

Understanding the Demand for Passenger Rail Travel

Transport Modelling Forum

Gerard Whelan & Steve Lowe | 10th June 2009



Outline of the Presentation

Part 1:

- Understanding trends in rail passenger demand.

Part 2:

- Why has rail demand recently grown so fast?

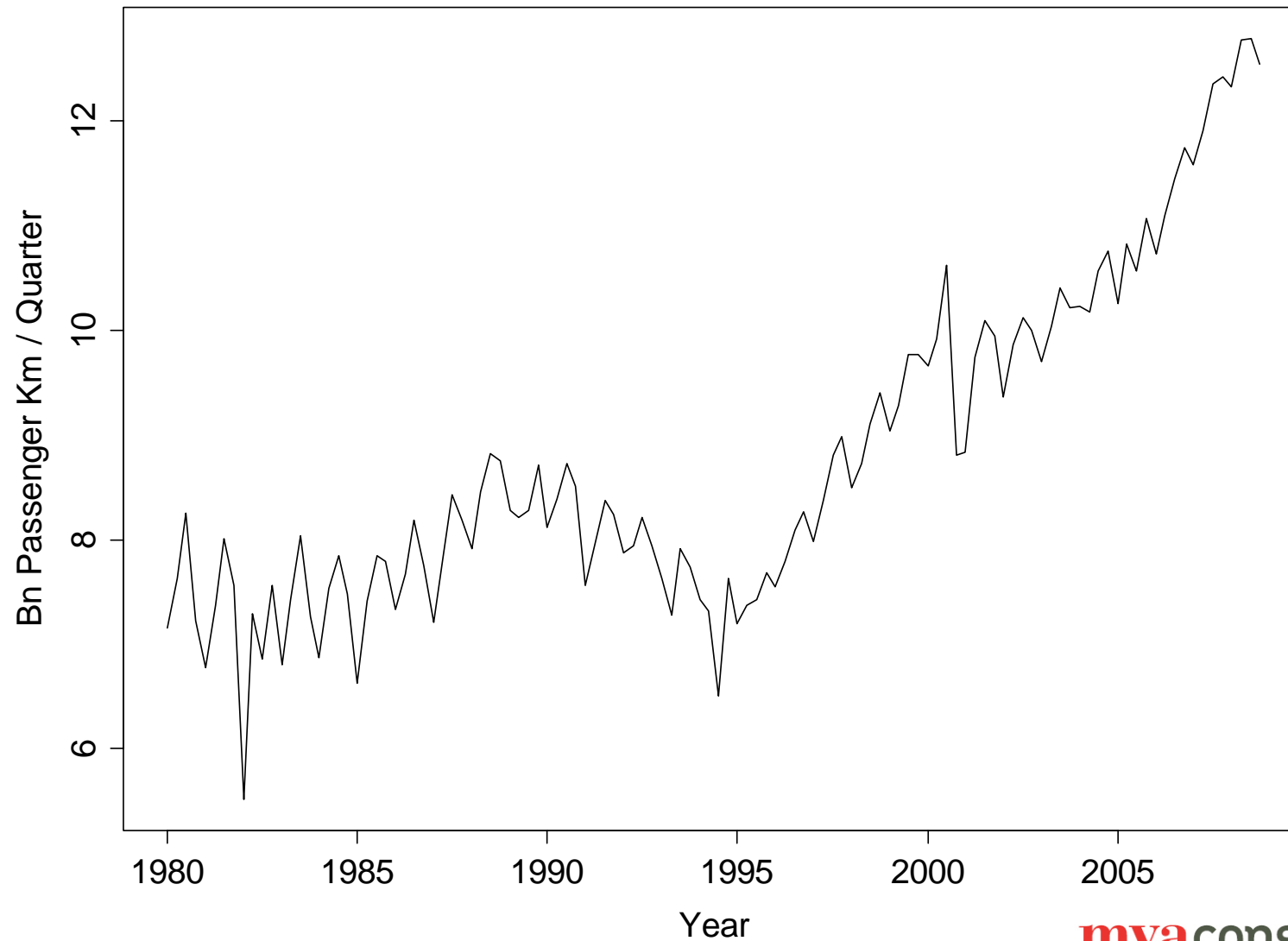
Part 3:

- Lessons for rail demand modelling.

Part 1: Understanding Trends

- Research contract undertaken for DfT by MVA Consultancy and Andrew Harvey, Professor of Econometrics and Fellow of Corpus Christi College, University of Cambridge.
- Investigated the time-series characteristics of rail demand over the past 30 years with a view to explore the impact of the economic cycle on demand.
- The focus of Part 1 of this presentation is on the use of **Unobserved Components Models** to identify 'unexplained' influences on demand.

National Passenger Km (1980-2008)



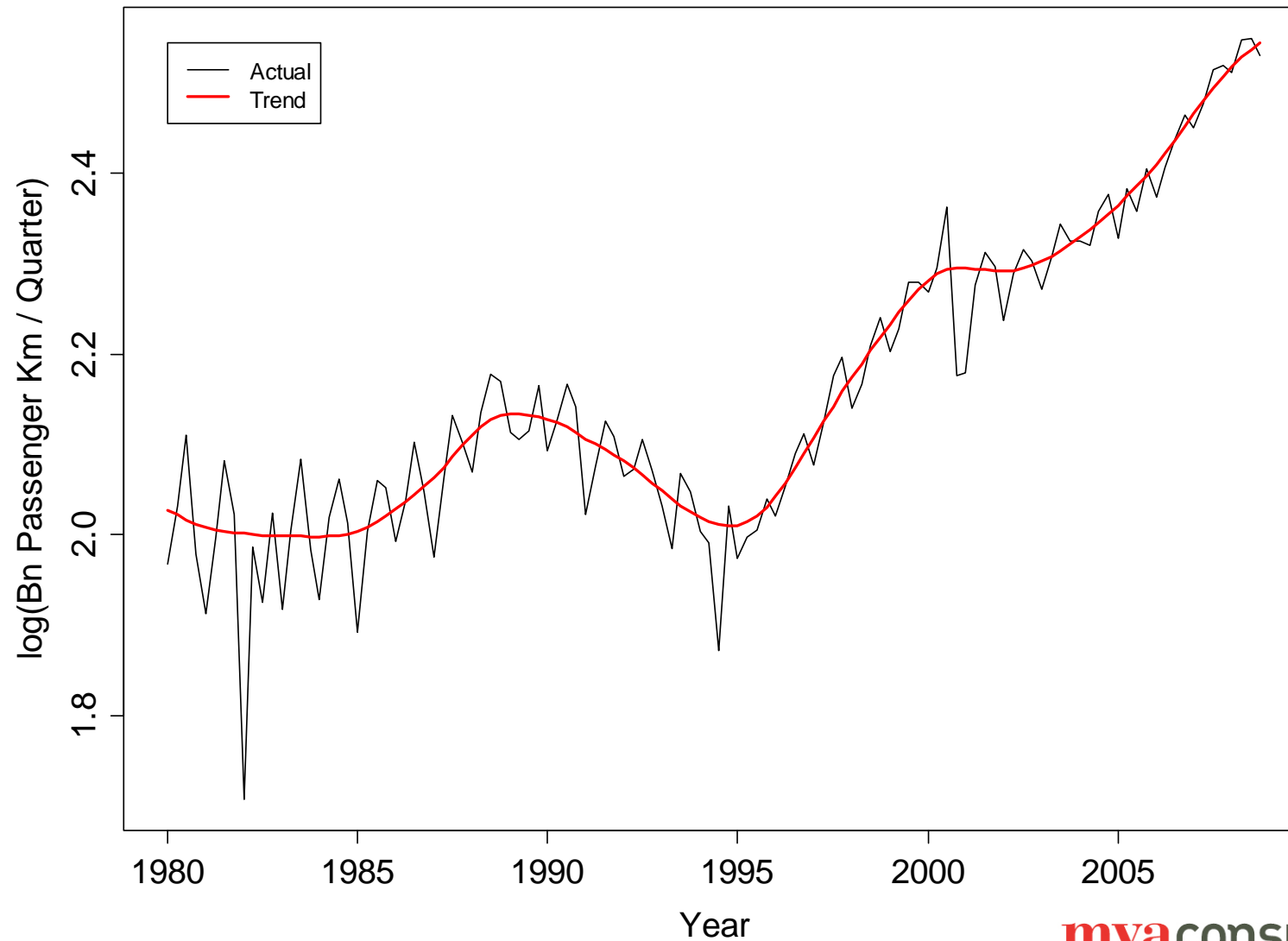
Understanding the Series

Unpack characteristics of time-series data by fitting structural time-series models.

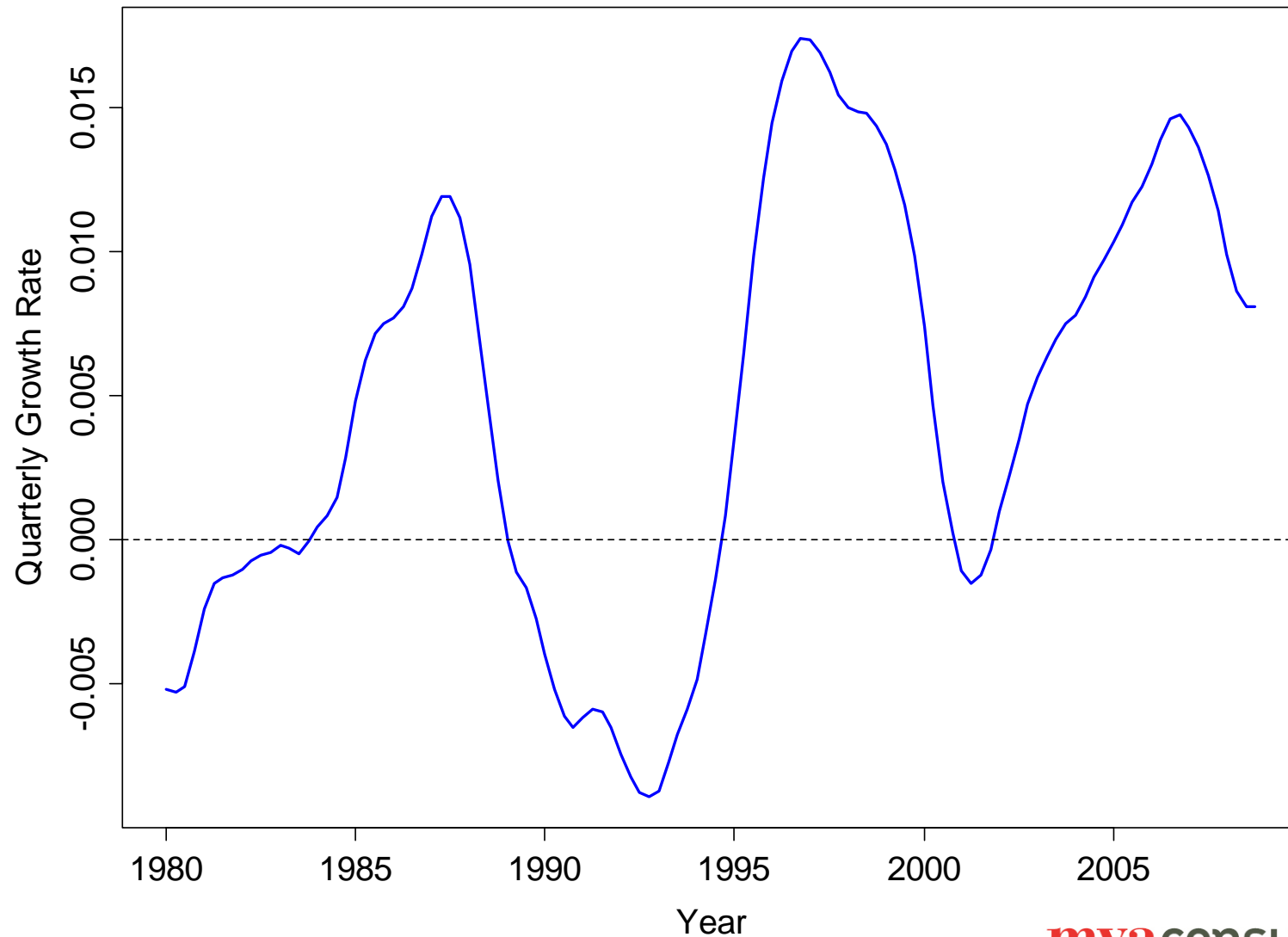
Decompose series into trend, seasonal and irregular components, augmented with **intervention** variables to account for strikes and accidents.

Series = trend + seasonal + interventions + irregular

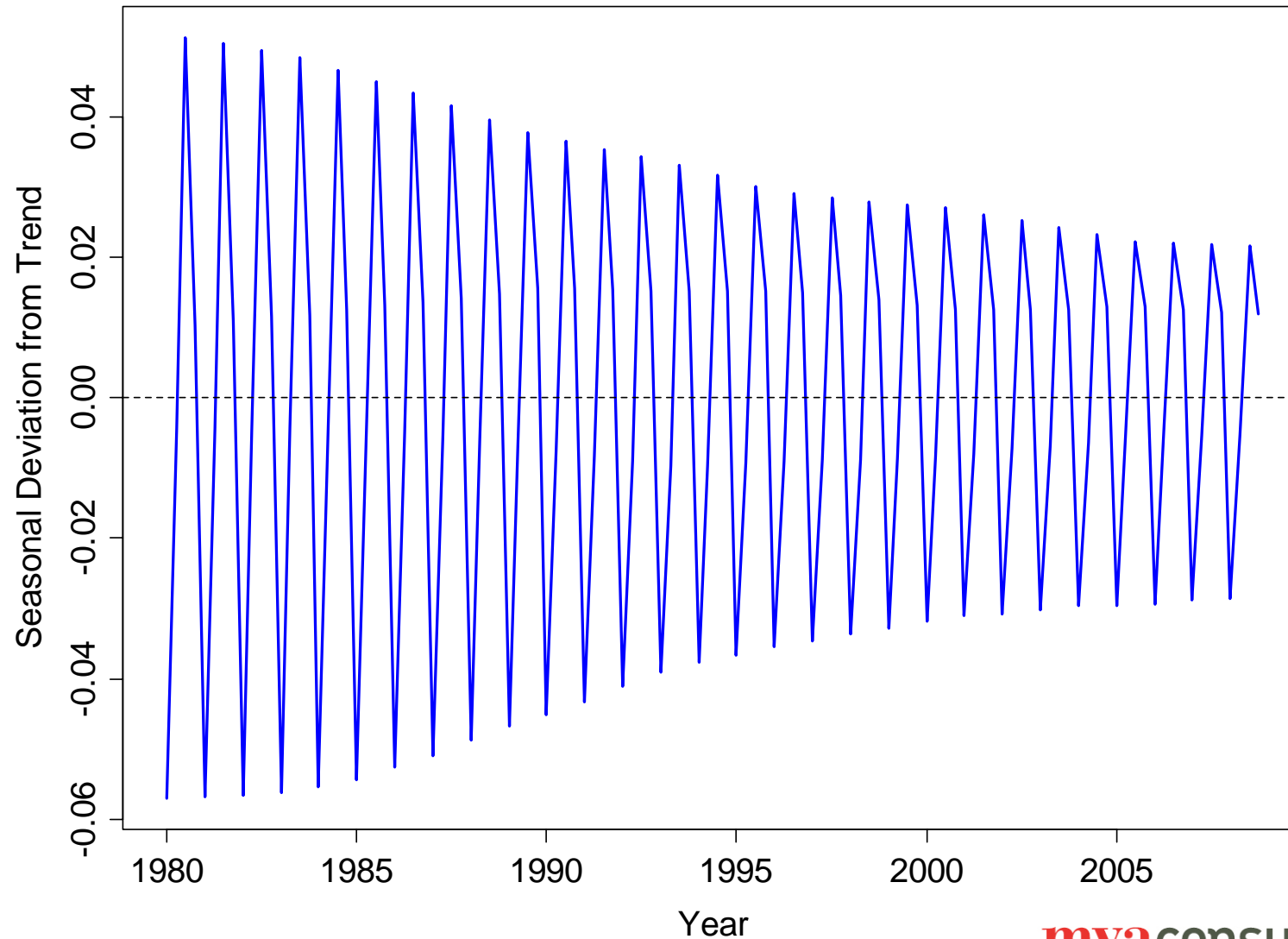
Trend in Passenger Km (1980-2008)



Growth in Passenger Km (1980-2008)



Seasonality in Passenger Km



Unobserved Components Model

Explanatory variables, such as fares and GDP, may be added to the structural time-series model:

Series = trend + seasonal + interventions +
explanatory variables + irregular

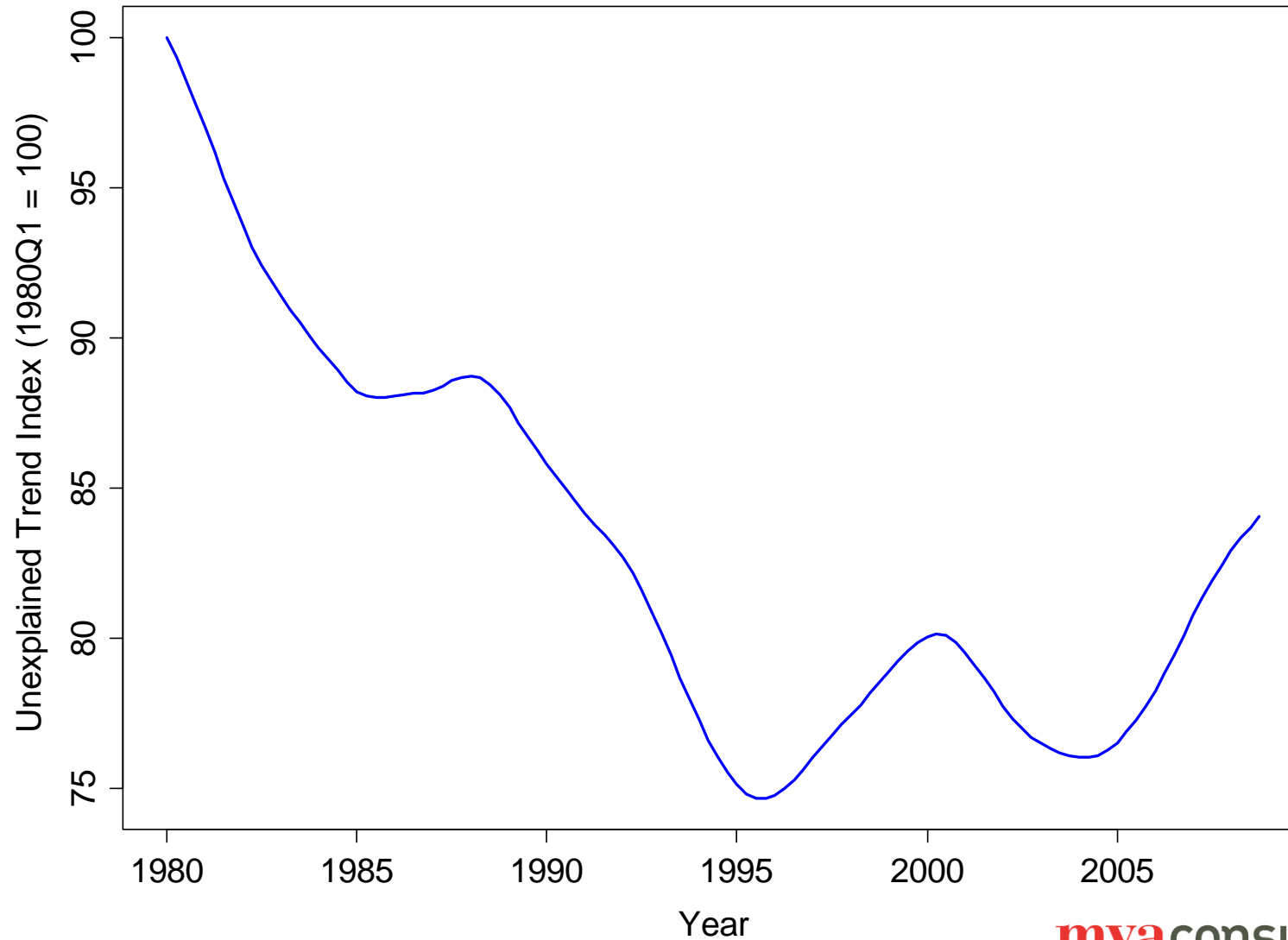
The role of the **stochastic trend** is to capture non-stationary effects (omitted variables) that cannot be measured, or are difficult to measure, such as changes in tastes.

Explanatory Variables and Interventions

Variable	Elasticity
Fare	-0.75
GDP	0.90
Rail Km	0.32
PPM	0.25
Fuel Cost	0.05

Intervention	Δ Demand
ASLEF 1982Q1	-21%
ASLEF 1982Q3	-12%
Signallers	-16%
Hatfield	-7%
Bombings	-3%

'Unexplained' Trend



Insights from Model

- Omitted variables and changes in tastes and preferences have a substantial influence on demand: it is important that these influences are explicitly accounted for.
- Unobserved Component Models produce better estimates of demand sensitivities but how do we accommodate the 'unexplained' trend in forecasts?

Part 2: Why has rail demand recently grown so fast?

Large scale consultation as part of on-going research for the Passenger Demand Forecasting Council with the aim to explain growth in regional rail flows.

Workshop Locations: Leeds, Manchester, Nottingham, Cardiff, Exeter and Glasgow

Workshop Participants: Property Developers, City Councils, PTEs, Chambers of Commerce, Operators, Network Rail, Transport Scotland and the Welsh Assembly

Key Themes from Consultation

Economic

- City centre regeneration and economic prosperity.
- Synergies between successful regional cities.
- Cultural events and attractions, retail and nightlife promote cities as 'destinations'.

Socio-Demographic

- Changes in employment structure - to service and finance.
- More long distance commuting (2 worker households).
- Increased numbers of students.
- City centre residential population with low levels of car ownership.

Key Themes from Consultation (2)

Improved Rail Service Quality

- Station and rolling stock improvements.
- Improvements to reliability and punctuality.

Deterioration in Car 'Service Quality'

- Variability in car journey times has increased markedly due to congestion.
- Extension in controlled parking zones and changes in pricing structure to discourage long-stay parking.

Part 3: Lessons for Future Modelling

Evidence suggests that:

- Rail demand has been growing faster than models predict.
- Direct demand (PDFH) models perform better than multi-modal models.

So, how can we improve?

Improved understanding of behaviour

- Ongoing improvements to the evidence base.
- Statistical estimation of models.
- Improved understanding of behavioural differences between demand segments and sub-markets.
- Greater appreciation of broad range of factors influencing demand.
- Identification of behavioural non-linearities.

More flexible models

- Further disaggregation of sub-markets.
- Wider range of explanatory variables - so long as historic data is available for estimation and variables can forecast for future scenarios.
- Accommodation of non-linearities in demand – either via flexible elasticity functions (elasticity surface) and/or non-linear attribute valuation.
- Less reliance on composite variables (e.g. GC) and greater use of specific cost elements.
- Incorporation of full behavioural response to cost change - including trip generation, time period choice, ticket type choice.



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