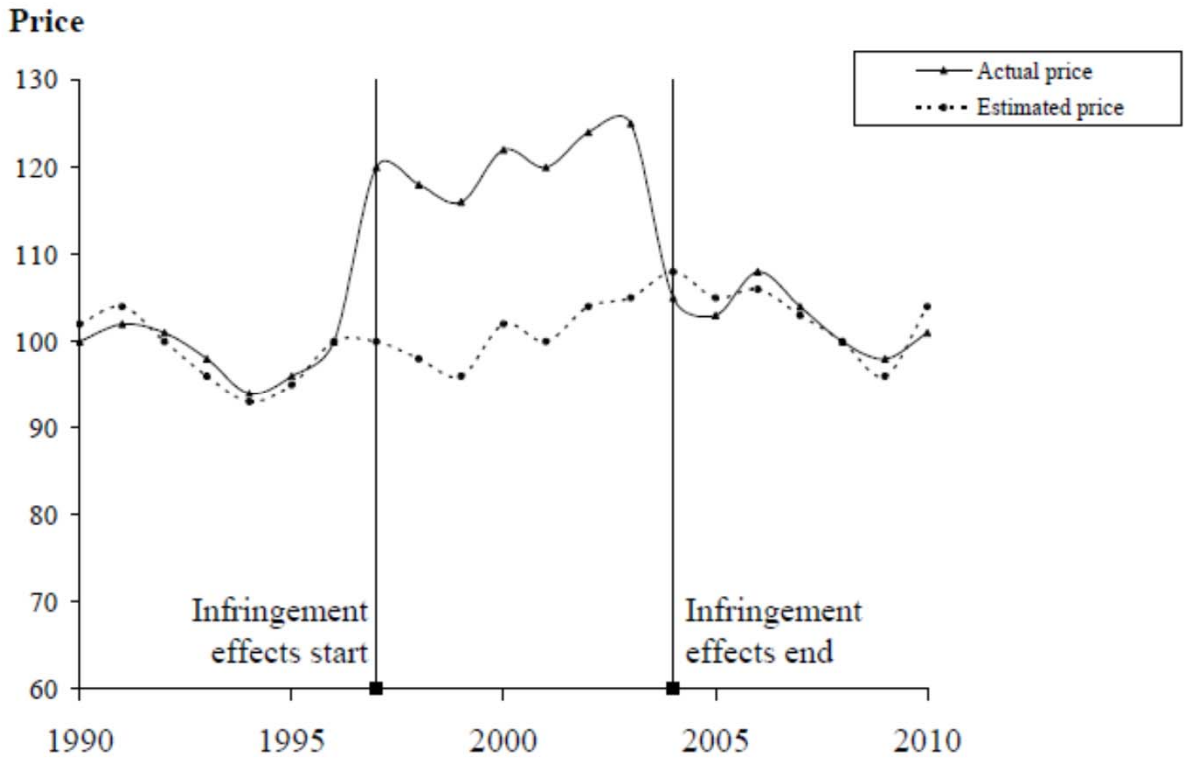
Cartel Dating

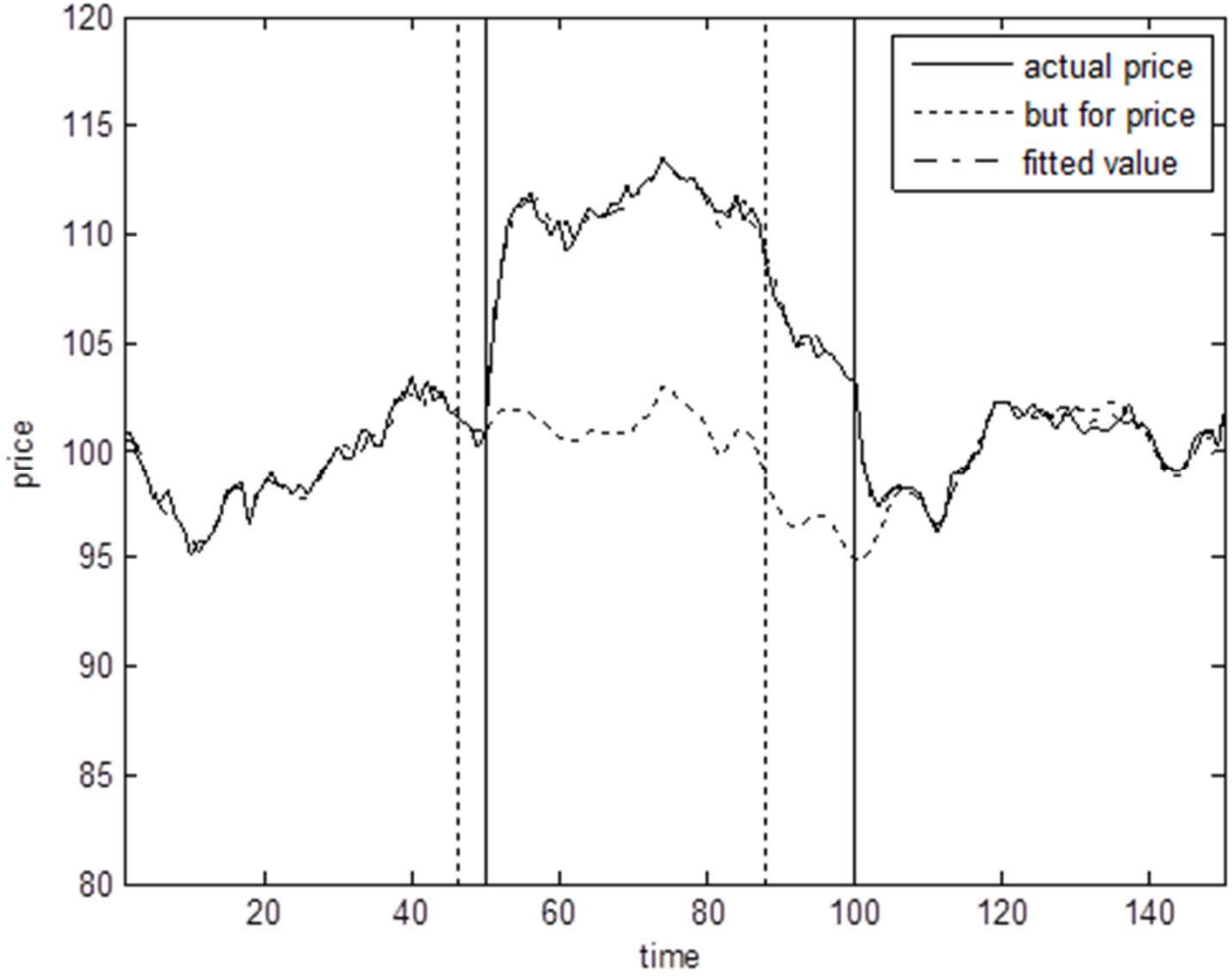
Prof. dr. Maarten Pieter Schinkel
joint work with Peter Boswijk and Maurice Bun
University of Amsterdam and ACLE

4th E.CA Competition Law and Economics Expert Forum
Berlin, 15 April 2016

UNIVERSITEIT VAN AMSTERDAM
Amsterdam Center for Law & Economics



Source: Practical Guide *Quantifying Harm* (2013)



UNIVERSITEIT VAN AMSTERDAM
Amsterdam Center for Law & Economics

$$y_t = \alpha_1 + \alpha_2 d_t + \gamma_1 y_{t-1} + \gamma_2 y_{t-2} + \beta' x_t + u_t$$

$$bfp_t = \hat{\alpha}_1 + \hat{\gamma}_1 bfp_{t-1} + \hat{\gamma}_2 bfp_{t-2} + \hat{\beta}' x_t$$

UNIVERSITEIT VAN AMSTERDAM
Amsterdam Center for Law & Economics

Formal versus Effective Dates

- Begin and end dates, intermittent price wars – fines, damages

- European Commision dates cartels to the day – evidence, negotiated:
  - "… *at least* from dd-mm-yyyy and until *at least* dd-mm-yyyy,"
  - "Single and continuous cartel infringement"

- In practice, dates are ambiguous: gradual entry and exit, delay in taking effect, post-cartel effects – ignorant buyers, long-term contracts, capacity build up, sophisticated former cartel members

- Formal and effective cartel dates need not coincide

- "Econometric analysis of observed data can be a way to identify when the infringement's effects started or ceased." Practical Guide *Quantifying Harm* (2013), recital 43

Wrong Dates Lead to an Underestimation of Harm

- Exogenous break dates introduce a specification error, that leads to attenuation bias – Aigner (1973)

- Using the formal cartel dates biases the dummy coefficient(s) downwards, irrespective of the direction of the misspecification

- Cartel dating materially affects estimation of the harm:
  - Lenght of the period(s)
  - Size of the overcharges – lower but-for prices

Simplest Model with Unit Price, No Controls and Two Breaks

$$y_t = \alpha_1 + \alpha_2 d_t + u_t,$$

$$\begin{aligned} d_t &= 0, \quad t \leq T_E, \\ d_t &= 1, \quad T_E < t \leq T_F, \\ d_t &= 0, \quad t > T_F, \end{aligned}$$

OLS: $$\hat{\alpha}_2 = \frac{s_{dy}}{s_d^2},$$

$$\hat{\alpha}_1 = \bar{y} - \hat{\alpha}_2 \bar{d},$$

What if: $T_E \neq T_B$ and/or $T_F \neq T_C$

UNIVERSITEIT VAN AMSTERDAM
Amsterdam Center for Law & Economics

Proposition 6: *Let $T_E \neq T_B$* and/or *$T_F \neq T_C$. Then the expected values of the OLS estimators of model (3.1) are such that:*

$$
\begin{aligned}
&E[\hat{\alpha}_2] < \alpha_2, \quad \forall T_B, T_C, T_E, T_F, \\
&E[\hat{\alpha}_1] = \alpha_1, \quad T_E < T_B, T_F > T_C, \\
&E[\hat{\alpha}_1] > \alpha_1, \quad \text{otherwise.}
\end{aligned}
$$

Proof: see the Appendix. ■

$$CD = \sum_{t=T_B+1}^{T_C} Q_t \alpha_2,$$

$$\widehat{CD} = \sum_{t=T_E+1}^{T_F} Q_t \left(y_t - \hat{\alpha}_1\right)$$

Proposition 7: *Let $T_E \neq T_B$* and/or *$T_F \neq T_C$. Assume that quantities sold $Q_1, ..., Q_T$ are not affected by the cartel. Then the expected value of the estimated damage is such that:*

$$E\left[\widehat{CD}\right] = E\left[CD\right], \quad T_E < T_B, T_F > T_C,$$

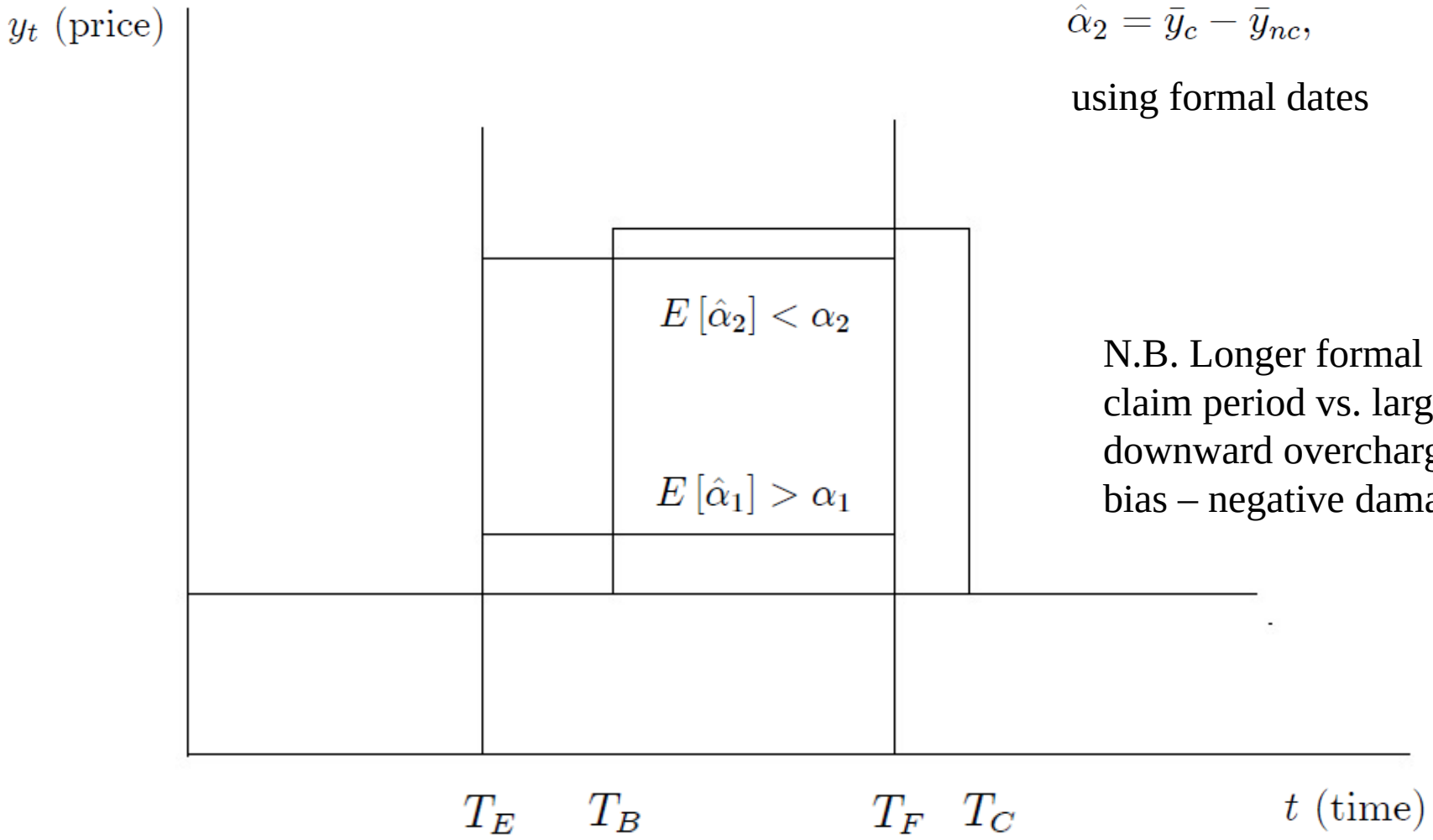
$$E\left[\widehat{CD}\right] < E\left[CD\right], \quad otherwise.$$

Proof: see the Appendix. ■

$$\hat{\alpha}_1 = \bar{y}_{nc},$$

$$\hat{\alpha}_2 = \bar{y}_c - \bar{y}_{nc},$$

using formal dates



N.B. Longer formal claim period vs. larger downward overcharge bias – negative damages

Econometric Methods for determining Cartel Break Dates

- Chow (1960) for known dates, Quandt (1960) for unknown dates – Harrington (2008)
- Quandt-Andrews (1994) finds single break. Bai and Perron (1998, 2003) finds multiple breaks, including the number of breaks
- Relies on dummy-variables approach – disputed: White et al. (2006), Marshall and Marx (2012), McCrary and Rubinfeld (2014)
- Alternative: hold out data from cartel period – often inferior

Bai-Perron for Cartel Dates

•Divide sample period in m+1 intervals for OLSs

$$y_t = z_t'\delta_j + u_t, \qquad t = T_{j-1}+1, ..., T_j,$$

$$S_T(T_1, ..., T_m) = \sum_{i=1}^{m+1} \sum_{t=T_{i-1}+1}^{T_i} (y_t - z_t'\delta_j)^2$$

$$\left(\hat{T}_1, ..., \hat{T}_m\right) = \text{argmin}_{T_1,...,T_m} S_T(T_1, ..., T_m)$$

•Sup F-test: the maximum of all possible F-tests

•Sequential: test m breaks against m+1 breaks

•Null hypothesis of m breaks is rejected if minimum value decreases

•Extra information: breaking parameters, trimming h, cartel is on/off , m even

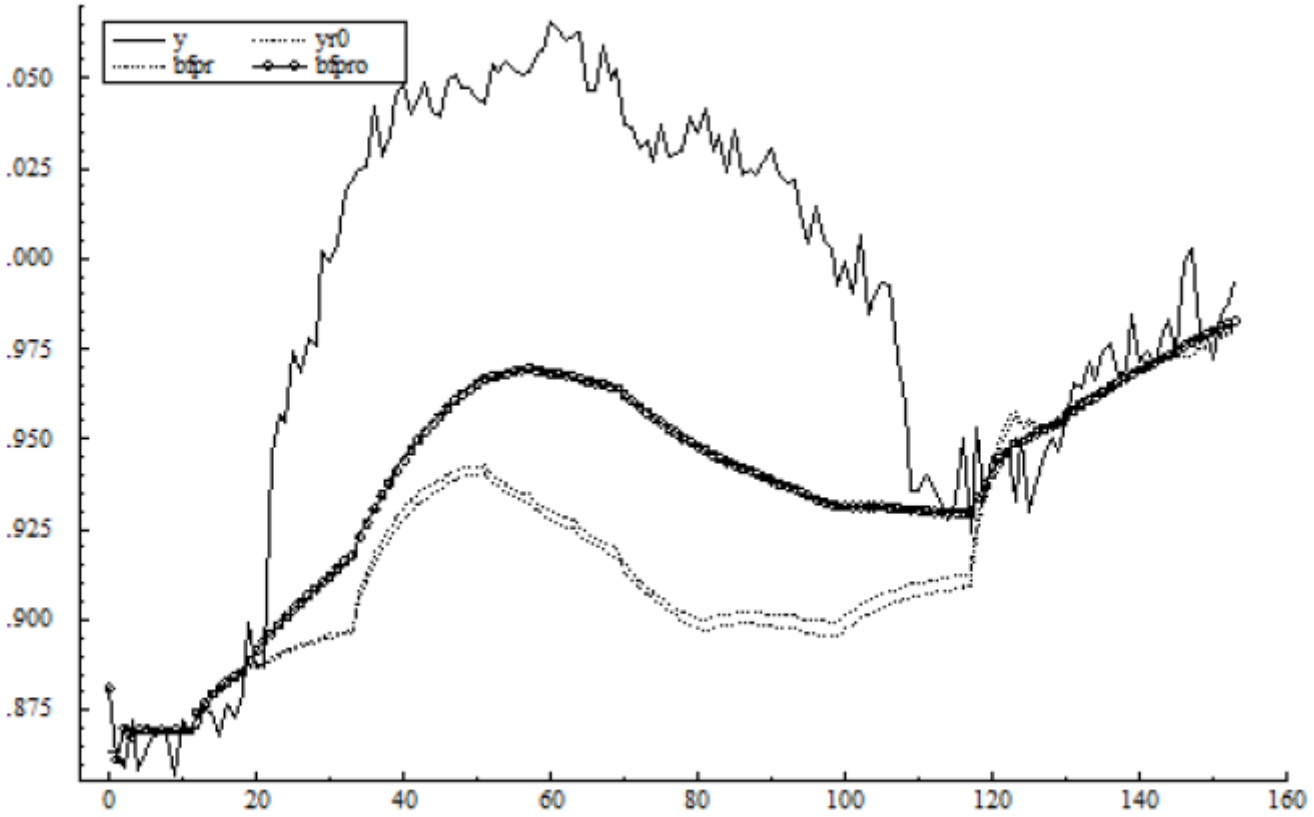
Underestimation with Controls

$$y_t = \alpha_1 + \alpha_2 d_t + \gamma_1 y_{t-1} + \gamma_2 y_{t-2} + \beta' x_t + u_t$$

$$bfp_t = \hat{\alpha}_1 + \hat{\gamma}_1 bfp_{t-1} + \hat{\gamma}_2 bfp_{t-2} + \hat{\beta}' x_t$$

- Results remain for stationary AR(1) processes
- Always underestimation for trend-stationary processes
- Monte Carlo experiment based on actual case: 27% higher but-for price

Figure 4: simulated and estimated but-for prices



Note: y is original price and yr0 is simulated but-for price; bfpr and bfpro are estimated but-for prices using effective and official ca respectively; based on 10,000 Monte Carlo replications.

Concluding Remarks

•Cartel dating essential to do – or (weak) underestimation of harm

•Suitable standard methods are available – *A Primer in Cartel Dating*

•Main D-v concern is the but-for simulation when explanatory variables are tainted

•Econometrics should be fitting to the cartel story

•Commission's wording "at least" is better, but not good enough

•Practical Guide leaves plenty of room for further developments

•"Lingering effect" – acknowledged German Federal Court of Justice

UNIVERSITEIT VAN AMSTERDAM
Amsterdam Center for Law & Economics