

# Do rising rents lead to longer commutes? A gravity model of commuting flows in Ireland

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## *Three trends in Ireland:*

- 1 Urban sprawl:** urban expansion, scattered use of land & low-density population structure (Ahrens & Lyons, 2018)
- 2 Commuting:** Average commuting times in Ireland have increased from 23.7 to 27.3min/journey over 2006-16 (+3.6min).
- 3 House price and rent rise in Ireland:** +42.7% increase in rents from 2012Q1 to 2018Q1 ([RTB rent index](#)).

**Research question:** can rents help explain the increase in commuting times?

## Environmental

- Compact cities are associated with lower travel times & lower GHG emissions; higher GHG emissions in suburbs (Glaeser and Kahn, 2010; Tol et al., 2009)
- Bi-directional relationship: Demand for long-distance commuting can lead to dispersed low-density urban structures.

## Mental & physical health

- Possible negative effects of commuting time on self-reported well-being and mental health (Stutzer and Frey, 2008; Dickerson et al., 2014; Künn-Nelen, 2016)
  - effects stronger for women according to Künn-Nelen (2016).
- Exposure to air pollutants has health effects, e.g. cardiovascular diseases, asthma & bronchitis risk (Kim et al., 2015; Achakulwisut et al., 2019)

## Monetary, social & time cost

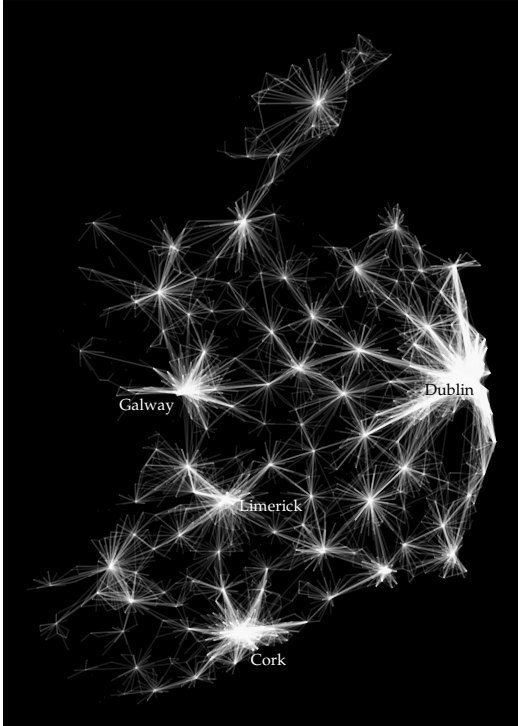
## Commuting flows:

- CSO's *Place of Work, School and College* (POWSCAR)
- Access to Census years 2006, 2011 and 2016
- For each worker, we have place of residence ('origin'), workplace ('destination'), journey minutes, as well as age, sex, etc.
- Aggregated to the level of Electoral Divisions (3,409 in Ireland), which yields ED-to-ED commuting flows.

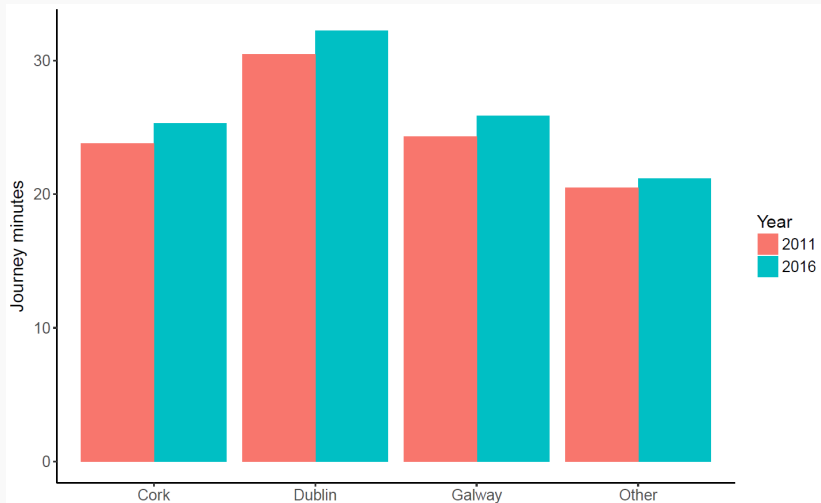
## Rental prices:

- Register of tenancy agreements from the *Residential Tenancies Board*
- We calculate ED avg rents for 2007-2011, 2012-2016
- Various property characteristics (e.g. number of rooms); 80% observations with Eircodes

Complemented by **socio-economic variables** from the Small Area Population Statistics.



Average one-way journey minutes have increased from 25.9 to 27.3min nationally (+1.4min) from 2011 to 2016.



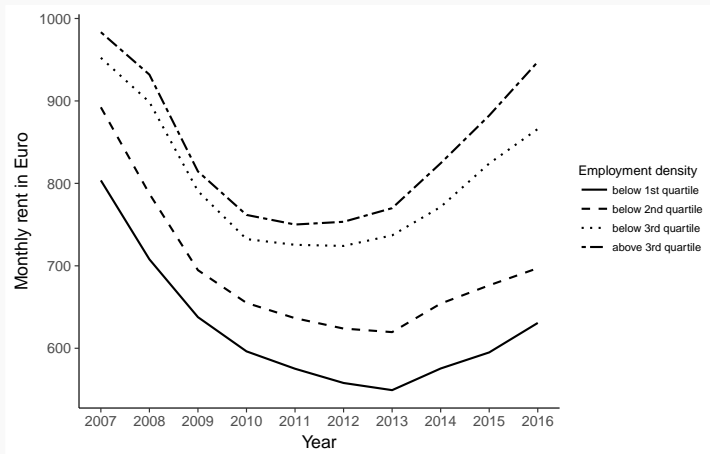


Figure 2: Time-series graph of average rents grouped by employment density quartile.

Assumption from monocentric city model: unit housing costs decrease with distance from the city centre where most employment is located; costs of transport to centre highest for residents on periphery.

We expect the number of commuters between ED  $i$  ('origin'=place of residence) and  $j$  ('destination'=place of work) to depend on

$$\text{commuters}_{i \rightarrow j} = f(\text{distance}_{i \rightarrow j}, \text{rent}_i, \text{rent}_j, \dots)$$

*Ceteris paribus*, the number of commuters between  $i$  and  $j$  is expected to be higher, ...

- the closer  $i$  and  $j$  are to each other,
- the cheaper the rent in  $i$ ,
- the higher the rent in and around  $j$ .



- Choice of origin and destination may be taken simultaneously
- So we opt for a form of *gravity model*
- Probability of choosing a given origin and destination pair is a function of commuter, origin and destination characteristics
- O-D characteristics include relatively fixed attributes (e.g. the distance between them, neighborhood attributes), and time-varying characteristics (e.g. rents)
- Robustness tests used to address specific issues: many possible confounding factors are correlated with one another and there is overdispersion in the dependent variable

Gravity panel model:

## Extended model

$$\pi_{ij,t} = f(r_{i,t}, r_{j,t}) + \mathbf{x}'_{i,t}\boldsymbol{\theta} + \mathbf{x}'_{j,t}\boldsymbol{\delta} + \mathbf{w}'_{ij,t}\boldsymbol{\gamma} + \mu_{ij} + \varepsilon_{ij,t}$$

Control variables at origin and destination include:

- property characteristics (e.g. number of floors, type of property)
- job and population density
- socio-economic & demographic variables (e.g. industry, education, age profile)

We also estimate the model in first-differences, effectively removing effects of all factors that do not vary over time.

$$f(r_{it}, r_{jt}) = \beta_1 r_{it} + \beta_2 r_{jt} \quad (\text{additive})$$

$$f(r_{it}, r_{jt}) = \alpha(r_{jt} - r_{it}) \quad (\text{rental differential})$$

The rent differential goes up if

- (a) the rent at place of work  $j$  (e.g. city centre of Dublin) rises,
- (b) the rent at place of residence  $i$  (e.g. Dublin commuter belt) falls.

We expect that the number of commuters from  $i$  to  $j$  to increase as the rent differential goes up, i.e.,  $\alpha > 0$ . Similarly, we expect  $\beta_1 < 0$  and  $\beta_2 > 0$ .

## Decompose change in journey minutes

National journey times have increased from 25.9 in 2011 to 27.3min in 2016 (+1.4min).

Two main factors can explain changes in commuting times:

- **Speed of travelling** from  $i$  to  $j$ : How long does it take to get from  $i$  to  $j$ ? Affected by congestion, mode of transport and infrastructure.
- **Residence-job decisions**: Where are  $i$  and  $j$ ? Affected by residence-job decision.

Conditional on origin-destination decisions, the rise in commuting times is +0.7min. That is, roughly half of the rise in commuting times is associated with location decisions.

- Pairs of EDs with a bigger differential in rents between origin and destination are more likely to be chosen; this association is significant in most models
- Scale of association varies depending upon the exact model used, but relatively inelastic; a 1% increase in rent differential assoc. with about 0.2-0.8% higher probability of a pair being chosen

## Illustrating strength of association between rent and commuting time

- Assume that the time it takes to get from  $i$  to  $j$  is fixed (i.e., no change in congestion, no improvements in infrastructure).
- And that there is a 10% increase in rents in the top quartile of EDs by employment density.
- For comparison, annual national rent growth for our sample was 8.2%.

Given our modelling results, such a 10% increase would be associated with:

- One way commuting times increased by 0.1-0.3 minutes in the national model
- One-way commuting times increased by 0.2-1.2 minutes in the Dublin model

## Based on preliminary modelling results

- 50% of rise in commuting from 2011 to 2016 is due to change in residence-job location decisions.
- A higher rent differential between two locations is associated with a higher commuting probability.
- Over the 5-year time horizon, effects are small, suggesting that commuters only adapt slowly.
- But findings are consistent with view that growth in urban rents is associated with sprawl

# Thank you



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