NEXT GEAR

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Shift2Rail

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Introduction

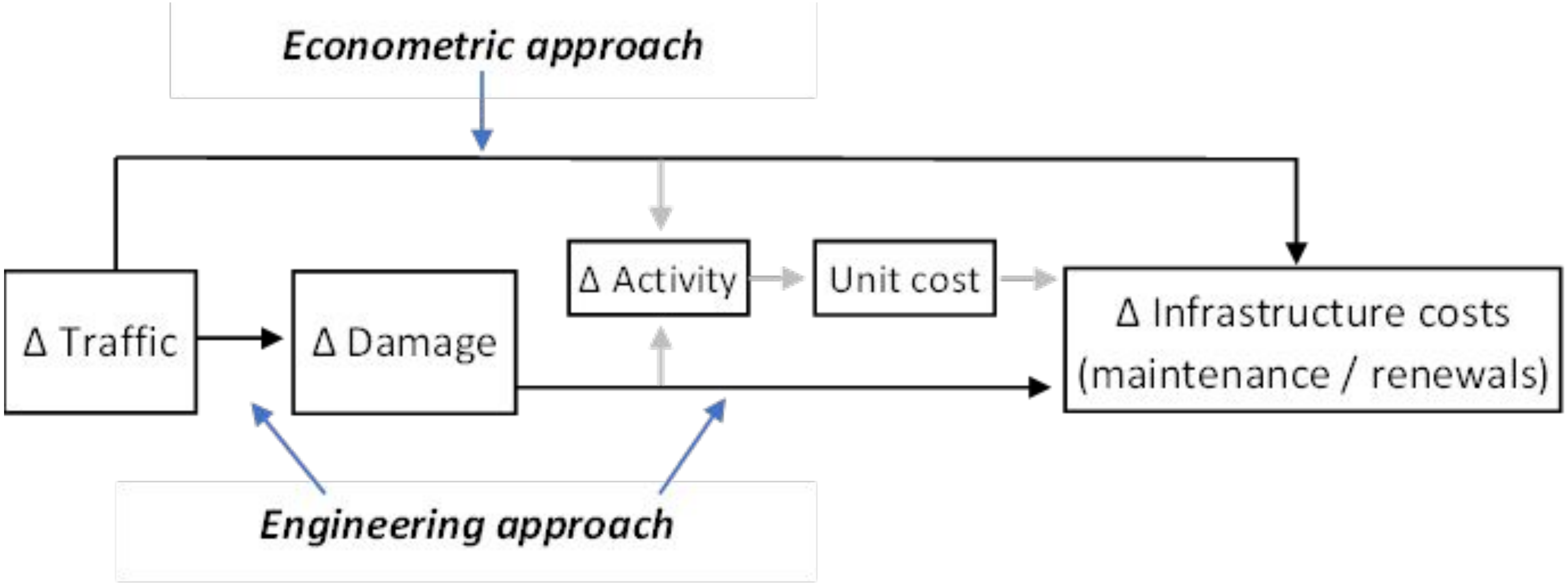
Background

- Variability of rail infrastructure costs with respect to traffic is key for level of track access charges
- Engineering and econometric techniques are two widely used (and permitted) methods – however, fundamentally different approaches and different results
- Variability of maintenance and renewals could be **25-45%** (econometric from EU country case studies) or **as low as 6%** (engineering approach in GB)

Aim of this presentation

- Compare **TU Graz's engineering method** with the **econometric method**
- Key here is that we can compare the two approaches using the same dataset – Austrian data – to draw new insights (preliminary findings)
- We also show some supporting results using French data

Overview of methods



Reasons why methods may produce different results

Hypothesis 1

1. *The difference in marginal cost (direct cost) estimates can (partly) be explained by the use of a representative track section(s) vs. "all" track sections on the network.*

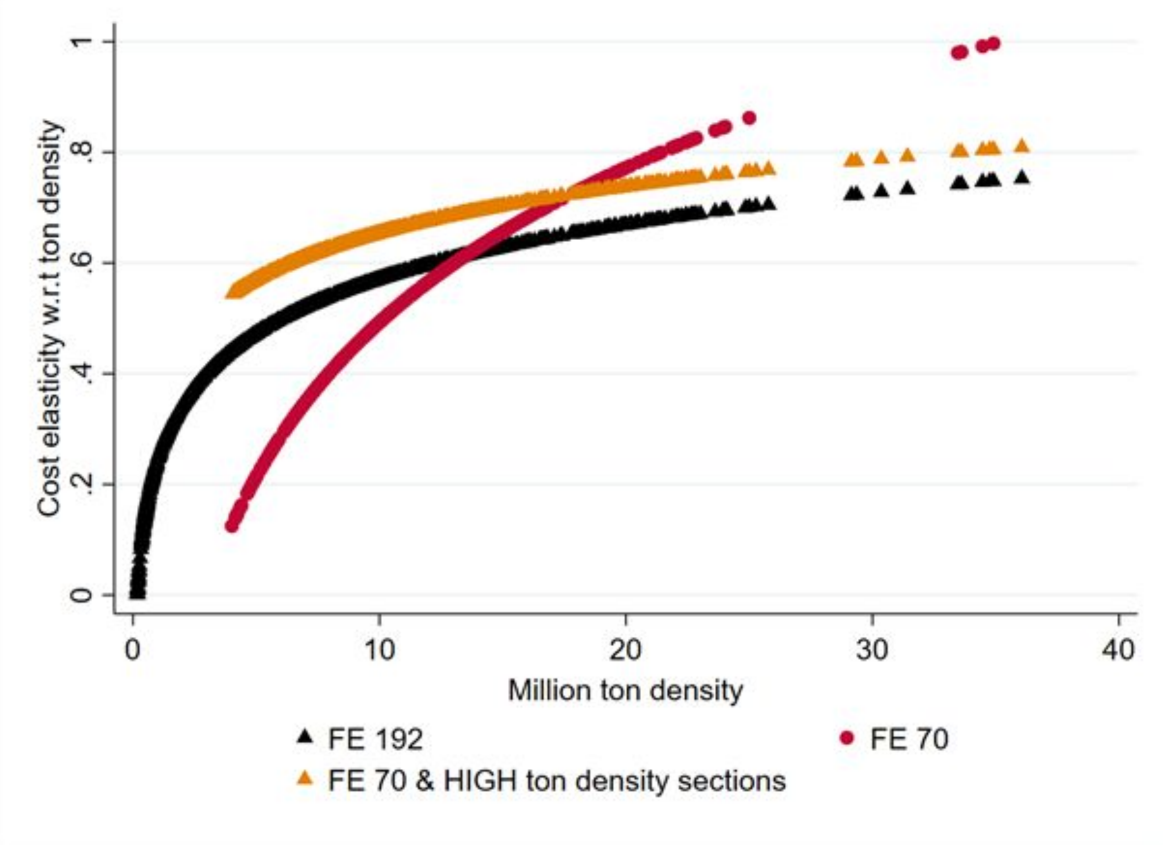
TU Graz approach focuses on <u>70 out of 192 track sections</u> (broadly can be seen as the higher loaded sections)

→ "Representative" track sections may imply smaller variation in traffic and maintenance costs less likely to capture effects on preventative maintenance regimes

Results: Hypothesis 1

Cost elasticities: $\frac{\partial ln(costs)}{\partial ln(ton\ density)} = \frac{Marginal\ cost}{Average\ cost}$

Cost variability



Note: There is a small number of negative elasticities (excl. from graph) which is common for very low ton density sections (extremes of the data set) in econometric models.

Results: Hypothesis 1

Marginal costs for different samples (Index: FE70=1.00)

Model	Number of observations	Weighted average
FE 70	420	1.00
FE 192	1142	1.22
FE 192 estimates for 70 sections	420	1.14

- In the econometric model using all the sections – which is the standard approach – **increases marginal cost (direct costs) by nearly a quarter**

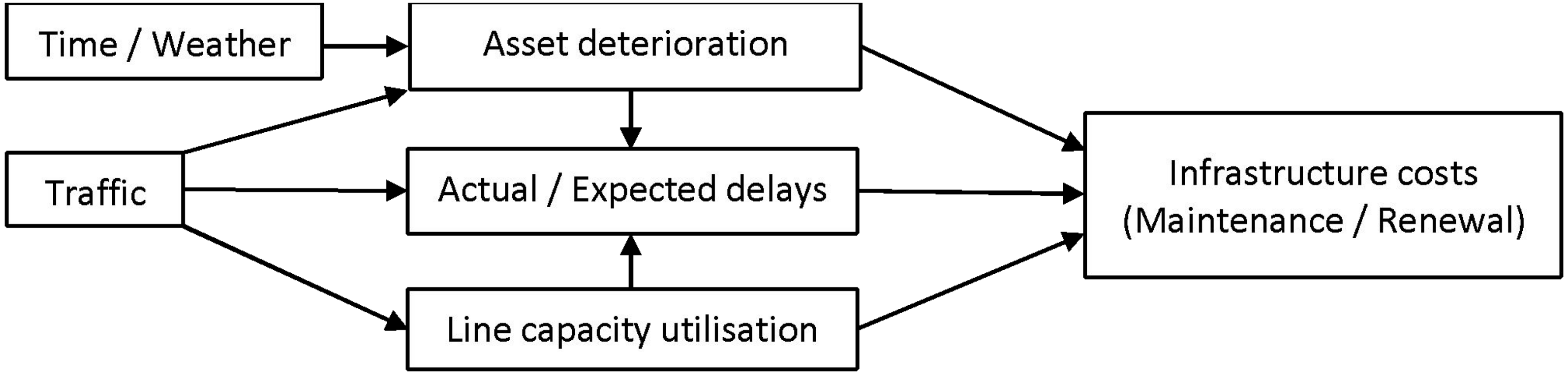
- Further work needed to compute marginal costs (direct costs) from engineering approach comparable with econometric approach for the Austrian data – **early indications are that the differences are smaller than previously thought however**

- **But sample selection seems to matter and explain part of the difference between econometric and engineering approaches**

Reasons why methods may produce different results

Hypothesis 2

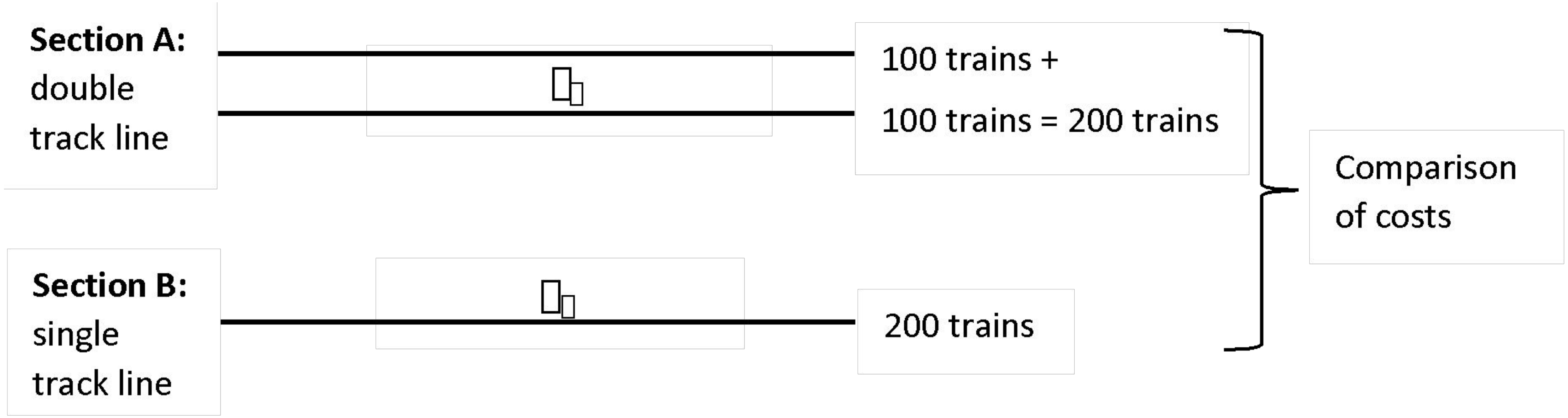
2. The econometric method includes costs **generated by traffic** but **not caused by asset damage from traffic**, which is not the case with the engineering method:
   a) Unit cost of doing work depends on how busy the network is (possessions access) and on scale of activity done (assumed constant in engineering model)
   b) Econometric method takes account of costs for activities carried out to mitigate delay costs when traffic increases, even though there is no extra asset damage caused by traffic.



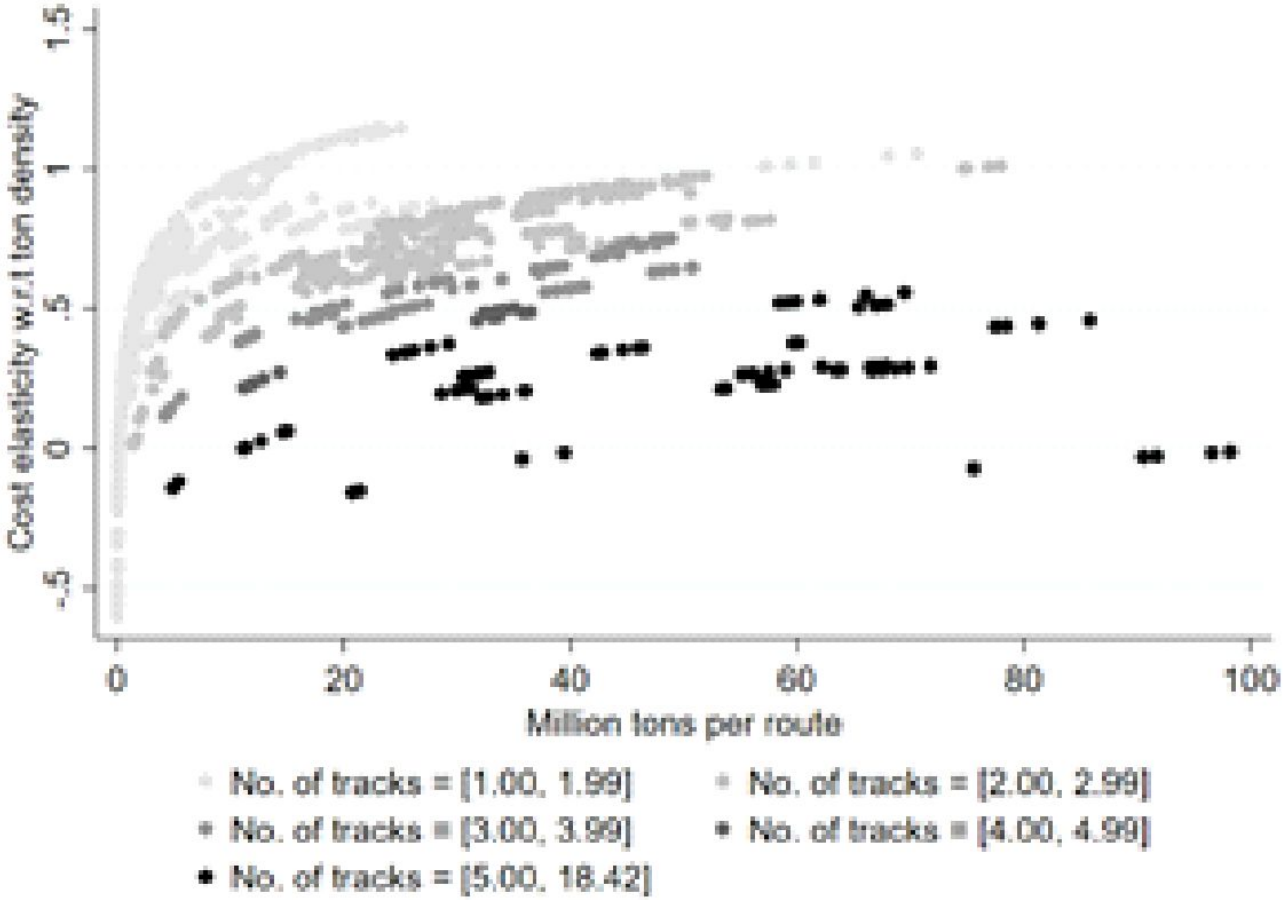
Costs for traffic NOT caused by asset damage from traffic?

Hypothesis 2

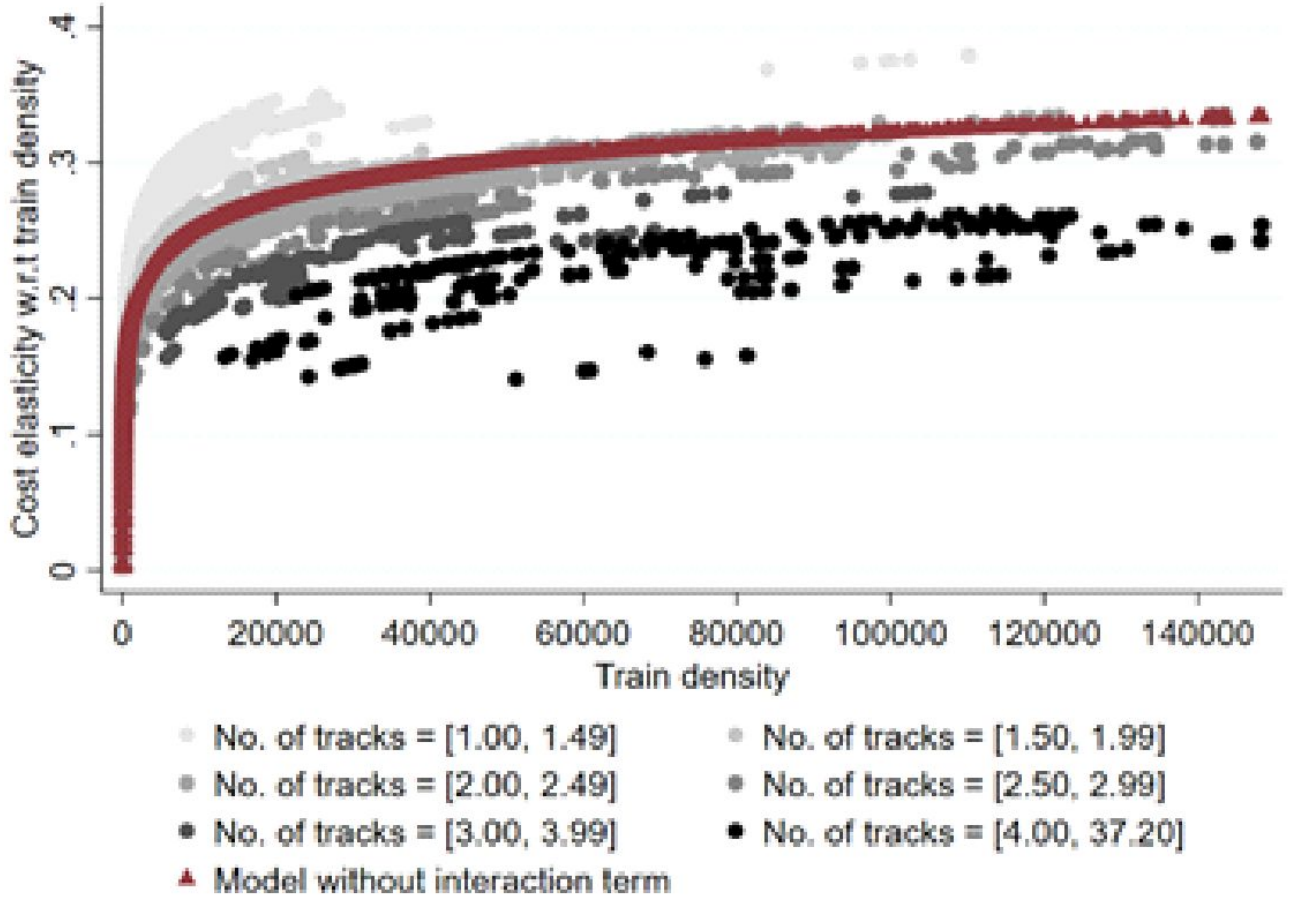
“The econometric method includes costs generated by traffic but <u>not</u> caused by asset damage from traffic, which is not the case with the engineering method”



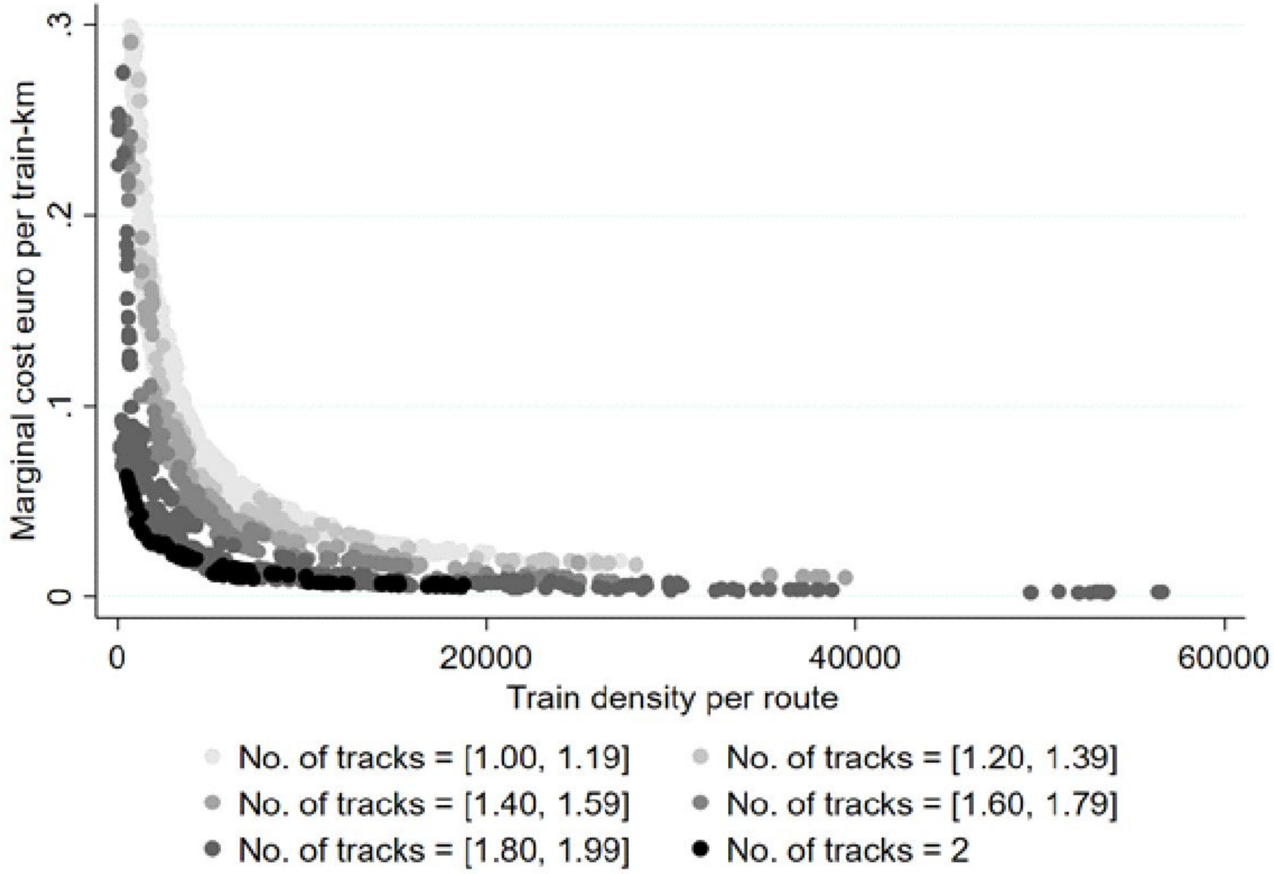
Results on elasticities: Hypothesis 2 (Austrian data) – track maintenance



Results on elasticities: Hypothesis 2 (French data) – signalling maintenance



Results in terms of marginal cost: Hypothesis 2 (French data) – signalling



- Further work to show this difference in comparing **marginal costs (direct costs)** in econometric and engineering methods

Conclusions

- Past research has emphasised that engineering methods produced much lower variable costs than econometric approaches – we seek to explain using a common dataset
- Our initial work shows that part of the difference may be **sample selection** – where engineering methods tend to use representative sections / or a sub-set of the data
- In particular ignoring variation between lower and higher tonnage sections could miss variation in **preventative maintenance costs**
- Our results also show that traffic can impact on costs **not only via asset damage from traffic**. Additional effects could reflect:
  - **Higher track possession costs** on busier sections
  - **Greater desire / activity to prevent delays** on busier sections

Further work needed to finalise the comparison between econometric and engineering estimates for Austrian data – though initial results suggest the gap between the two methods is smaller than previously thought

Further research

Finalise comparable marginal costs and elasticities / variability proportions for the two methods: engineering and econometric

Explore differences between methods further:

- Expanding engineering approach to lower tonnage sections
- Steps in cost as traffic changes in larger jumps (variable/semi-variable/fixed)
- Varying cost of interventions on different line types
- Motivation to prevent delays on busy routes

Further comparison with different types of engineering approaches that simulate damage using simulation models

Thankyou for your attention

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See also:

Track access charges: reconciling conflicting objectives Case Study – Great Britain Prof. Andrew Smith, University of Leeds Prof. Chris Nash, CERRE & University of Leeds

https://cerre.eu/wp-content/uploads/2020/06/180509_CERRE_TrackAccessCharges_CaseStudy_Britain_Final.pdf