Carbon pricing for transport: The case of US airlines

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Overview of this talk

① **Update on climate policy for the transport sector**, particularly for aviation (and shipping)

② **Economic theory for large-scale estimation** of profitability impacts of carbon pricing

③ **Estimates of ‘carbon cost pass-through’** for US airlines and implications for fuel demand

Climate policy for transport: Aviation

Aviation is growing fast & hard to decarbonize

— CO_2 emissions = 2.5% of global total (5% by impact)

— Set to triple by 2050 without new policies

Climate policy for aviation is starting to pick up…

1. **EU ETS** since 2012 (\$5/tCO_2)
2. **China regional ETSs** (\$1/tCO_2)
3. **2016 International agreement** (ICAO)
    - Global market-based policy from 2021
        - Emissions offset system

Similar policy dynamic for shipping industry

How does carbon pricing affect firms?

Who cares?

1. *Regulated firms*
2. *Policymakers*
3. *Institutional investors* + Mark Carney

‘Simple’ market structure in ‘early adopter’ sectors

— Electricity, aluminium, steel, etc.

— Small no. of markets; homogenous products

Airline industry is much more complex

— Many routes; differentiated-products competition

— Existing models become difficult to implement

Factors affecting the impacts of carbon pricing

What does the profit impact for firm A depend on?

— Firm A's production **technology** (abatement)
— **Demand** for firm A's (differentiated) product
— **Competitiveness** of the market

… and also characteristics of firm A's *rivals*:

— Completeness of **regulation** (cost changes)
— Production **technologies** (abatement)
— Product-market **strategies**

⇒ **Our approach *radically* simplifies this problem**

New economic theory of profit impacts

"General linear model of competition" (GLM)

— From the viewpoint of a (single) firm A

Key assumptions about firm A:

1. Chooses its emissions intensity optimally (given the carbon price)
2. Follows a linear product market strategy
   — Many well-known models of imperfect competition are nested as special cases
   — Static, dynamic, 'behavioural'

NB. *No* assumptions about the demand structure or about firm A's rivals (technology, strategy, etc.)

Main result from the theory

Profit impact ≈ 2 x (firm A's cost pass-through – 1)
x carbon price
x firm A's historical emissions

⇒ **Cost pass-through as a "sufficient statistic"**

— Captures *all* relevant information about firms' technologies (abatement) & strategies, customer demand patterns etc.

Implications:

1. Higher pass-through improves profit impact
2. Profits rise if pass-through exceeds 100%

Data on US airline industry

US airline industry

— World's largest market with 30% of global emissions

  — *Emissions*: 172mtCO_2 = $8.6bn (at $50/t$CO_2$)

  — *Profits* (2015): $7.5bn

Key features of dataset

Product = Carrier-route, over time, average ticket price

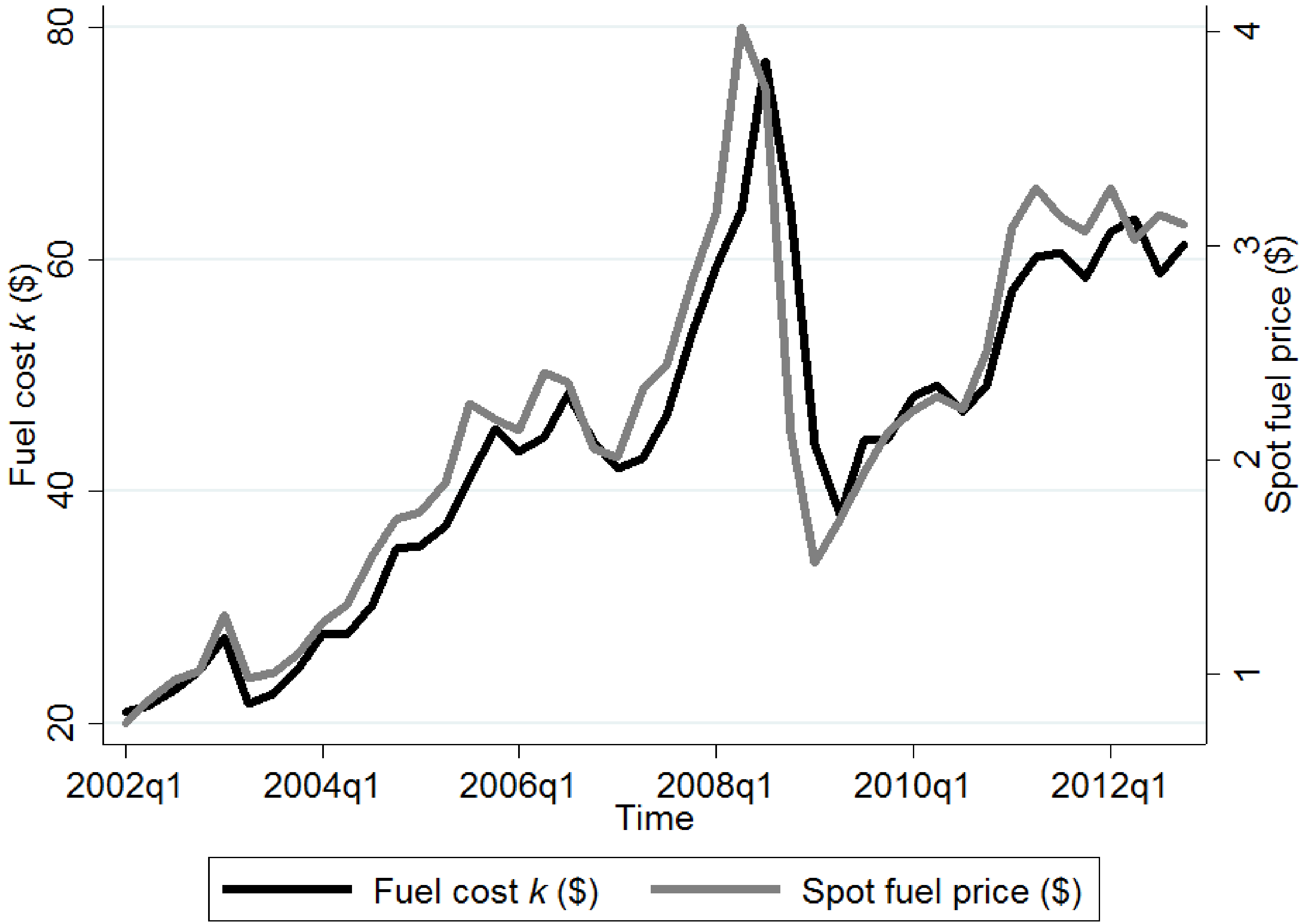
  — 10% sample of all airline tickets sold

    — Exclude frequent fliers, non-economy tickets, outliers, tiny airlines

  — Construct per-passenger fuel costs

⇒ **669 carrier-routes over 44 quarters (2002-2012)**

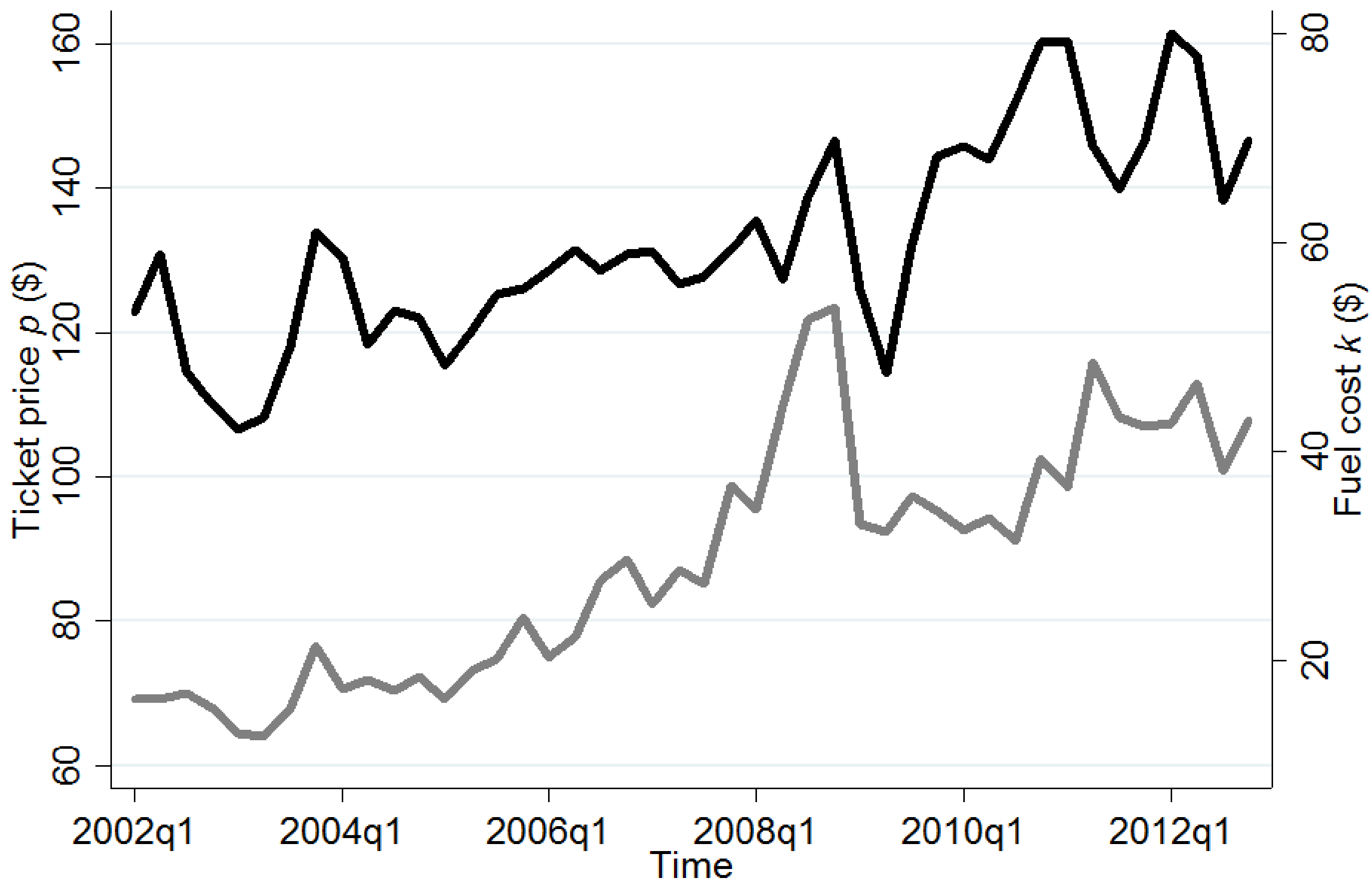
Airlines' fuel costs have been very volatile



Estimates for Southwest on LAX-SLC route

Pass-through = 109-115%
— Profits ↑
— Jet fuel demand ↑
— CO_2 ↑

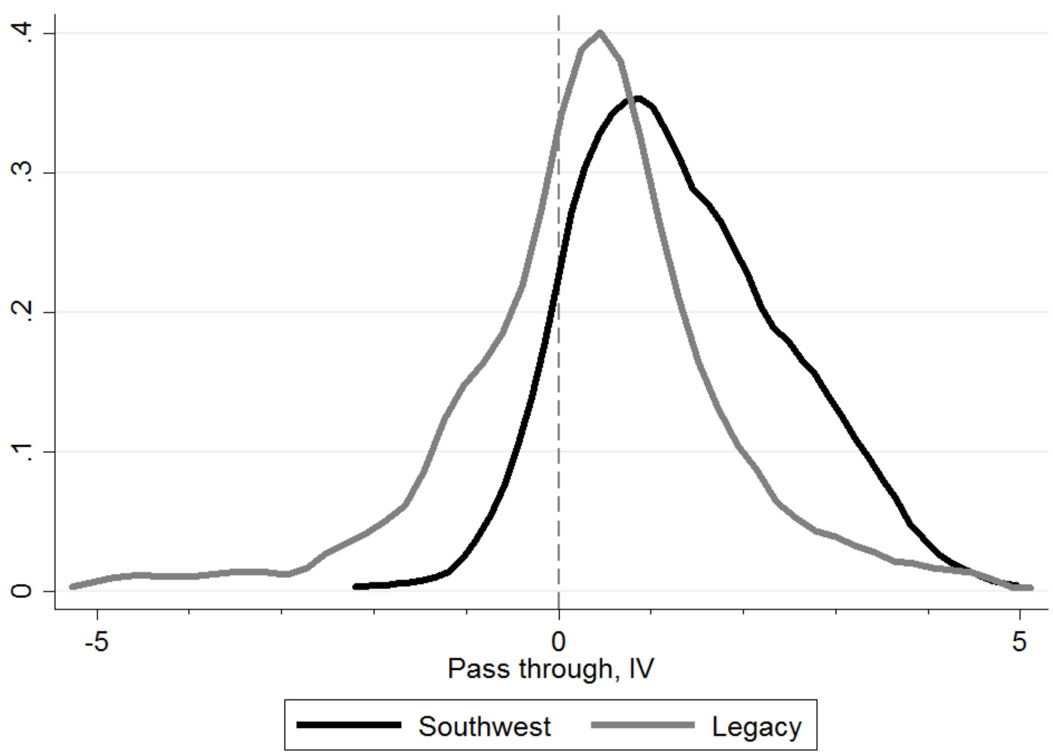
⇒ Carbon pricing <u>*good*</u> for Southwest



Notes: Pass-through after 4 quarters. Controls for GDP growth, non-fuel costs, number of competitors, seasonality. Instruments for endogeneity of per-passenger fuel costs

Heterogeneity in profit impacts of carbon pricing

	Southwest	Legacy carriers
Average carbon cost pass-through	135%	41%
Total profit impact (\$50/tCO_2)	+\$0.3bn	–\$4.0bn



⇒ Profits of legacy carriers are ***almost wiped out***, across the routes in our dataset, by \$50/tCO_2 (*American*, *Delta*, *United*, *US Airways*)

What explains differences in pass-through?

1. **Route portfolio (~60%)**
   - Southwest flies shorter routes than legacy carriers
     - Shorter routes have higher carbon cost pass-through (*why?*)

2. **Fuel efficiency (~20%)**
   - Southwest is more fuel-efficient
     - Mostly due to flying newer aircraft

3. **Demand factors (~20%)**
   - Southwest tends to have lower ticket prices & larger market share than legacy carriers
     - Customers perceive product differences

Conclusions

① **Carbon pricing for transport increasingly likely** in key jurisdictions from 2020s onwards

② **Competition in airlines and shipping is more complex** than in existing carbon-regulated sectors

③ **New theory allows large-scale quantification of impacts** using (only) estimated pass-through rates

④ **Airline profit impacts likely very heterogeneous**

- — Winners & losers can be anticipated
- — Implications for fuel demand & emissions

References

Thank you

Comments welcome: rar36@cam.ac.uk

This talk is mostly based on a forthcoming paper:

Felix Grey & Robert Ritz (2017). "Carbon pricing and firm profits: Theory and estimates for US airlines". In progress for 2017Q4.

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