Laboratory Experiments Inform Emissions Permit Market Design

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Markets are Influenced by Universal Natural Forces

- **Why** conduct experiments? They provide a step towards understanding whether predictions developed through theoretical reasoning can be applied to **more complex** field conditions
- Laboratory markets are populated by profit-motivated human agents, just as markets are in the field
- **Wind tunnel** testbedding
  - Imagine testing a new wing design on an airplane without first assessing its actual aerodynamic properties in controlled wind tunnel testing
  - Note that such testing focuses on *specific* components of a new aircraft, not the entire system

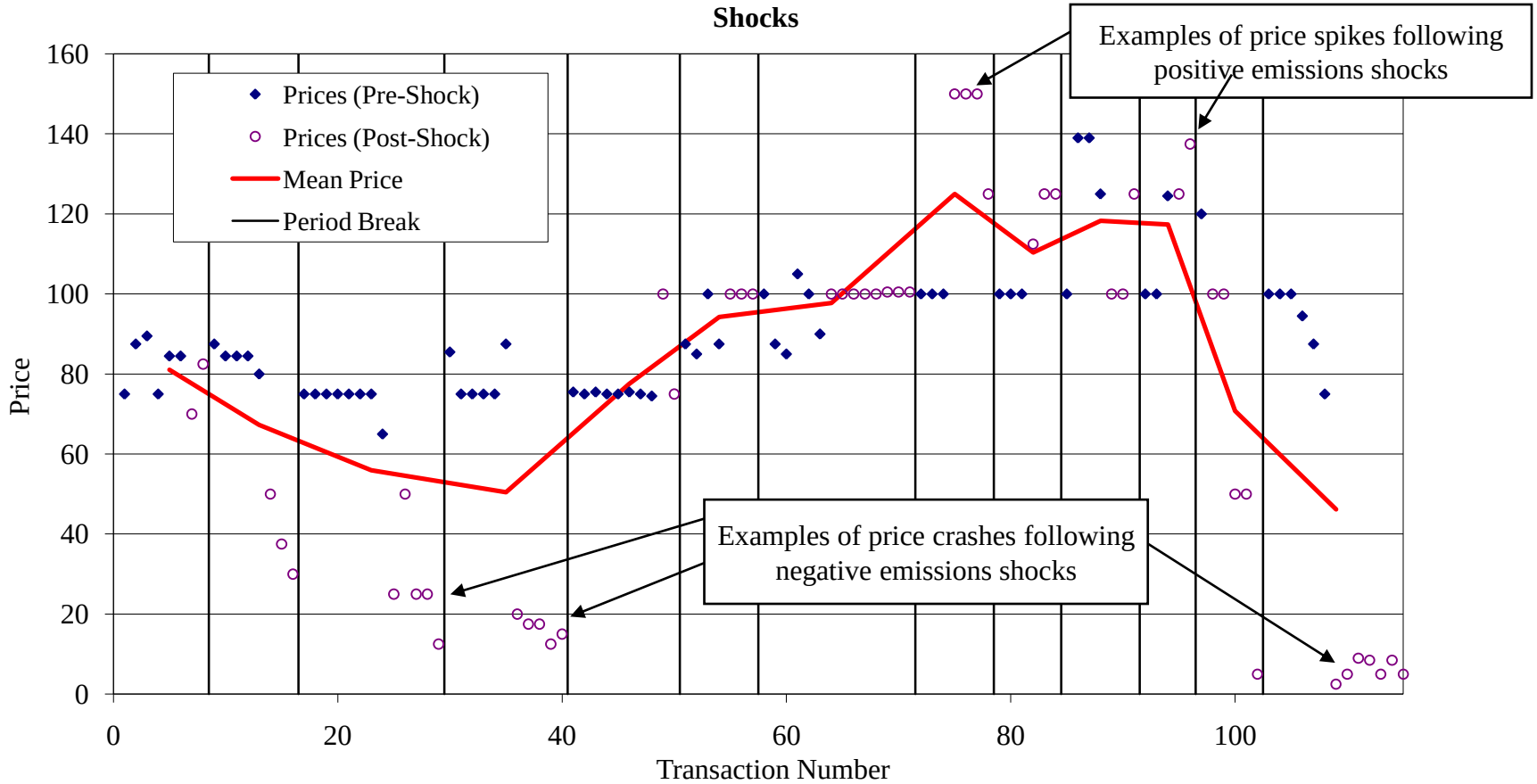
Example #1:
Banking and Price Volatility

Prices are **relatively stable** over time when traders can use banking to store unused permits or carry forward permits as a buffer against emissions shocks

Figure 2: Transaction Prices for Session BUN3, with Banking and Uncorrelated Emissions Shocks

Especially if emissions shocks are correlated (e.g., due to weather), **price spikes and crashes** occur without banking at the end of some compliance periods

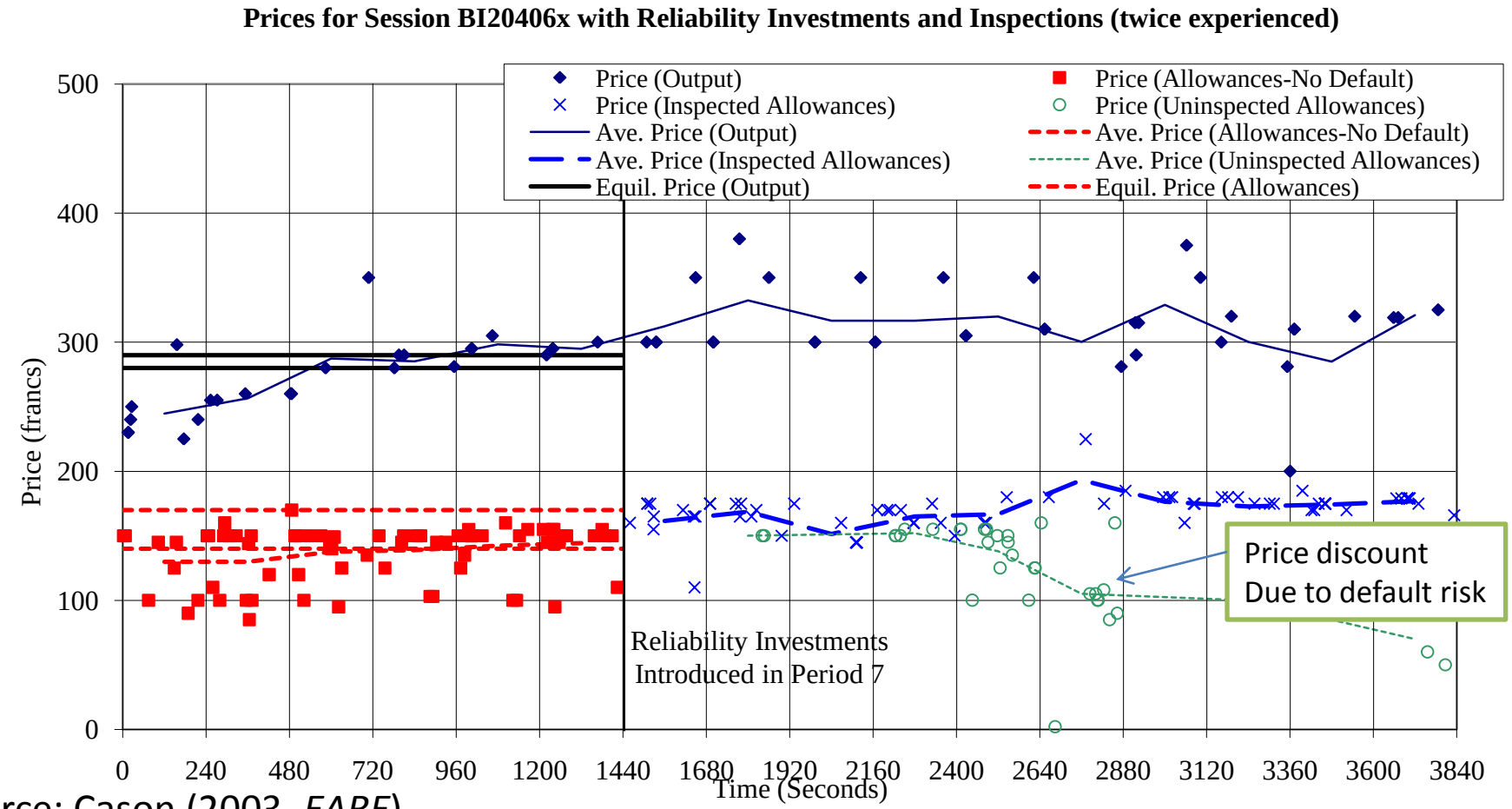
Figure 3: Transaction Prices for Session NBCO3, with No Banking and Correlated Emissions Shocks



Other designs, such as overlapping permit validity periods, can also reduce price volatility

Source: Cason & Gangadharan (2006, *JEBO*)

Example #2: Buyer Liability Rules Create Incentives for Sellers to Invest in Reliability



Source: Cason (2003, *EARE*)

Buyer liability may perform poorly, however, when sellers cannot inspect reliability investments (Godby & Shogren, 2008)

Example #3: Auction Rules can Strongly Influence Revenue Raised and Price Discovery

- Earliest government permit auctions (U.S. SO_2 permits, starting in 1993) resulted in **biased price signals** for this emerging market
  - Cason (1995, *AER*); Cason & Plott (1996, *JEEM*)
- **Uniform price** auctions (such as an ascending price clock auction) reduce incentives to strategically manipulate bids to influence price
- Substantial revenue recycling benefits from auctioning rather than freely allocating permits
  - Provides resources to more directly assist harmed industries and consumers (regressive impacts of increased energy costs)
  - Estimates for U.S. suggest that a policy applied upstream needs only 5 to 15 percent freely allocated to preserve energy industry asset values (Bovenberg & Goulder, 2001)

Example #4: Compliance and Enforcement

- Compliance responds to enforcement efforts, and it interacts with other design features
  - E.g., **noncompliance** may increase with more flexible banking and trading rules (C&G, 2006 *JEBO*)
  - Permit market equalizes compliance costs across firms, but experiments reveal that net permit buyers tend to have lower average compliance (Murphy & Stranlund, 2006 *JEBO*)
  - Increased enforcement has both a **direct positive** effect on compliance incentives, but also an **indirect negative** effect by forcing permit prices higher (M&S)

Conclusion:
The Devil is in the Details

- Researchers have come a long way from the 1970's naïve proposals to "plant a market, let it grow"
- Distributional, economy-wide implications are best assessed using CGE modeling techniques
- **Economics experiments** are useful for evaluating some details regarding market design, permit characteristics, liability rules, auction rules, enforcement, etc.