
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5. Take home messages

How does **starting a long duration commute** affect wellbeing over the longer term?

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Sig level: 99%^{***}, 95%^{**}, 90%^{*}

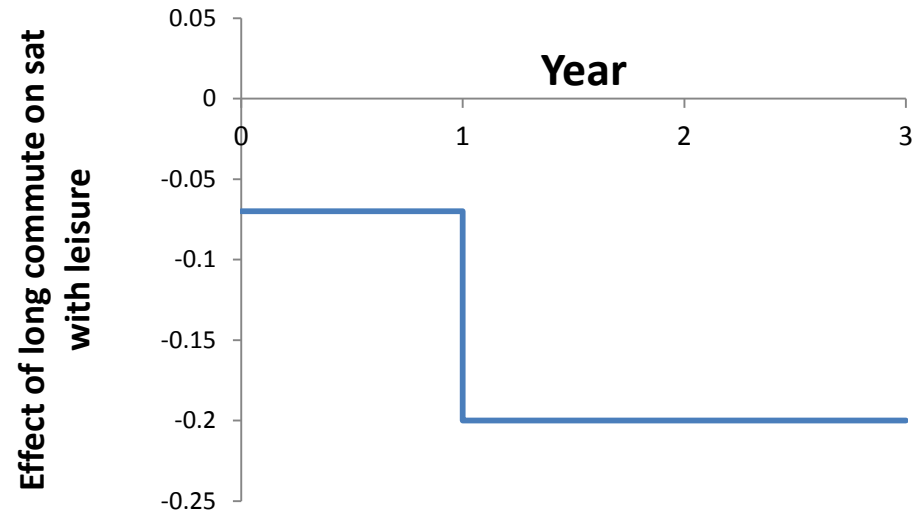
How does **starting a long duration commute** affect wellbeing over the longer term?

Implications

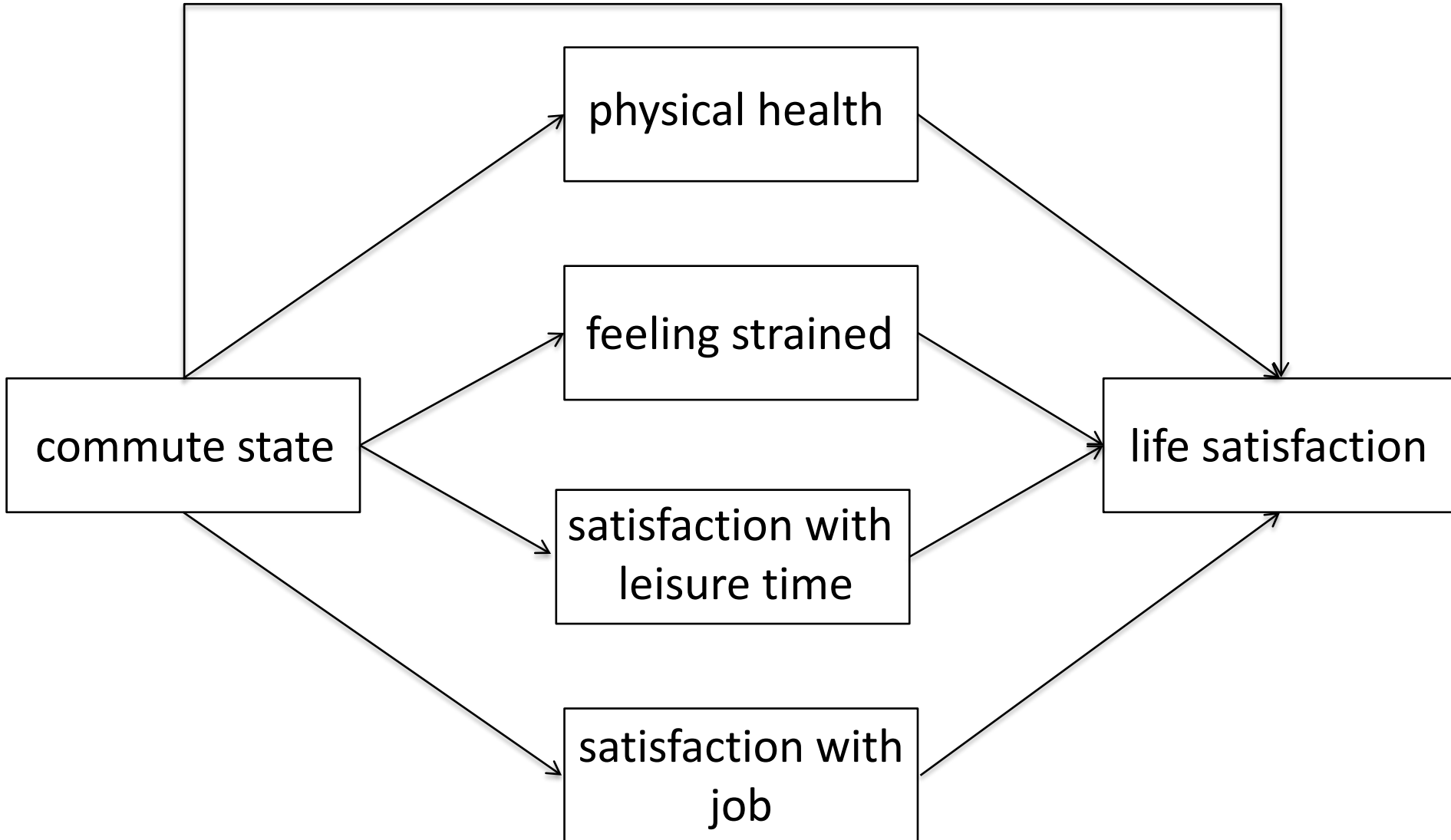
- Long duration commutes are linked to lower satisfaction with leisure time availability (in any period)

Dynamics

- The full negative effect of *starting* a long duration commute takes over 12 months to kick in
- It then stays the same...



Take home messages



Take home messages : Findings

- Changing commute mode / duration does not (strongly) influence overall life satisfaction
- But there are influences on the sub-domains of wellbeing, e.g.:
- Switches from driving to walking / cycling are linked to:
 - Increased sat. with leisure time availability
 - Reduced strain
 - Increased job satisfaction
 - Increased SR-health for cycling
- Longer / lengthening commute durations are linked to:
 - Reduced satisfaction with leisure time availability (drive, bus, rail)
 - Increased strain (drive)
 - Reduced job satisfaction (drive)
- Emerging evidence that the size of effect alters over the long run

Take home messages : Methods

- Panel models offer valuable insights into how wellbeing alters in response to changing commute mode / time
- Informative to build understanding using a range of analytical approaches (cross-sectional, panel models)
- There are limitations in how quantitative panel models can
 - represent complex long run effects
 - explain mechanisms

Further work

- Do the commute duration / mode relationships vary by e.g. gender, age group, income distribution?
- Feedback loops - Do people with low life satisfaction move home / job to improve their wellbeing?