Ownership and Competition: Finding Performance Breaks for Great Britain's Power Plants

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Infraday, Berlin, 2014

Motivation: public ownership + no competition = waste?

"The coal stations were even worse as I found out when my company became vertically integrated. Golf courses, gymnasiums, subsidised bars, countless luxuries were lavished on the bloated work force. Corruption was rife, Procurement Manager was the best job at the station, I knew one such on £25k who wore a gold Rolex and boasted of having a whole draw full of the them. Managers treated the stations as their personal fiefdoms.", anonymous comment, ft.com, 30 October 2013.

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- Competition and ownership are important drivers of firm performance.
- Changes to competition and ownership in utility industries offer an unique opportunity to study effects on performance (Fabrizio et al, 2007; Gao and Van Biesebroeck, 2014).
- Agency models predict that private ownership and competition increase technical efficiency via management.

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- Did changes to ownership (privatization) and competition increase technical efficiency at UK generation plants?
  - When and by how much?
  - For fuel and labour.
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- First plant-level analysis of UK restructuring and privatization.
  - We can compare the effects of competition and ownership for the same country and industry.
  - Timing of the reforms allows us to draw conclusions about the relative importance of changes to competition and ownership.
  - We distinguish incentive and selection effects.
  - We analyse an actual privatization. Privatized is not necessarily the same as private!
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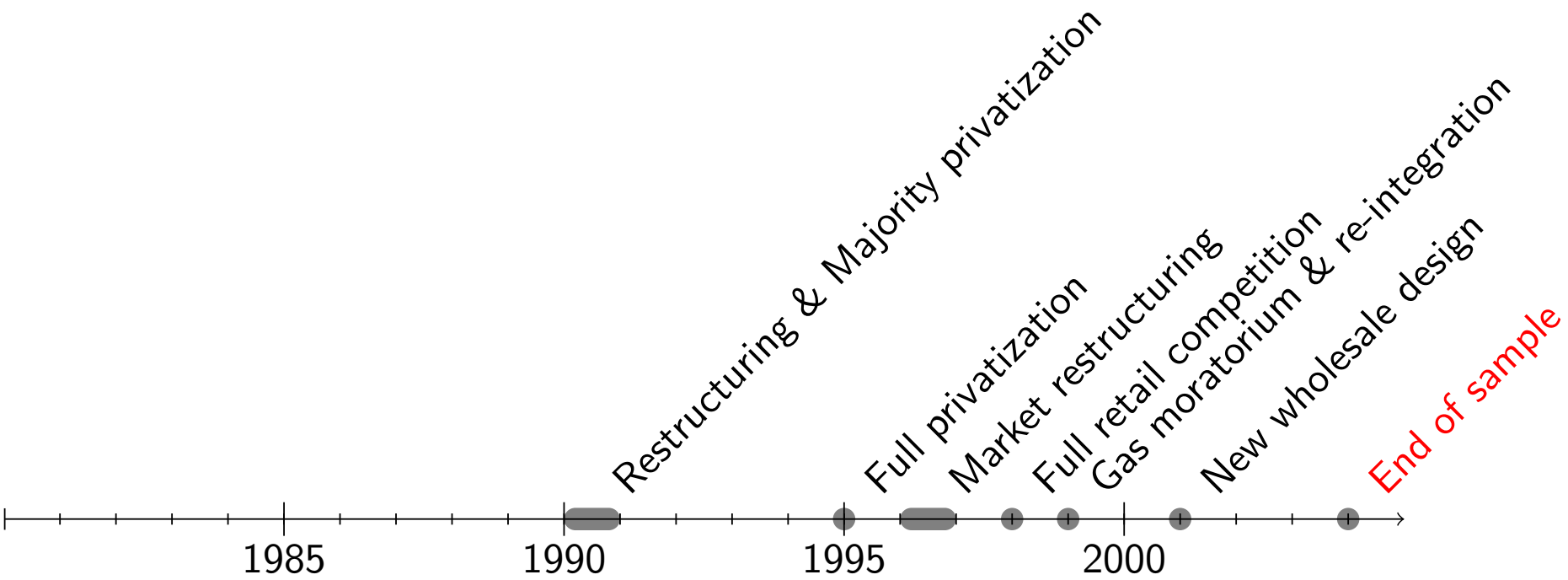
Background: timeline of UK reforms



Background: environmental policy

- Economic reforms not aimed at environmental performance (Pearson 2000).
  - But public owners might internalize pollution more.
- Environmental regulation of SO2 and NOx but not CO2. Limits might not bind at plant-level due to switch to low emission fuels after privatization.

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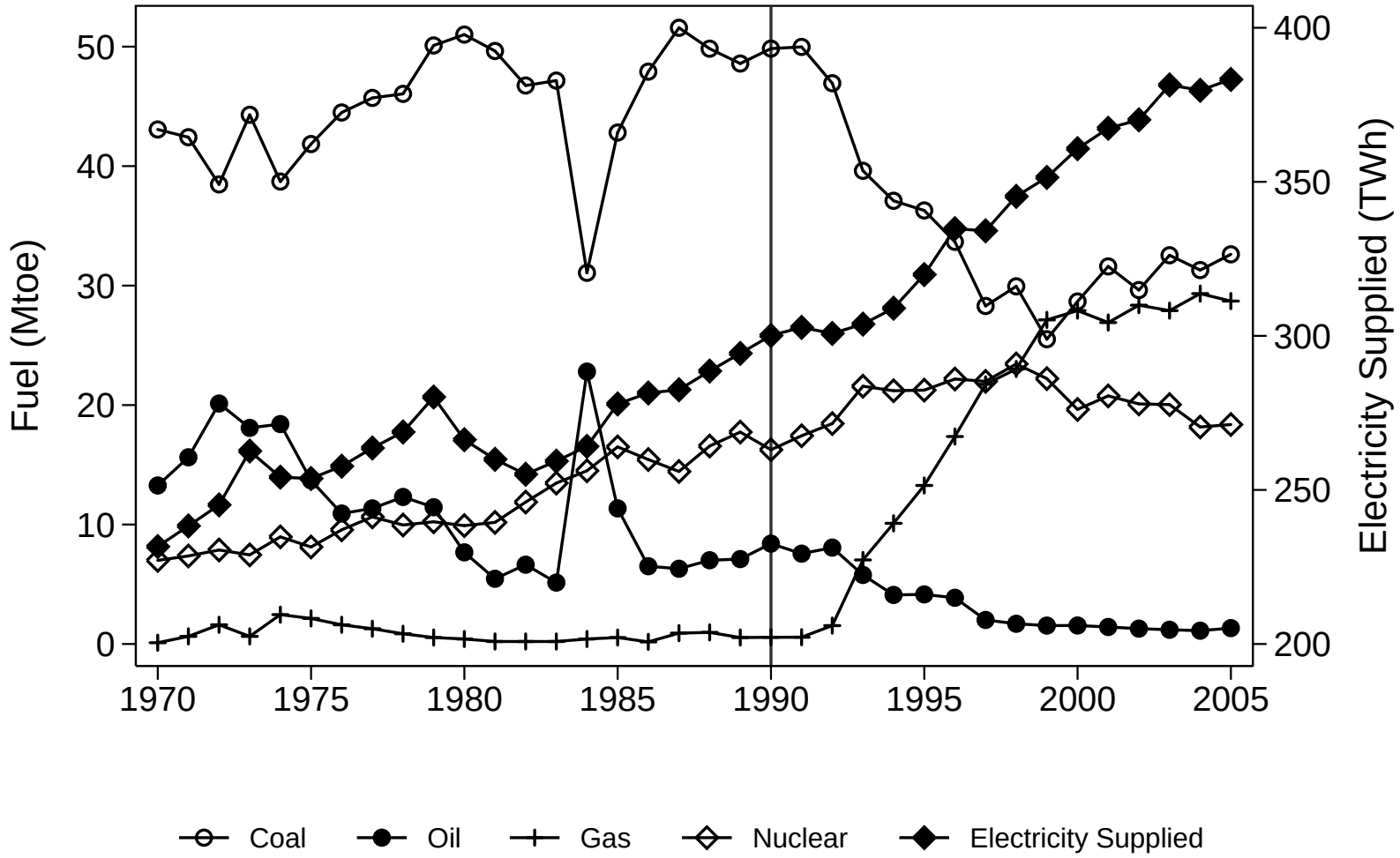
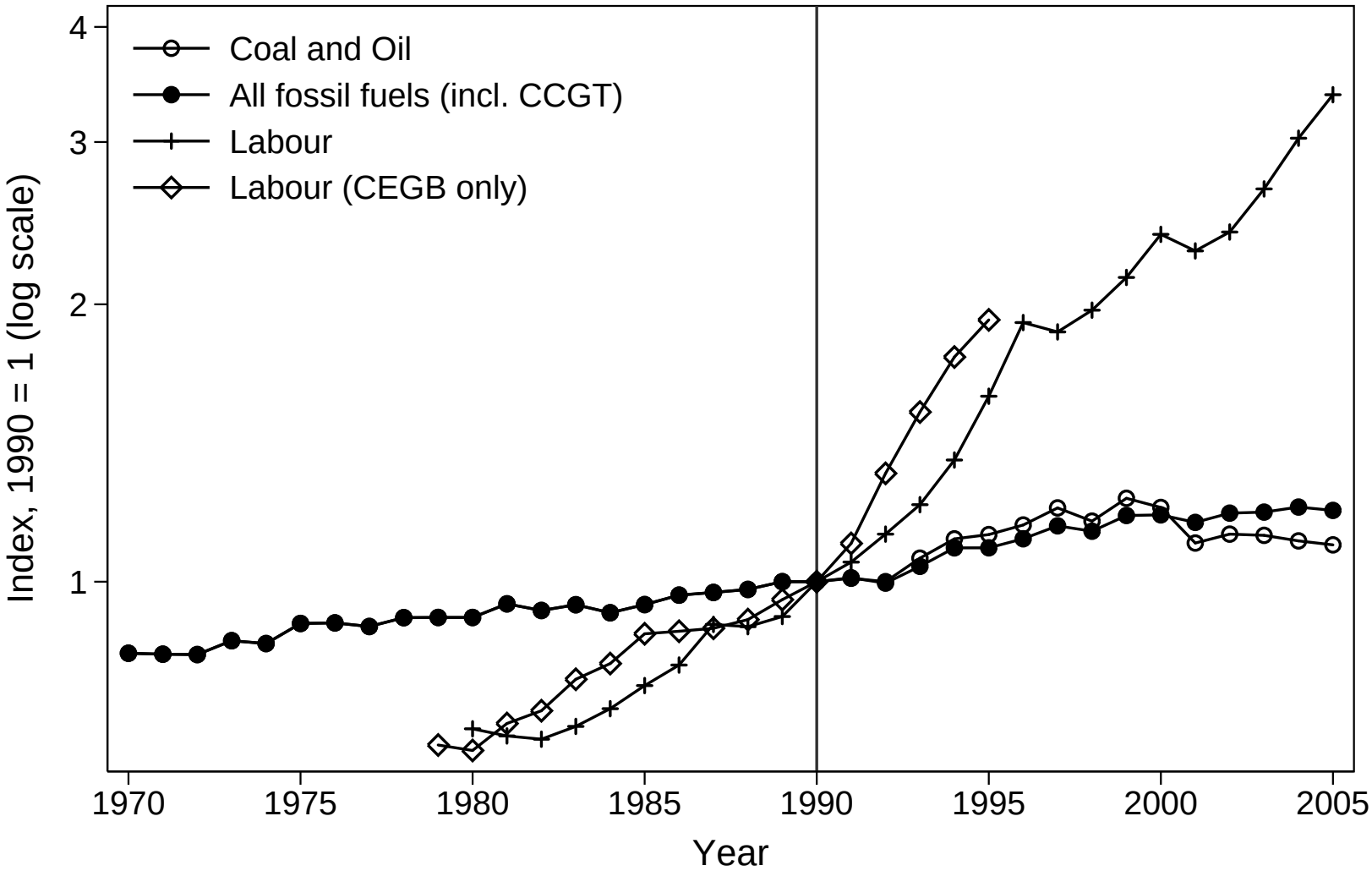


Background: Aggregate single factor productivity



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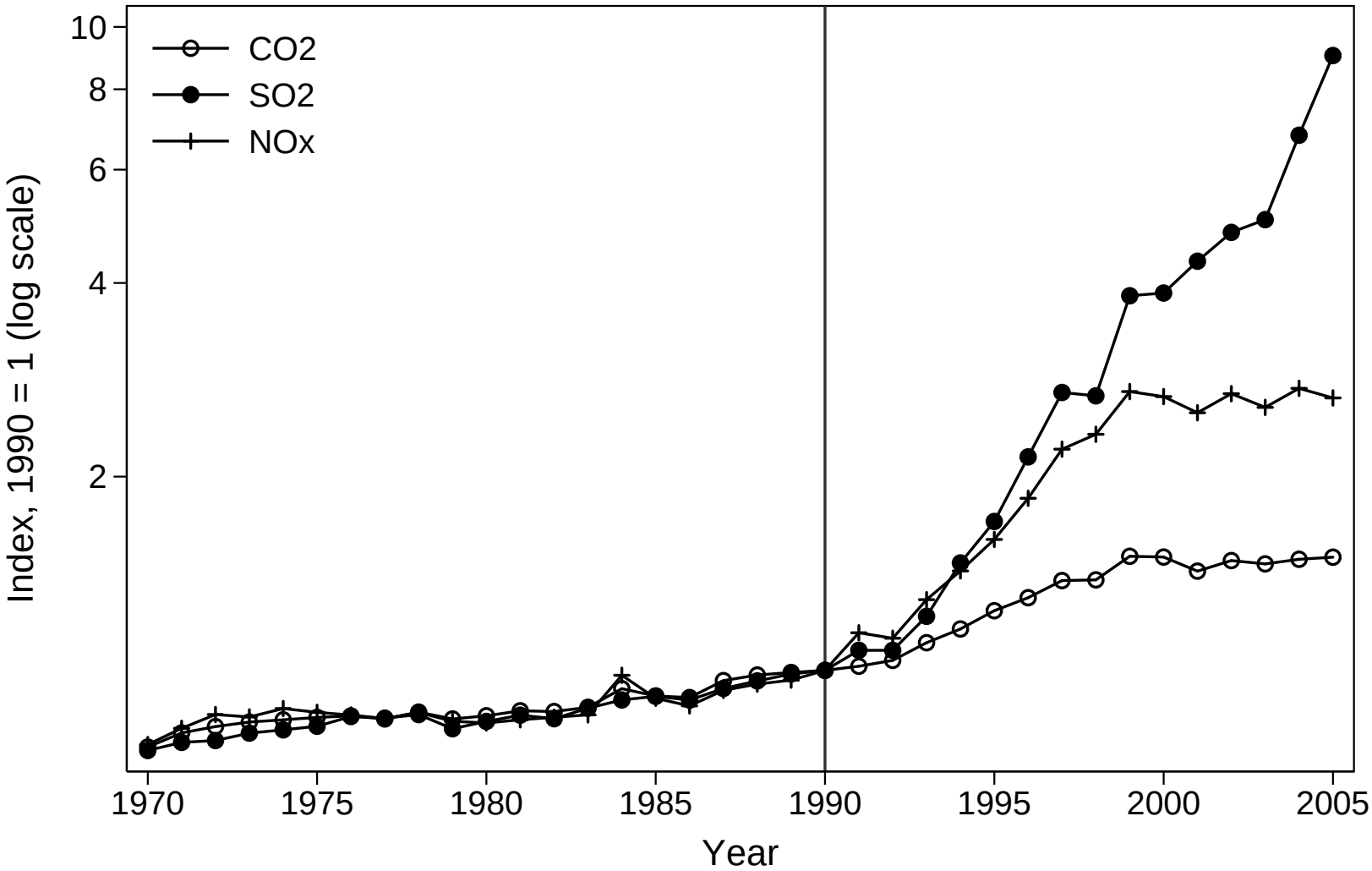

Analytical Approach: summary

- Derive factor demands from a behavioural model of cost minimization (Fabrizio et al, 2007; Gao and Van Biesebroeck, 2014).
- Estimate break dates and effect sizes.
  - Caveat: impossible not to find a break!
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Preview of Results

- We find large improvements to labour productivity right after restructuring and privatization (R&P).
  - Ownership effect dominates.
- No (positive) ownership effect for fuel. But positive correlation with competition (positive and negative).
  - Competition effect dominates.
- For the air pollutants we find only some evidence for breaks that are independent of fuel efficiency.
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Analysis: Production function

- Leontief production function to capture sequence of input decisions at plant level (capital before labour, labour before fuel).
- Actual output for plant i in year t is:

$$Q_{it}^{A} = \min[g\left(E_{it}, \Gamma^{E}, \epsilon_{it}^{E}\right), f\left(C_{it}, \Gamma^{C}, \epsilon_{it}^{C}\right), h\left(S_{it}, \Gamma^{S}, \epsilon_{it}^{S}\right), q\left(X_{it}, \Gamma^{X}, \epsilon_{it}^{X}\right), Q_{it}^{P}\left(K_{i}, L_{it}, \Gamma^{P}, \epsilon_{it}^{P}\right) \exp\left(\epsilon_{it}^{A}\right)]$$

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Analysis: Derivation of Input demand

- Assuming cost minimization constraint by $Q_{it}^{P} = Q_0(K_i) L_{it}^{\rho} exp\left(\epsilon_{it}^{P}\right)$ we get:

$$\ln L_{it} = \ln(\lambda\rho) + \ln Q_{it}^{A} - \ln W_{it} - \epsilon_{it}^{A}$$

- Adding regime subscripts r and capturing the unobserved multiplier by controls and the restructuring effect:

$$\ln L_{irt} = \alpha_{ip}^{L} + \ln Q_{irt}^{A} - \ln W_{irt} - \epsilon_{irt}^{A} + \delta_{r}^{L} + \tau^{L} t + \epsilon_{irt}^{L}$$

- Derivations for fuel and pollutants use monotonicity.

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- Estimate a common break date across panels (Bai, 2010).
  - Estimator for break date: min SSR in a least squares framework.
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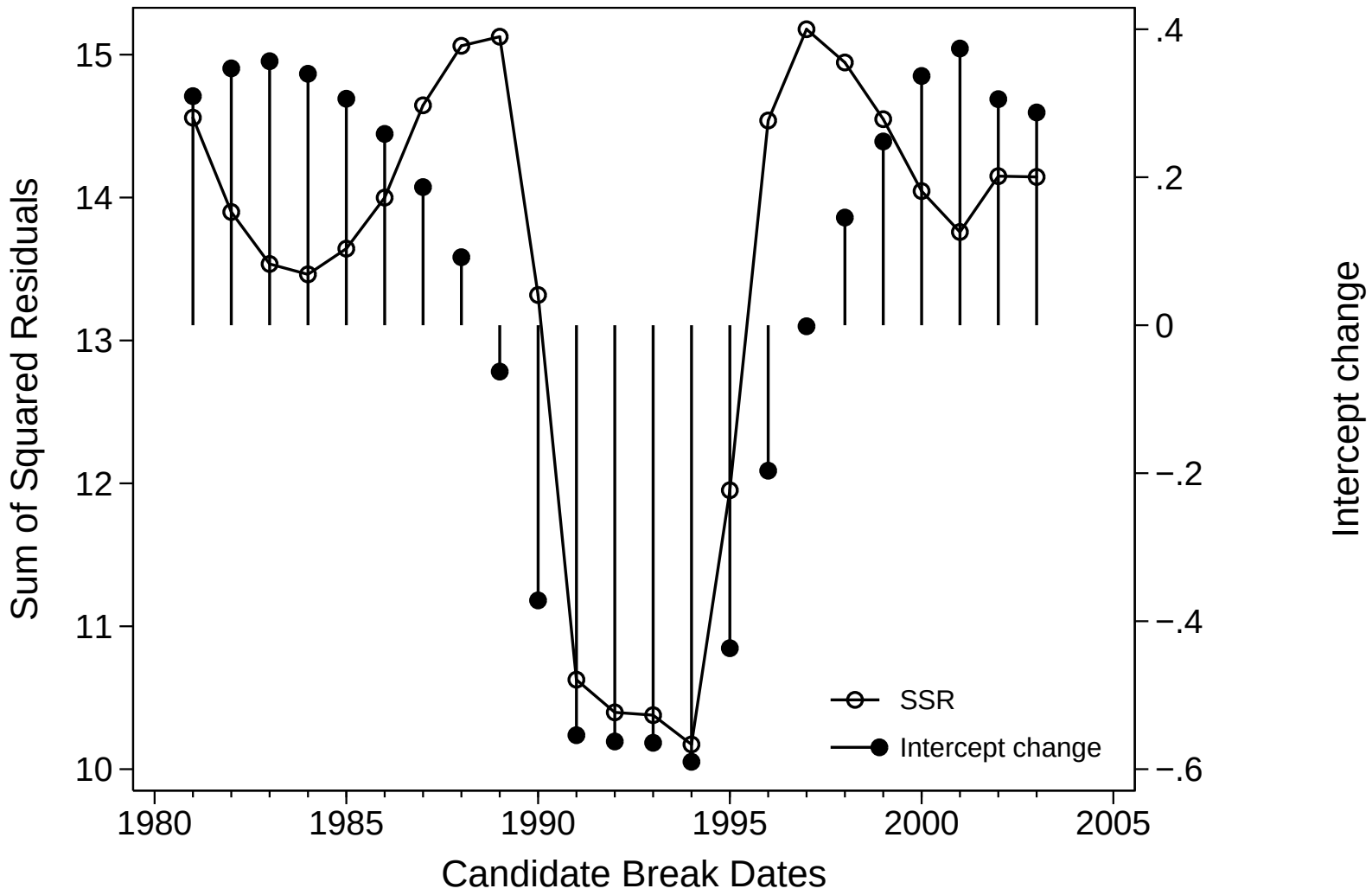

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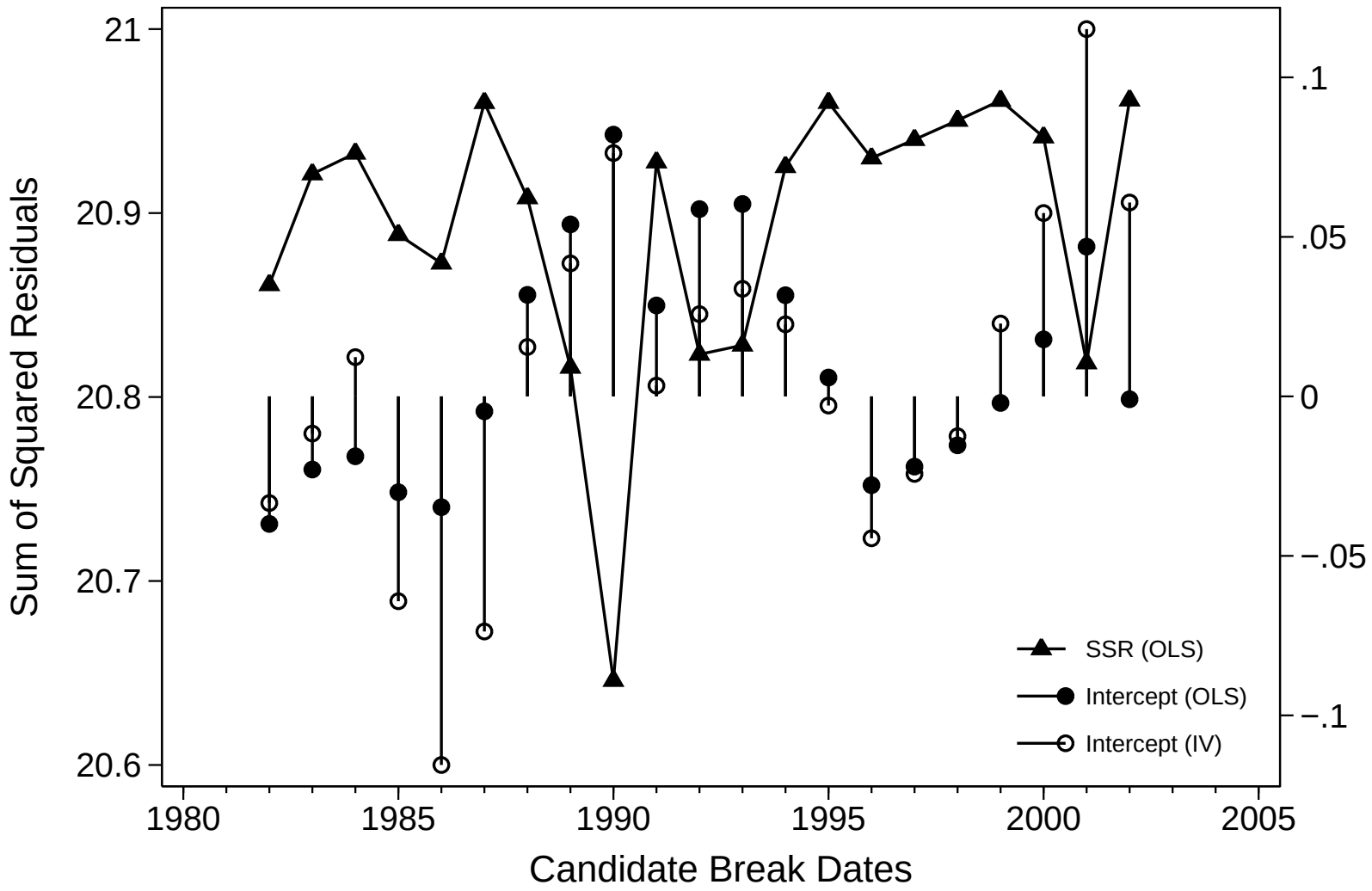
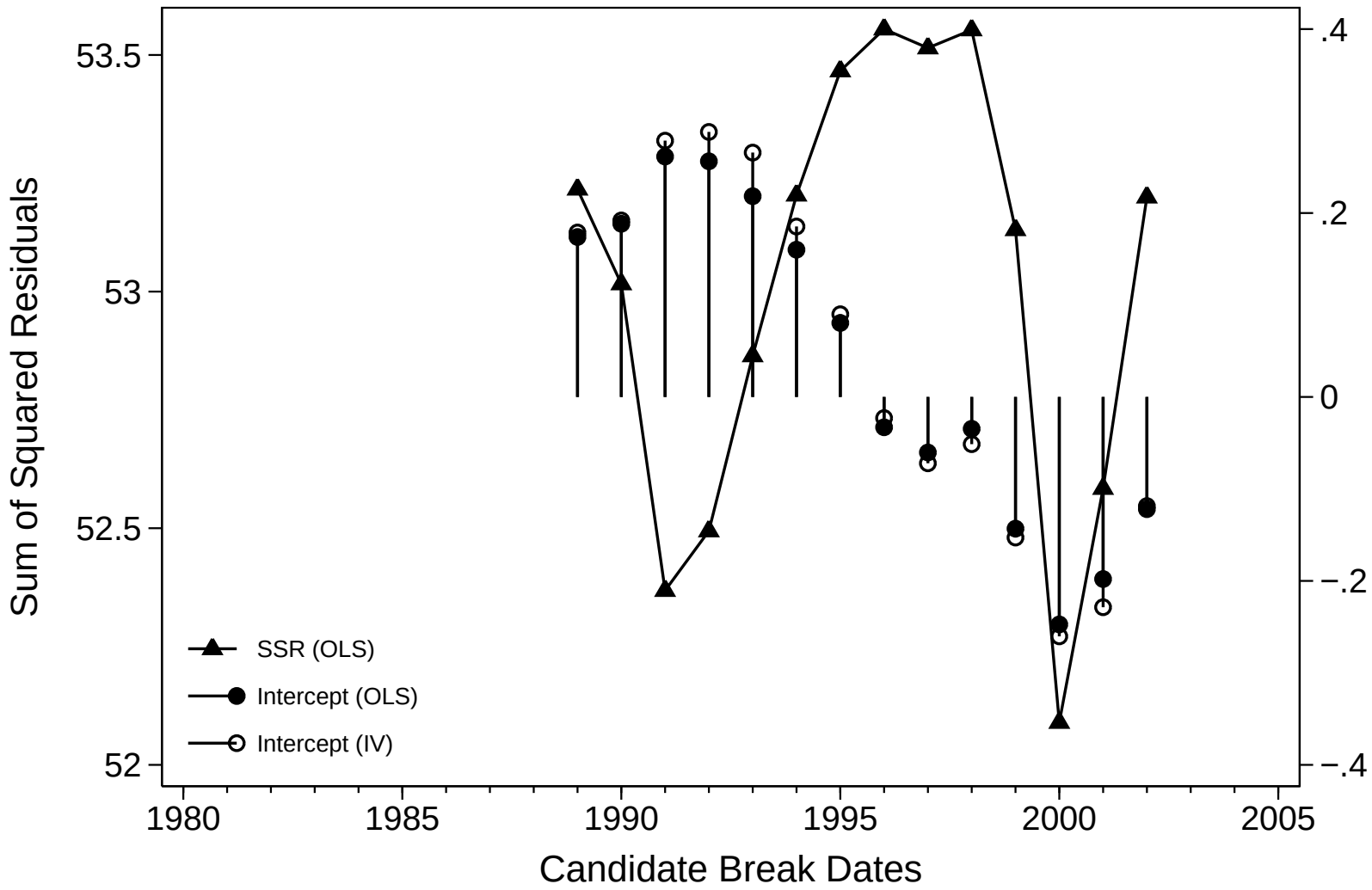


Results: SO2 emissions



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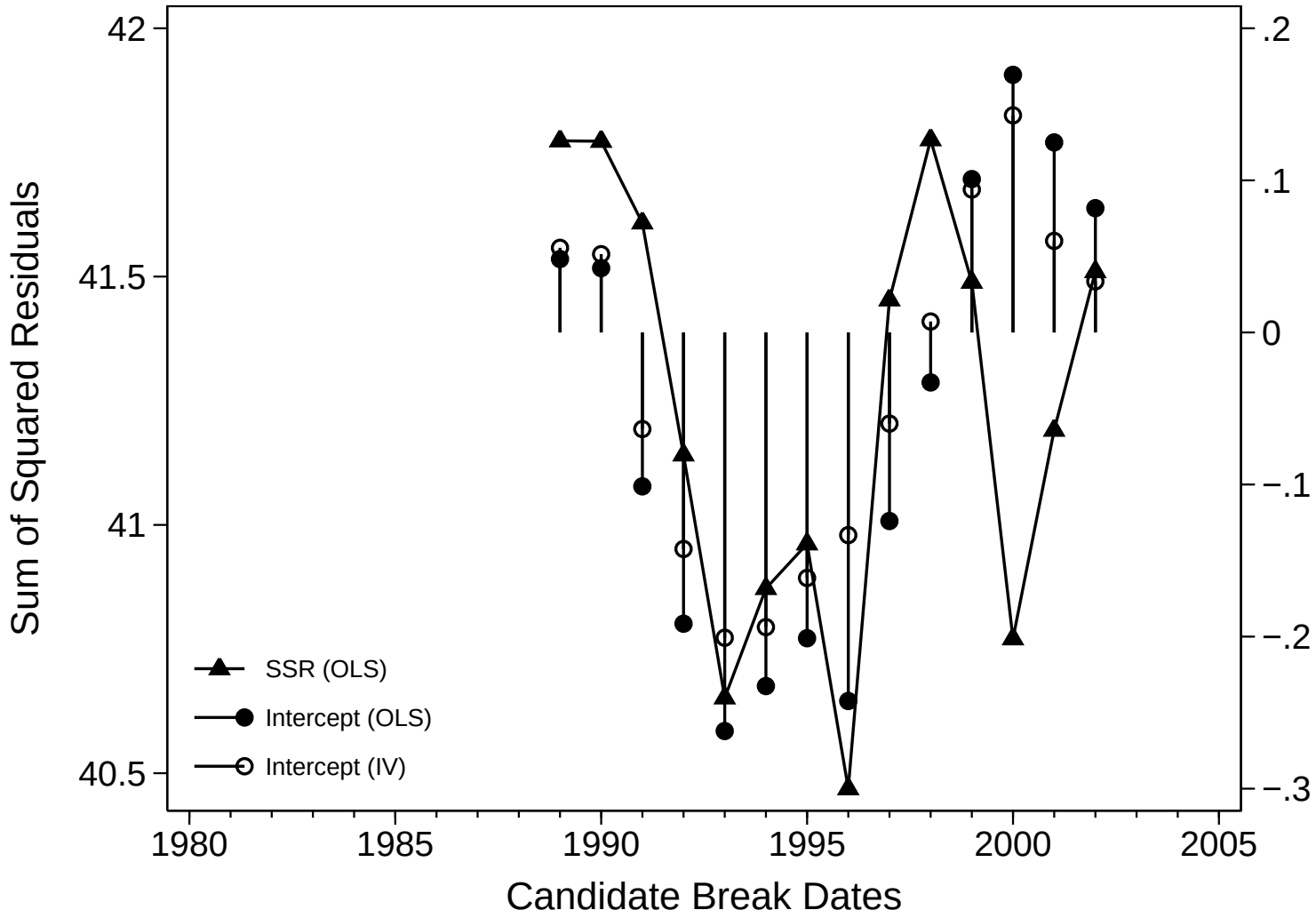

Discussion

- Large improvements to labour productivity right after restructuring and privatization.
  - Strong effect of ownership change.
  - Other factors: reduced union power, generous redundancy packages.
  - No aditional effect from competition.
- No (positive) ownership effect for fuel. But positive correlation with competition (positive and negative).
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Empirical form

$$\begin{aligned} \ln N_{irt} &= \beta_1^N \ln NET\ GWH_{irt} + \beta_2^N \ln PRICE_{irt}^N + \beta_3^N FGD_{irt} \\ &+ \beta_4^N AGE_{irt} + \beta_5^N POST_{irt} + \alpha_{ip}^N + t^N + e_{irt} \end{aligned}$$

Results: CO2 emissions