Weather Shocks and Supply Chains

Han Lin (University of Exeter, UK)
Tim Lloyd (Bournemouth University, UK)
Steve McCorriston (University of Exeter, UK)

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Context

- Weather and disease pose serious threat to food supplies (Zappalá 2023)
- Weather important driver of commodity prices (Ubilava 2017*)*
- Consumer prices? These are determined by the extent to which firms in the food chain mediate these shocks
- Food supply chains characterised by large firms in multiple stages (retailers, processors, importers etc.)

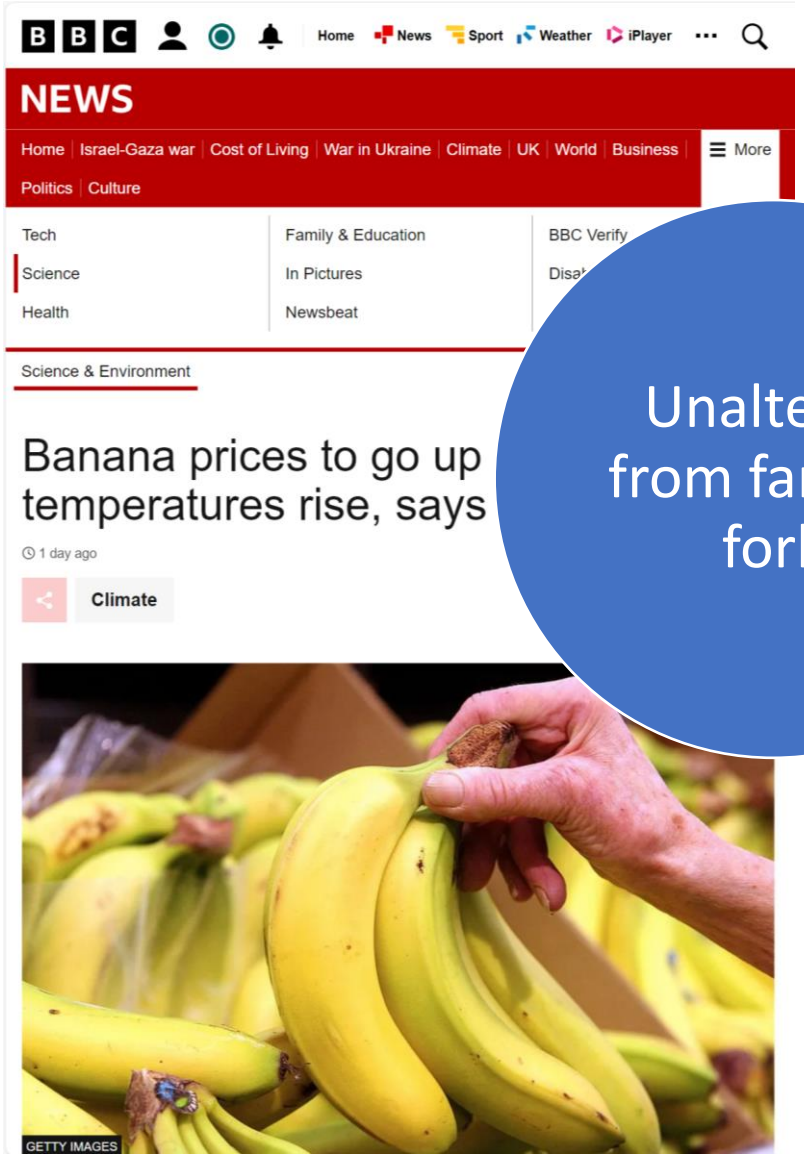
In this Paper we . . .

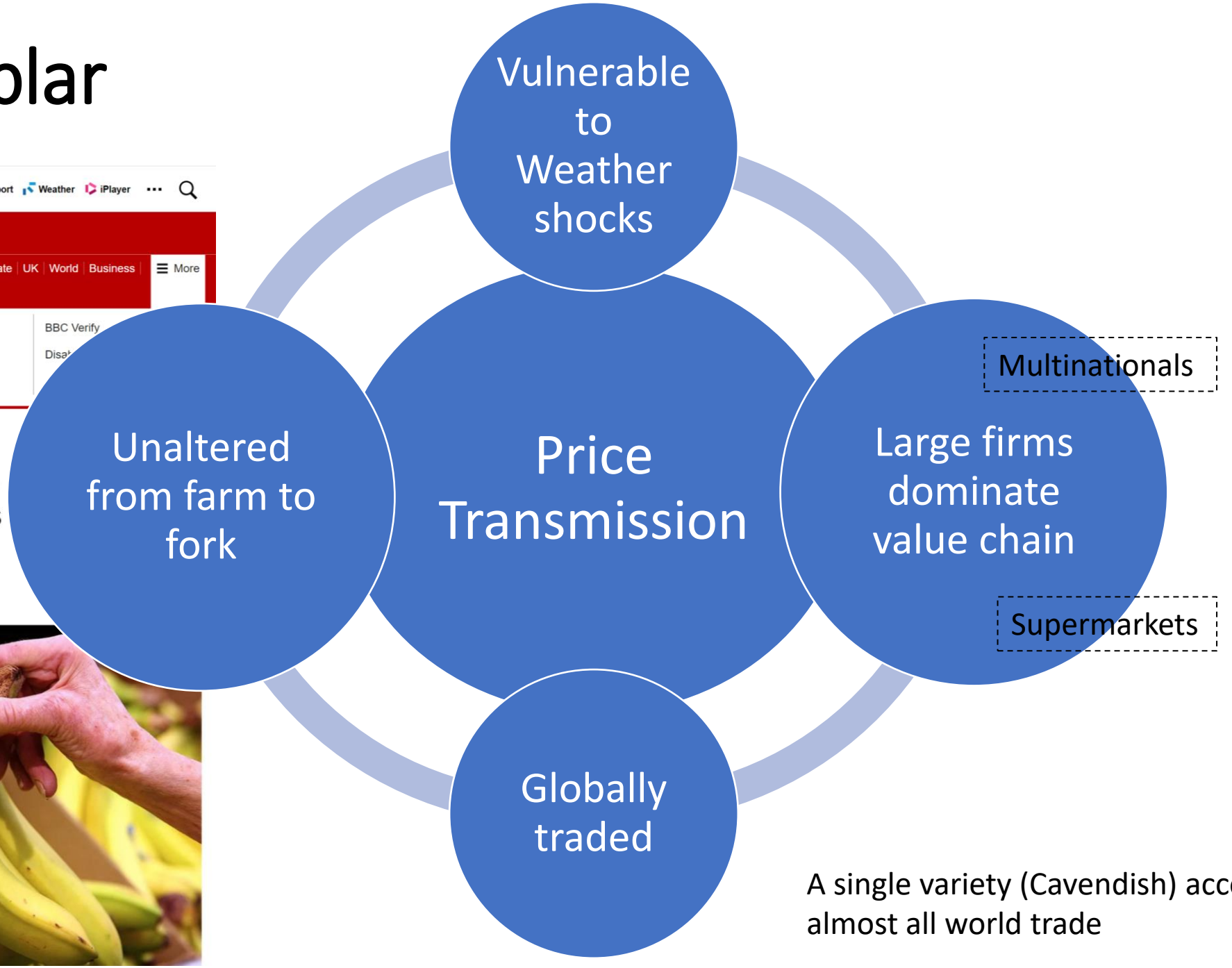
- Explore how price spreads (difference in prices at different stages of the supply chain) adjust following weather shocks
- Develop a theoretical model of imperfect competition in a three-stage chain to locate where in the supply chain margins adjust and by how much
- Use adjustment of spread as indicator of imperfectly competitive behaviour in three large consuming countries
- Banana supply chain exemplar of imperfectly competitive markets

Contribution

- Theoretically, a multistage framework pinpoints more accurately where in the food chain market power is being exercised
- Empirical evidence found in all three countries
- UK evidence is most clear cut

An Exemplar





A single variety (Cavendish) accounts almost all world trade

Novel features

Theory

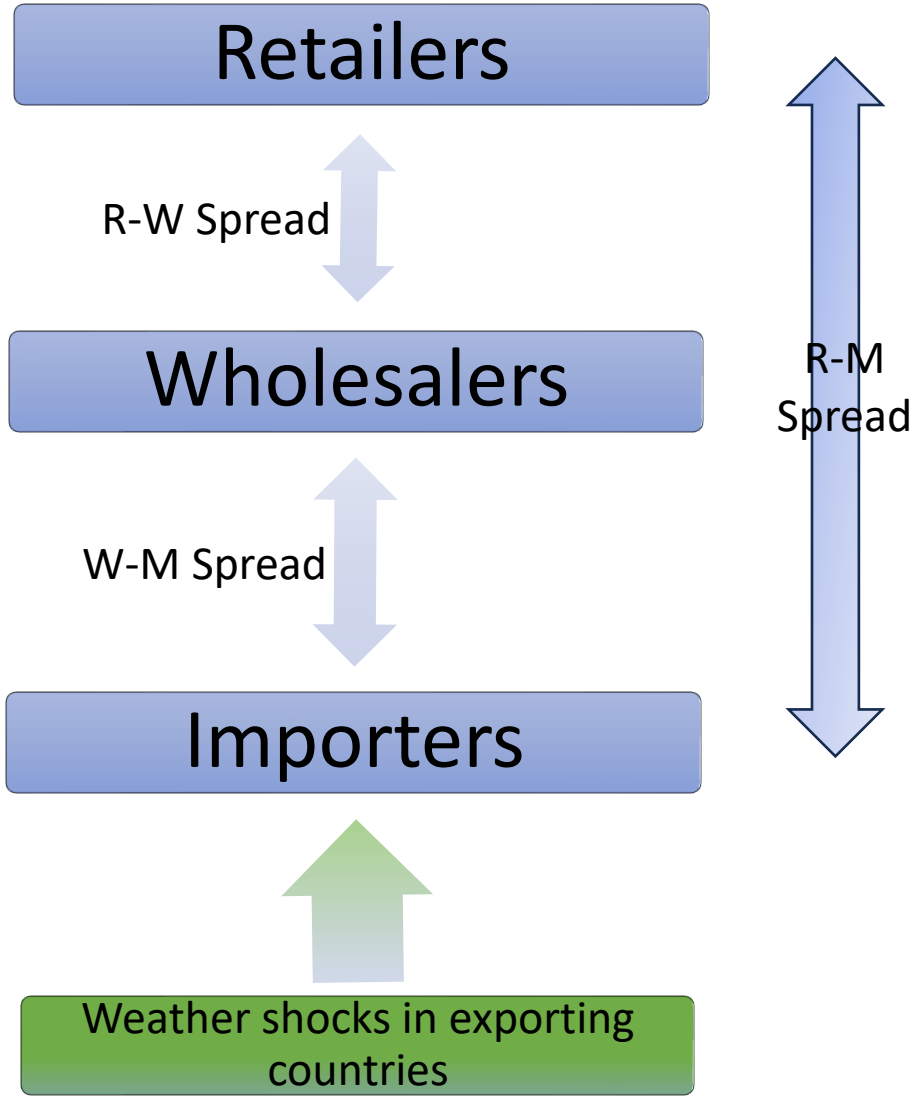
- Model of successive oligopoly in multistage supply chain
  - Reveals richer story than single stage analyses

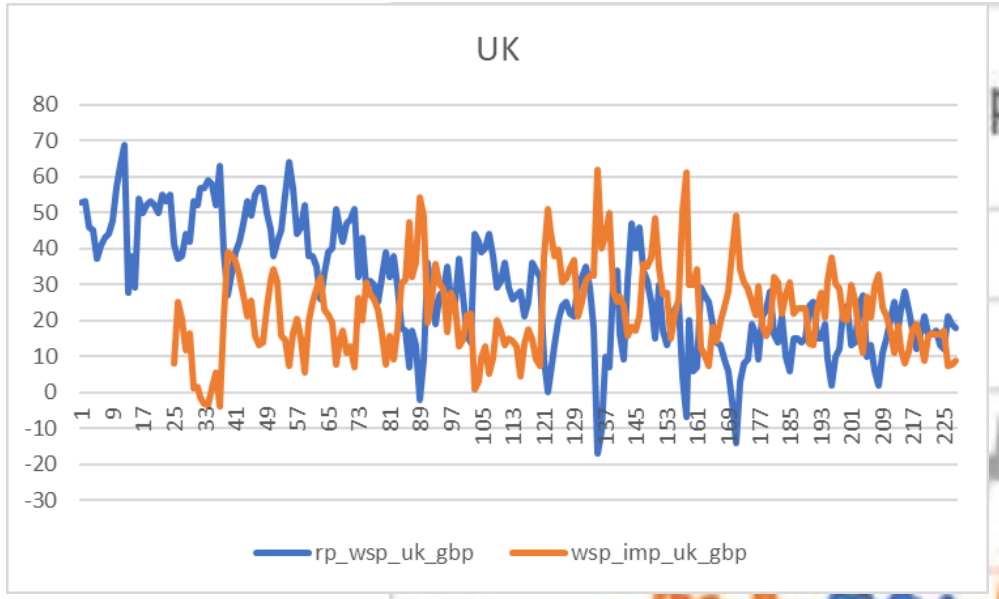
Data

- Two decades of monthly prices at retail, wholesale and import for near
- Three major importers (US, UK, France)
- Granular geospatial weather data in exporting countries

Methods

- Impulse response functions by local projection

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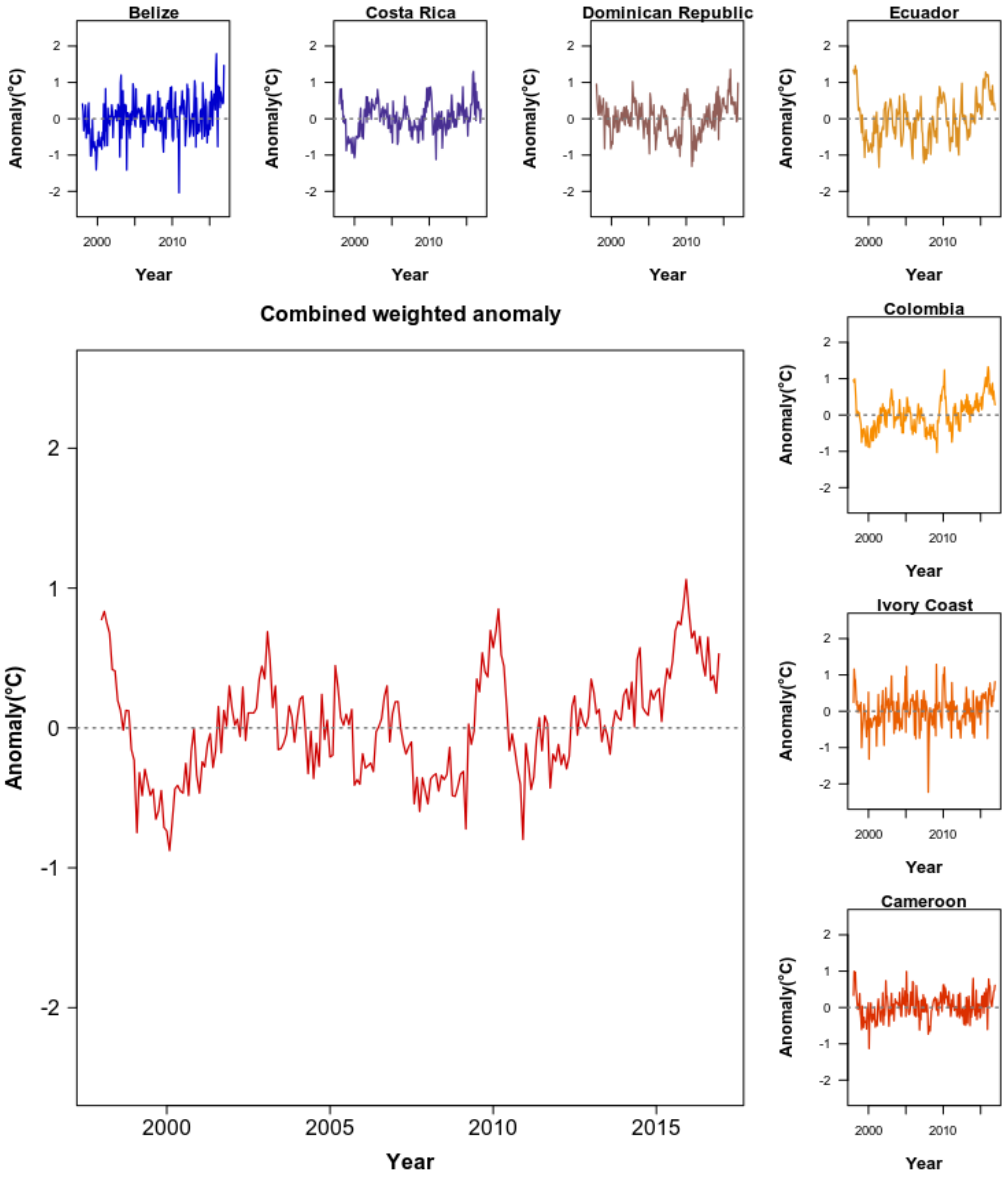
Is market power responsible?

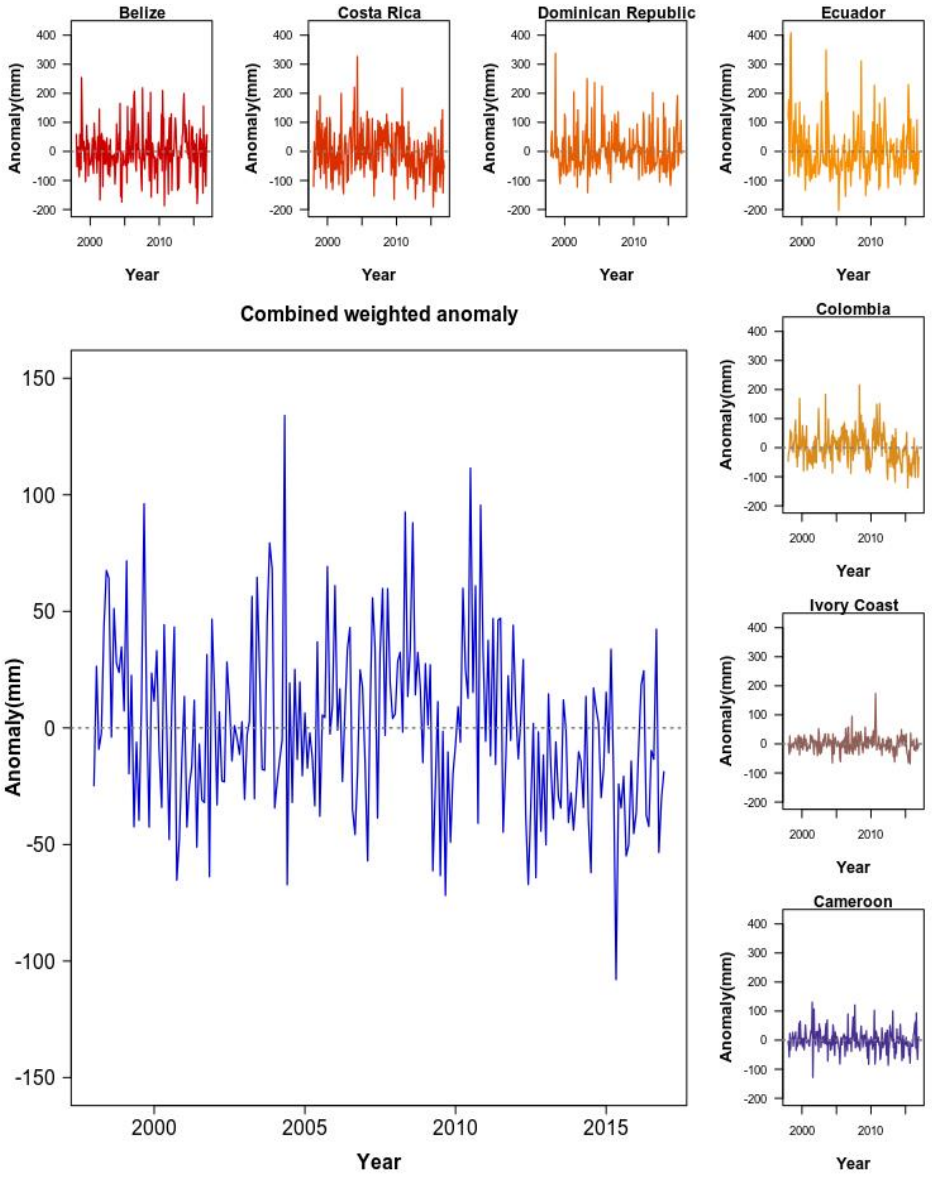
- Many factors explain the behaviour of these margins (technology, supply chain costs are obvious candidates but imperfect competition too?
- Theory tells us that supply shocks are fully transmitted in perfectly competitive chain so that margins are unaffected
- Margin adjustment to exogenous weather shocks identifies departure from the perfectly competitive model.
- Weather data is our identifying tool

UK

Temperature

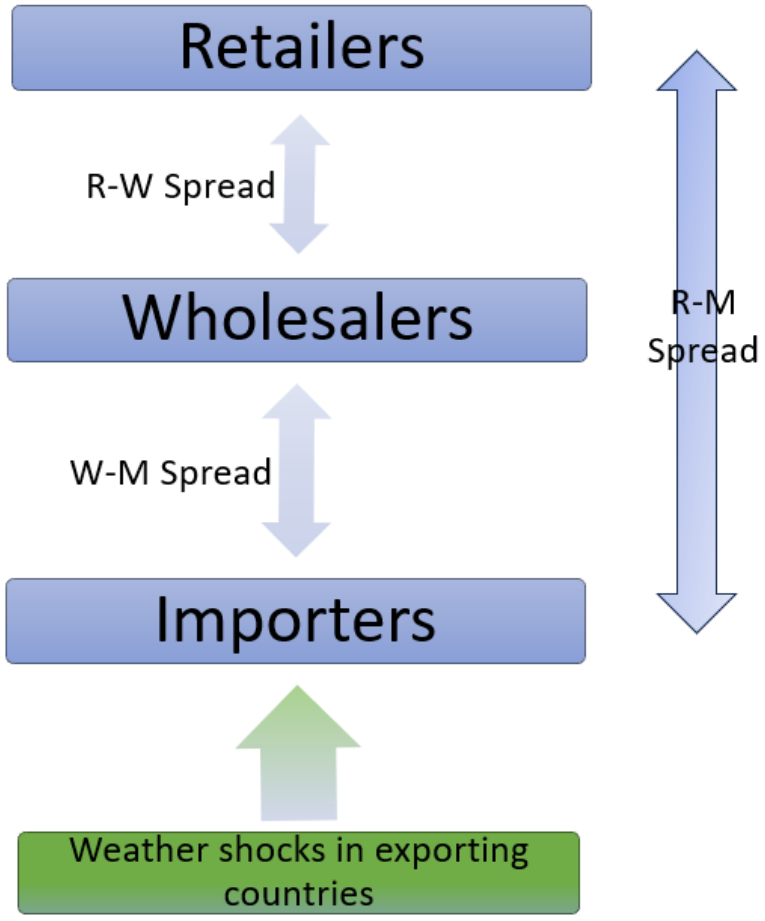


Precipitation

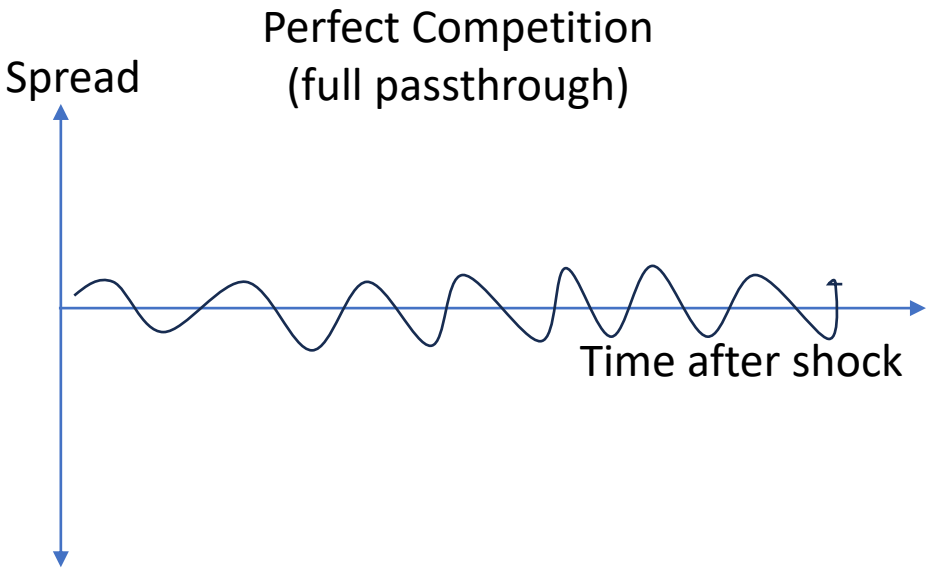


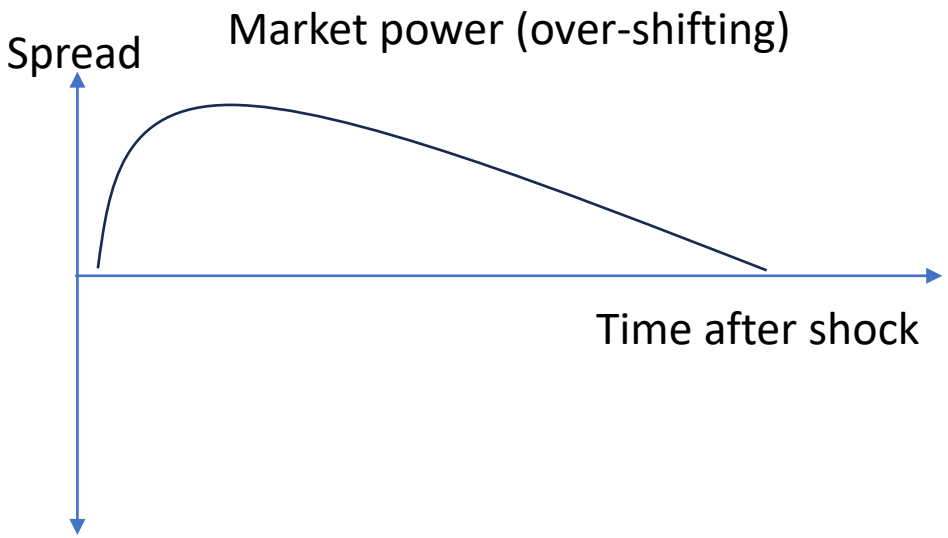
Methods

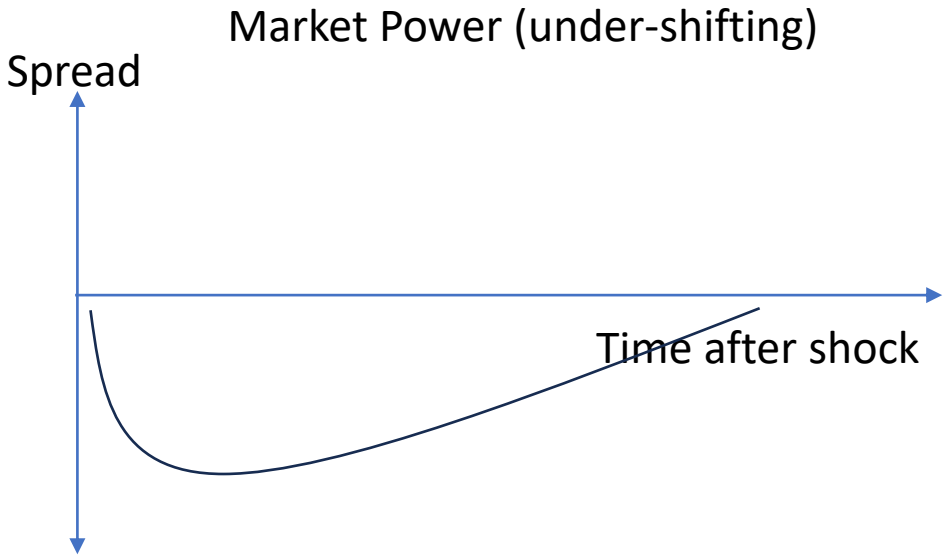
- For each country we examine the dynamic effects of weather on
  - Retail-Wholesale price spread
  - Wholesale-Import price spread
- Two types of weather shock
  - Temperature and rainfall in exporting countries
- Impulse response functions (IRF) by local projection
  - Jordà (2005, 2009); Plagborg-Møller and Wolf (2021); Montiel Olea and Plagboard-Møller (2021)
  - Country-stage controls



What do we expect?







Hot weather shock: UK Price Spreads

Hot weather shock: US Price Spreads

Hot weather shock: France Price Spreads

State Dependence: Commodity Crisis (2007-11)

UK Firms profiteering from the crisis?

Key Findings

- Behaviour of price spreads consistent with imperfectly competitive firms in all countries but not all stages
- Pricing in UK supply chain most clear cut
- Under-shifting predominates; little evidence of ‘profiteering’ during commodity crisis

Implications

- Firms in food supply chains will play a role in determining the incidence of increasingly frequent weather shocks of the future

- Multi-stage analysis reveals where in the chain this occurs

- Results have broader applicability given the dominance of large firms in almost all international value chains.

Next Steps

- Local projection methods readily facilitate non-linear analysis
- Asymmetric responses
  - Are hot (wet) weather shocks worse than cold (dry)?
  - Do firms behave differently to rising and falling temperatures (rainfall)?
- Quadratic weather effects?
- Interaction Effects (e.g. hot and wet)

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Thank you for listening!