The Puzzling SO_2 Price Spike of 2005-2006

Ellerman/Feilhauer/Parsons
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DDCF Project

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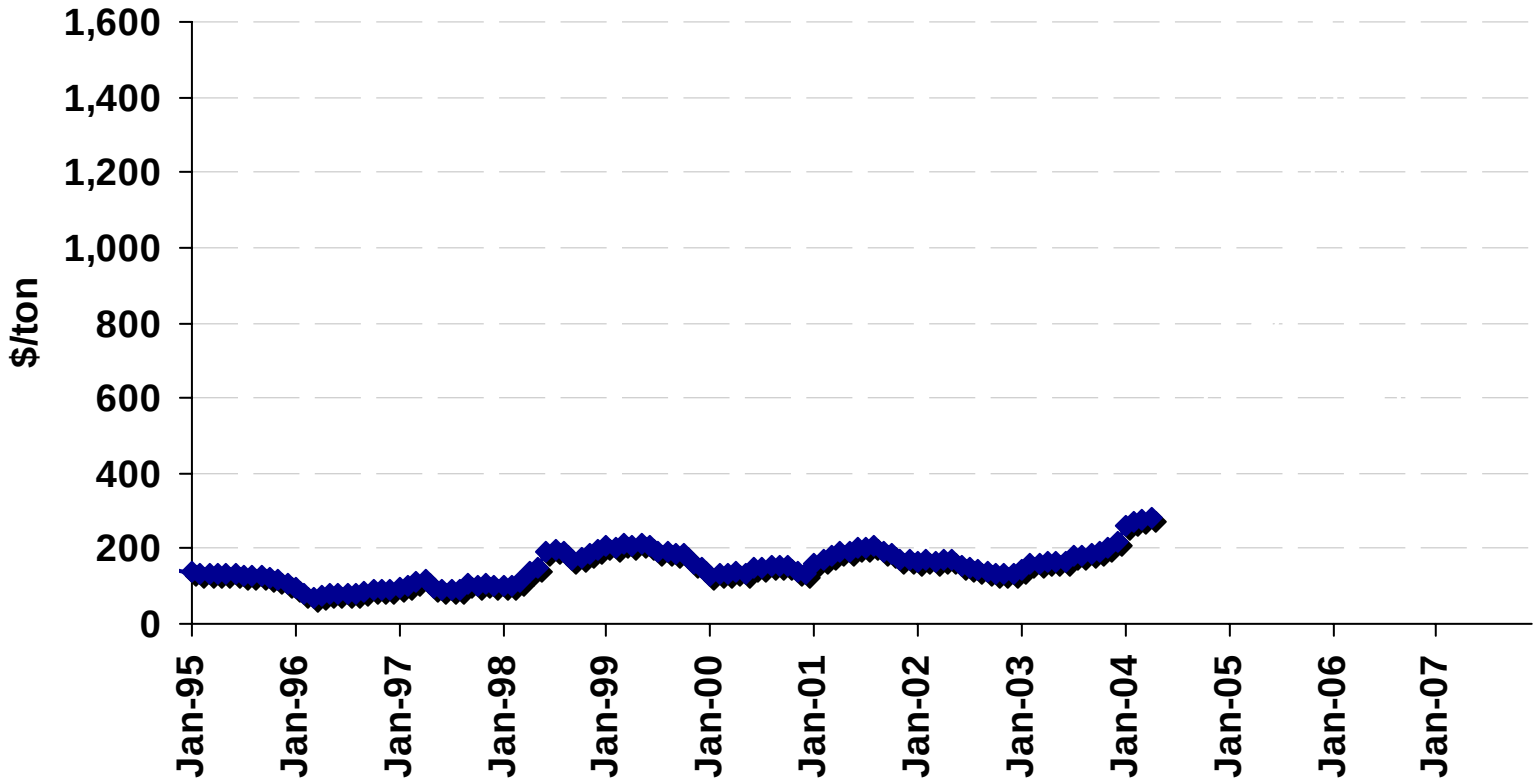
The Spike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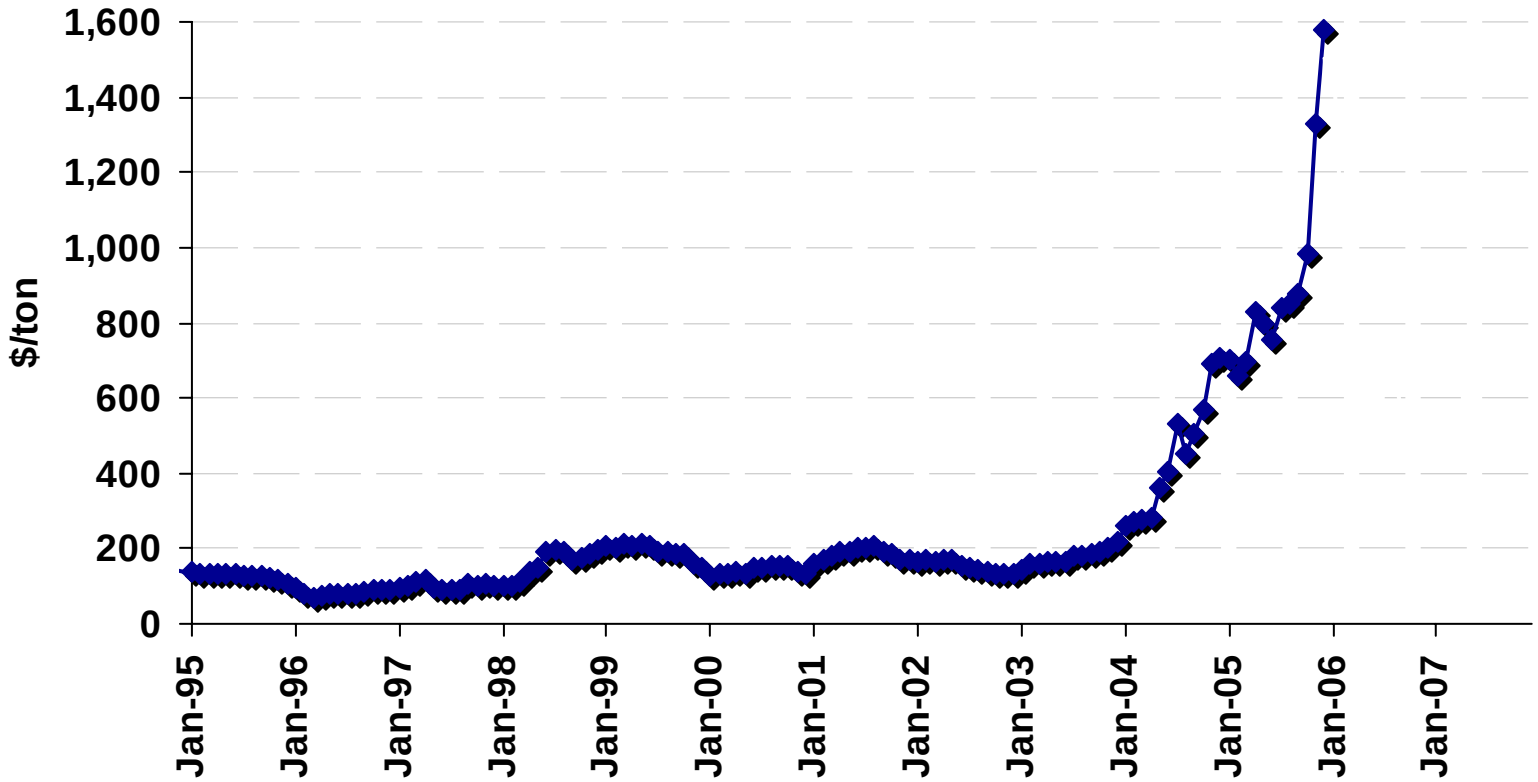
The Spike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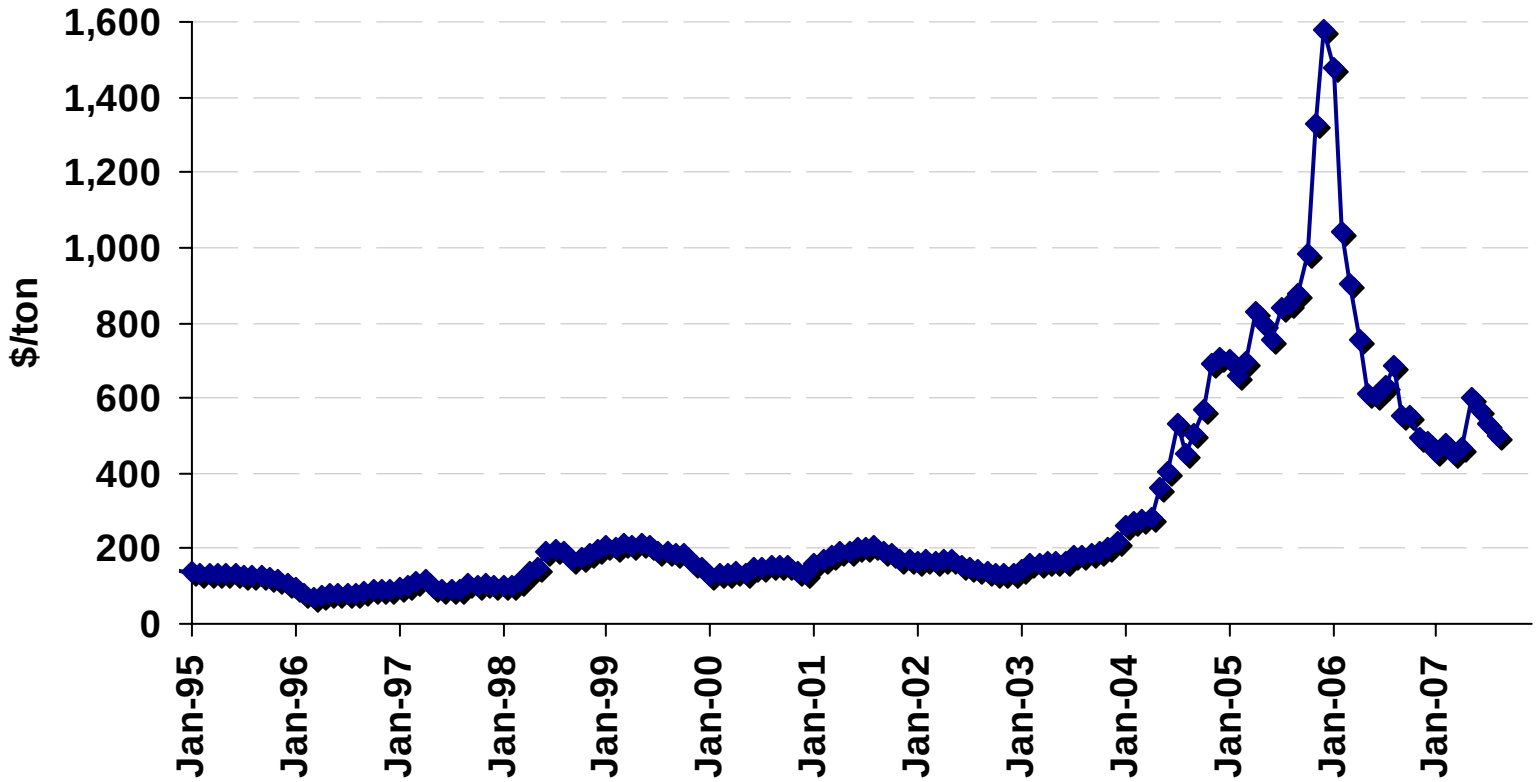
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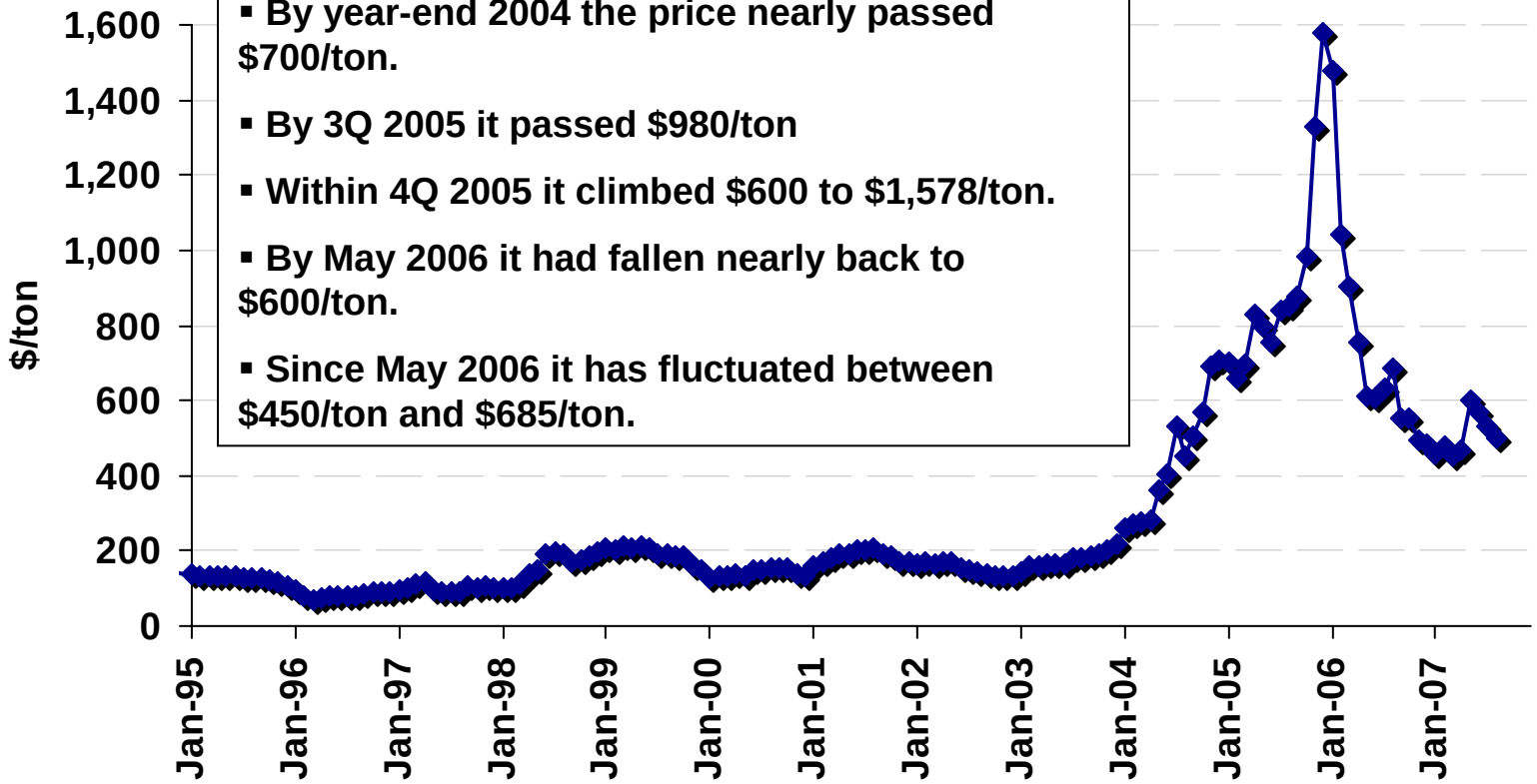
The Spike

- Through year-end 2003 the price ranged within a band from $69/ton to $217/ton.
- By year-end 2004 the price nearly passed $700/ton.
- By 3Q 2005 it passed $980/ton
- Within 4Q 2005 it climbed $600 to $1,578/ton.
- By May 2006 it had fallen nearly back to $600/ton.
- Since May 2006 it has fluctuated between $450/ton and $685/ton.



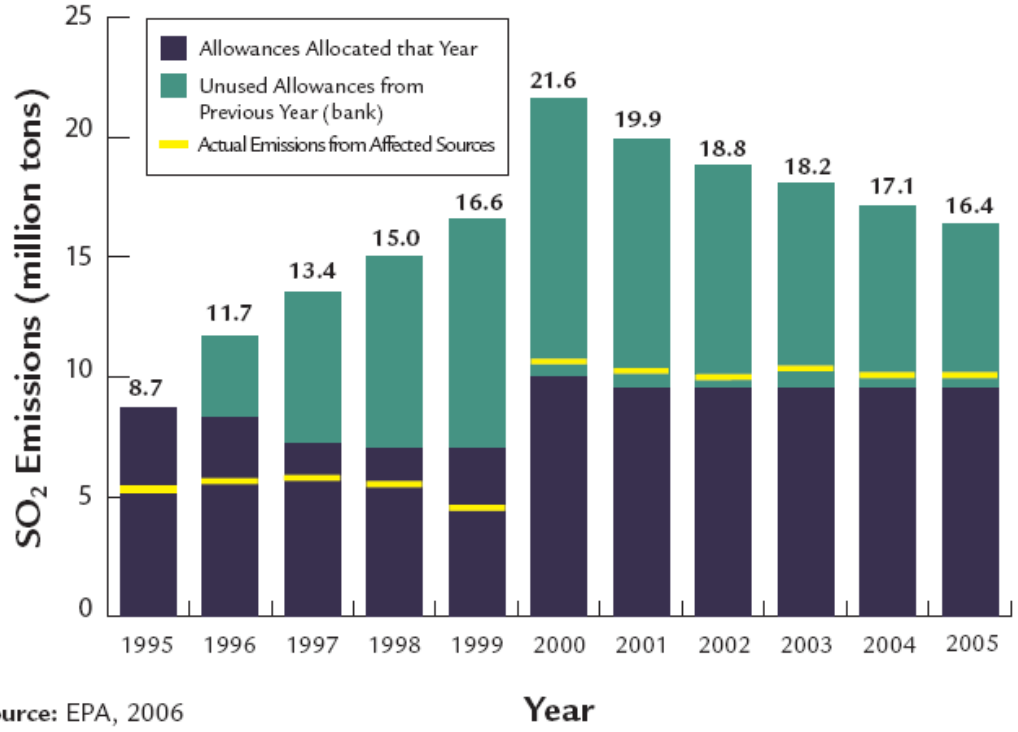
Why is this a puzzle?

- Many commodity prices exhibit sharp fluctuations.
- Some are predictable seasonal fluctuations:
  - e.g., natural gas.
- Others are short-run or transitory responses to supply or demand shocks:
  - e.g., natural gas esp. in winter,
  - electricity in summer peak hours,
  - orange juice prices after sudden frosts.
- Why should SO_2 be different?

Banked allowances should smooth the impact of transitory shocks.

- SO2 allowances are dated or vintages, but are usable to cover emissions in any year after their allocation.
- A large bank existed…

Figure 3: SO_2 Emissions and the Allowance Bank, 1995-2005

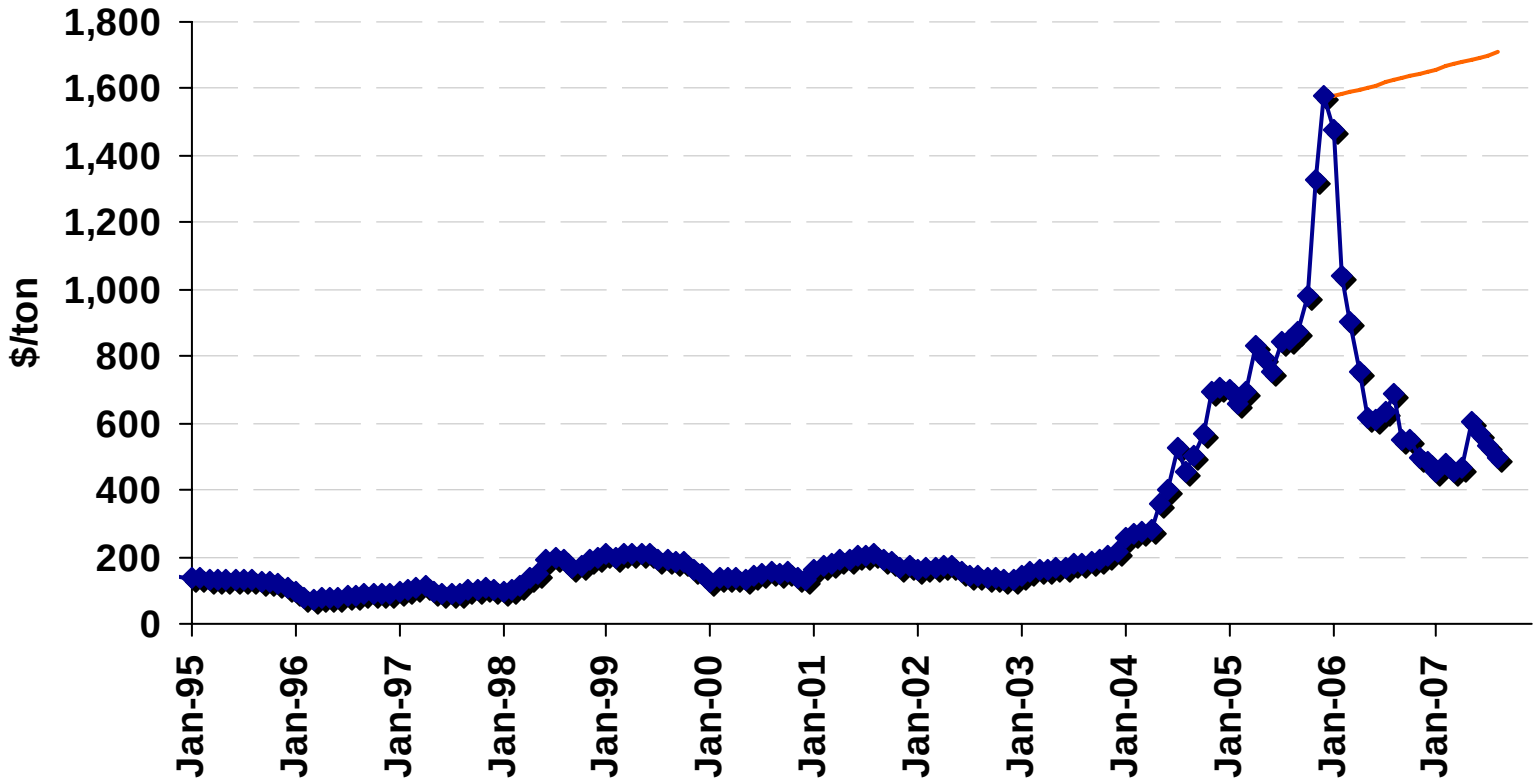


Source: EPA, 2006

Banked allowances should smooth the impact of transitory shocks. (cont.)

- SO2 allowances are dated or vintages, but are usable to cover emissions in any year after their allocation.
- A large bank existed…
- Suppose a sudden shock required extra emissions in 2005. Then the extra emissions would be covered with allowances from the bank, and the result would be a reduction in emissions in subsequent years.
  - E.g., increase emissions by 100 in 2005
  - Decrease emissions by 10 in years 2006 to 2015.
  - Equate marginal cost in each year.
- Result #1. Price impacts should be attenuated. A transitory shock does raise the price. But the increase is attenuated by the reallocation of the bank across all years.
- Result #2. Price impacts should be “permanent”. The expected allowance price should be higher in ALL future years. There should be no “spike”

Forecasted price @ Dec ’05 given a bank.



Does this matter?

- What was the added cost of compliance due to the spike?
- During the “inflation”, between September 2004 and April 2006…
  - there were more than 11 million allowances sold between economically distinct entities as recorded at the EPA registry—compared against approx. 10 million tons in emissions,
  - at a weighted average inflation of $449/ton,
  - implying a potential $5 billion in extra costs to those buying allowances at the inflated price.

- Lessons for the design of a US CO_2 market.
  - …and worries about the debate.

Fundamental Explanations

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2 candidate fundamental explanations for the spike.

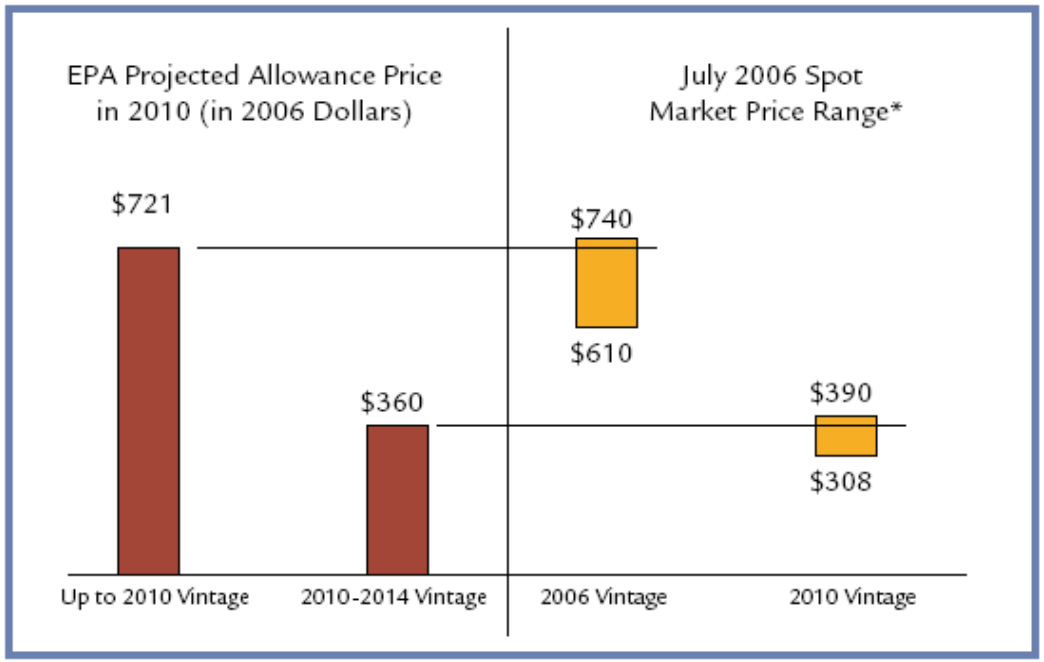
- The Clean Air Interstate Rule permanently raised the cost of compliance.
- Disruptions to deliveries of PRB low-sulfur coal temporarily raised the cost of compliance.

The Clean Air Interstate Rule

- Finalized in March 2005.
- Imposes an SO2 cap tighter than the original Acid Rain Program.
  - Technically overlaid on top of the ARP.
  - Allowances are a common currency for satisfying both regulations.
- 2010 standard is 2:1 relative to ARP.
- 2015 standard is 2.86:1 relative to ARP.

Forecasted higher compliance costs and allowance prices.

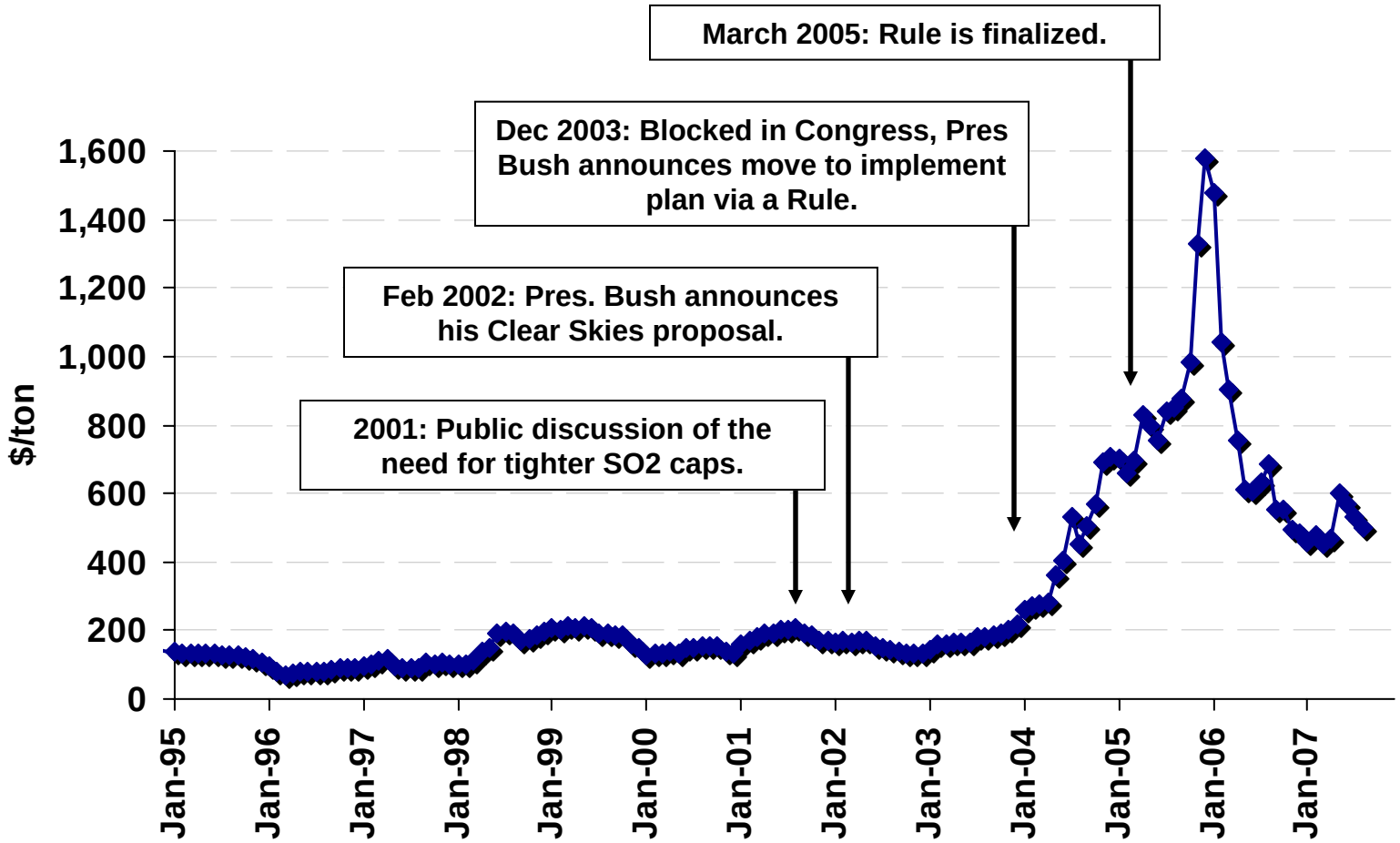
Figure 6: Actual and Forecast Allowance Prices



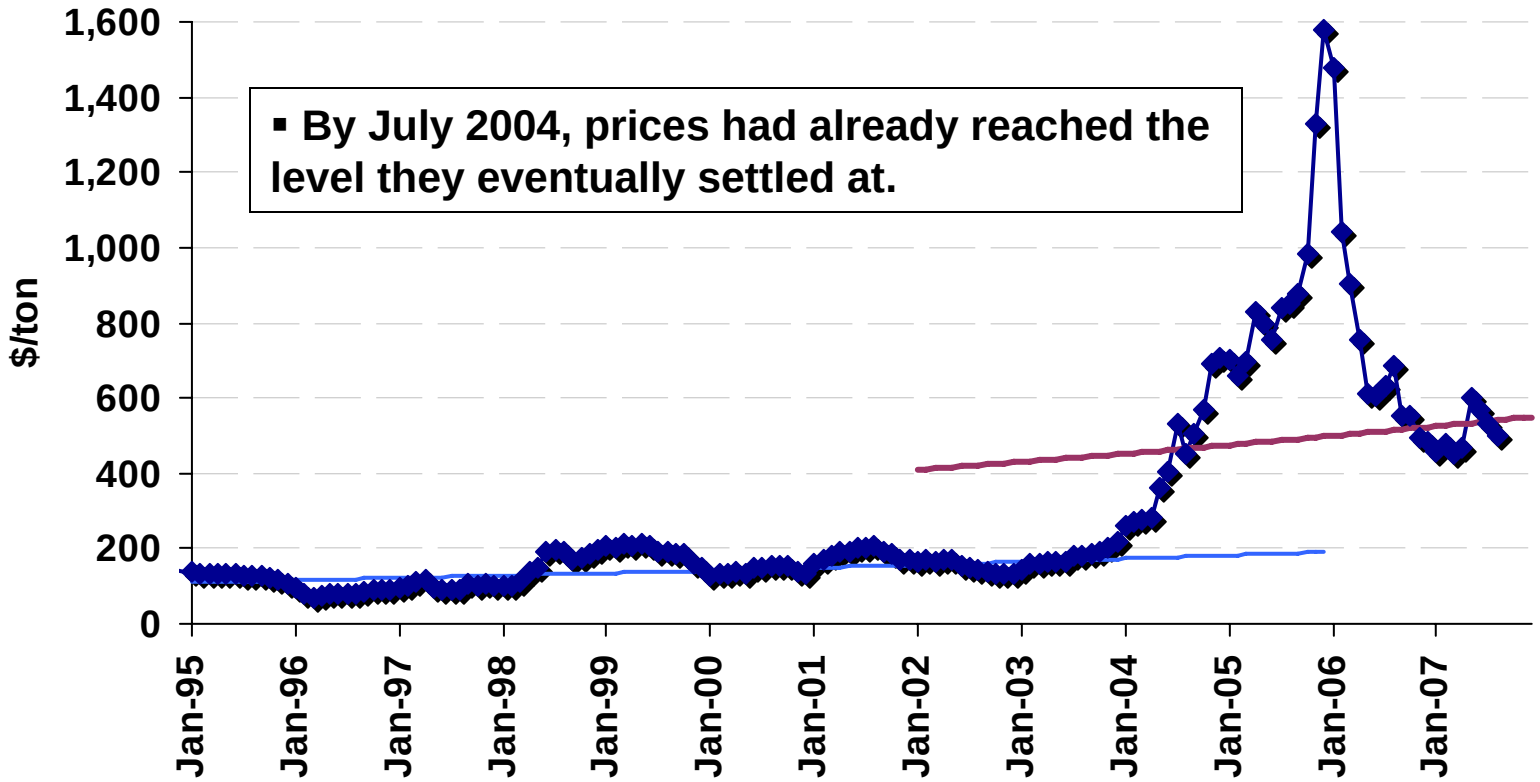
* EPA analysis suggests that 2006 vintage allowances should be selling for about $600 per allowance and 2010 allowances should be about $300 per allowance.

Source: EPA, 2006, and Evolution Markets, LLC, 2006

Key Events Leading to CAIR



Anticipation and the SO2 Price.



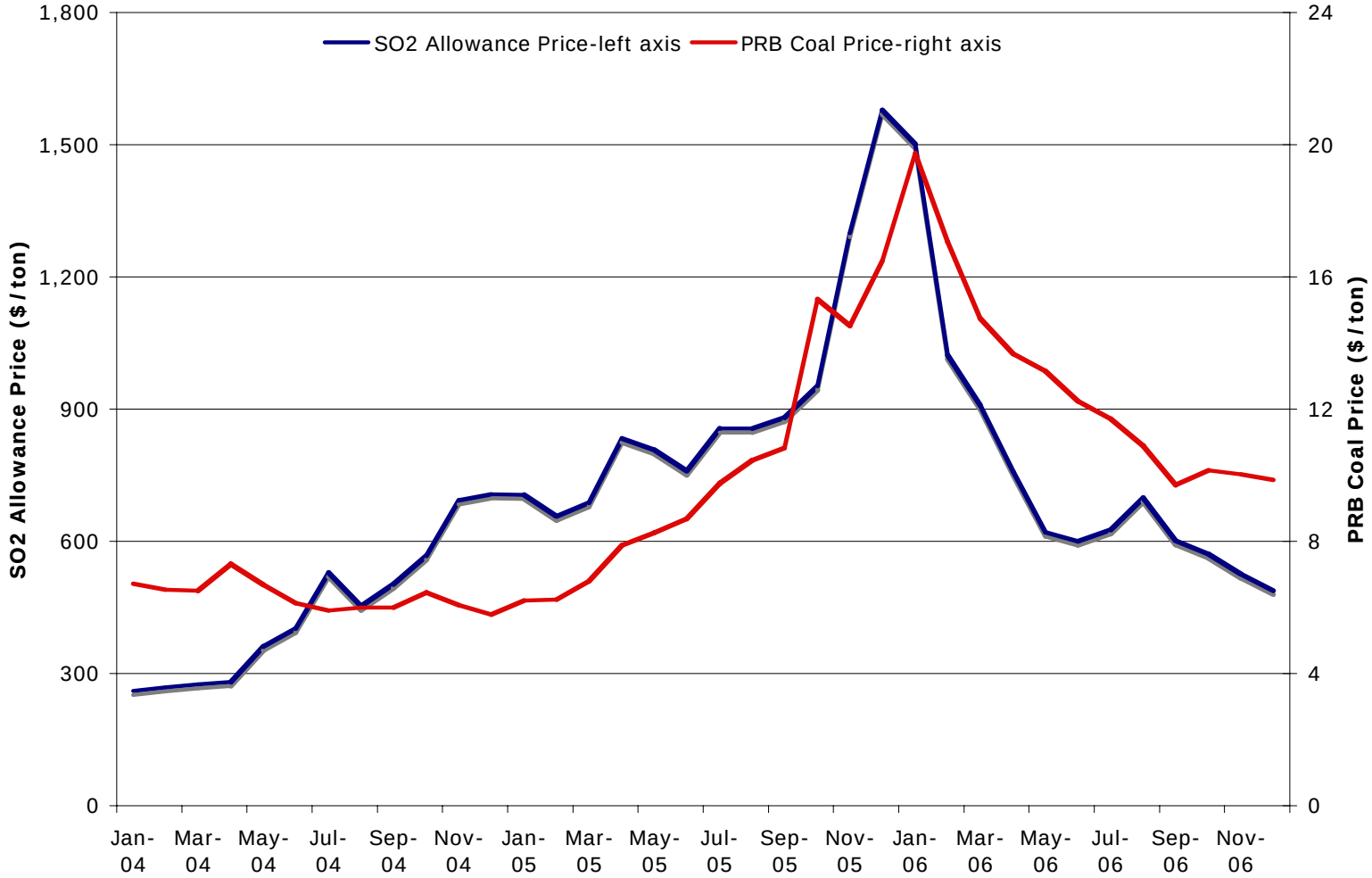
EPA view of “overconservative” market participants.

“In 2004, the market started to react to the likelihood of future emission reduction requirements that went beyond the existing caps of the ARP. The price of SO2 allowances continued to rise during 2005, ending the year at about $1,550 after beginning the year at about $700. Market observers believe this price run-up occurred due to initial uncertainty as EPA finalized the Clean Air Interstate Rule (CAIR). CAIR requires further SO2 reductions from sources in many eastern states beginning in 2010.These additional reductions cause an increase in the expected marginal cost of compliance in future years. Because allowances are bankable today for use in future years, estimates of future control costs impact the current market price of allowances. However, an apparent overly conservative reaction by buyers, who wanted assurance that they could cover current and future allowance needs, caused market prices to exceed EPA’s estimate of future control costs. In the first half of 2006, however, allowance prices have fallen sharply, and were just over $600 per ton at the end of June 2006.This price level is more consistent with where EPA has expected allowances to be today, given estimates of the marginal cost of reducing SO2 emissions under CAIR. EPA has seen temporary run-ups in the allowance markets before, with appropriate downward adjustments as buyers and sellers more completely assess market fundamentals. For instance, at the beginning of compliance with the NOx Budget Program, EPA observed a similar pattern of market run-up followed by a self-correction.”

Supply disruptions to PRB coal

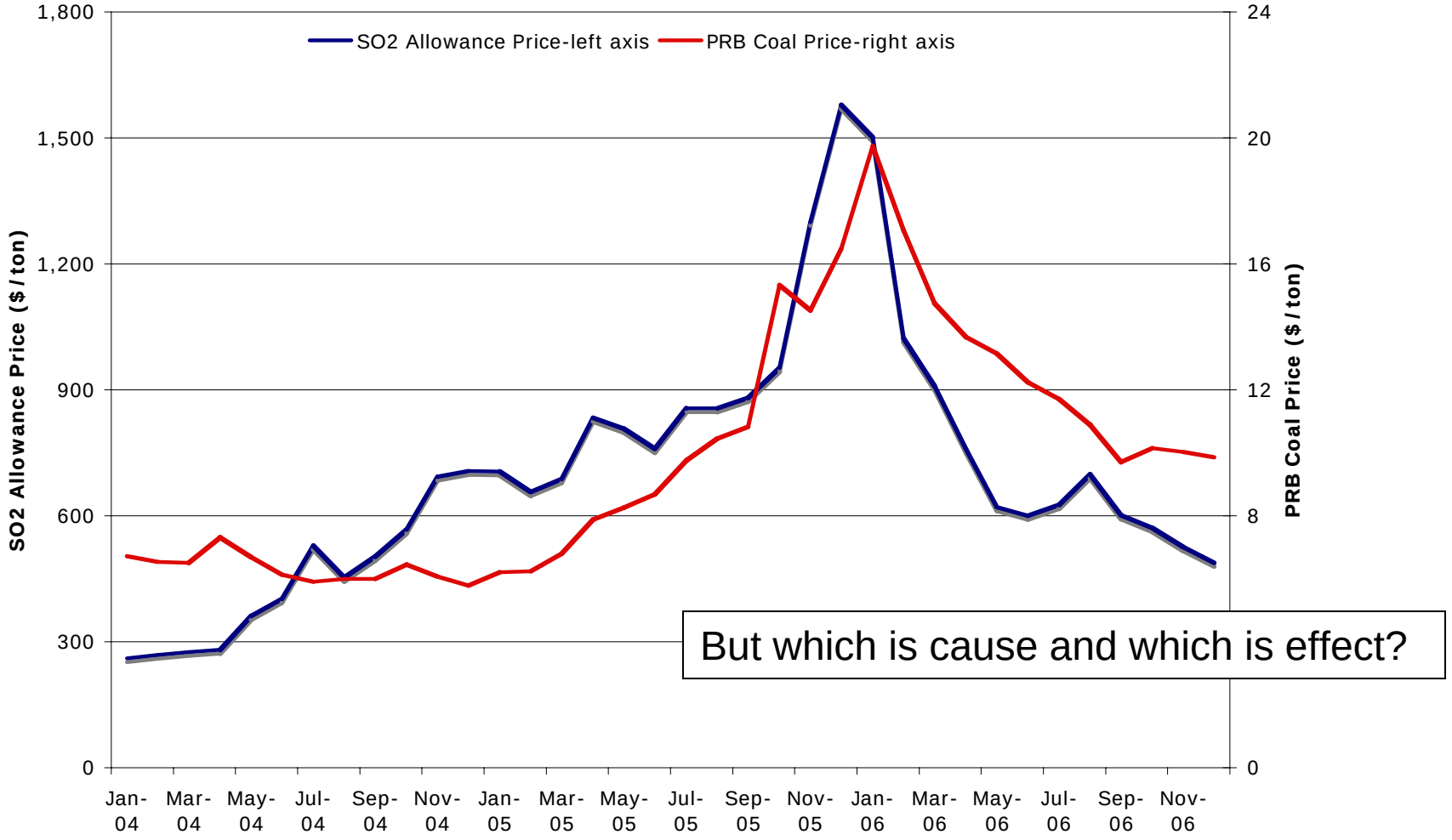
- A track failure and derailment in Wyoming in May 2005 caused extensive rebuilding programs by the two main operators, Union Pacific and Burlington Northern Santa Fe. The railroads cut contracted deliveries by 15-20% through November.
- October rains also damaged Union Pacific track near Topeka, disrupting deliveries further.
- Arch extended the outage on its West Elk mine, yielding estimated losses of 1.1 million tons. CONSOL Energy reported delays in repairing its Buchanan mine.
- The affected utilities switched dispatch to gas (Xcel, Arkansas Electric) or purchased power on the open market (Xcel, WE Energies, Entergy & Alliant Energy), shifted to using high sulfur coal (AEP) or imported coal (CPS).
- Coal's share of electric generation in 2006 was 0.6 percentage points less than 2004. Total generation was up 2.4% to 3.9 million killiowatts.
- PRB spot coal prices were up 220% in Dec 2005 over Dec 2004, reaching $18.25/ton.

Price correlation between PRB and SO2.



Source: Platts weekly PRB coal prices averaged monthly; Cantor Fitzgerald monthly SO2 index

Price correlation between PRB and SO2.



Source: Platts weekly PRB coal prices averaged monthly; Cantor Fitzgerald monthly SO2 index

How correlated should allowance prices be to transitory shocks?

- Received wisdom has been that the daily CO2 price variations in the EU-ETS are driven by variations in natural gas prices and weather variables.
- Given a sufficient window for banking & borrowing, these variables should be mostly transitory.
- The EU-ETS trial period was only 3 years, so a transitory variable becomes, in part, permanent.
- How long is long enough?

An Alternative Explanation: Market Design

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Float / Liquidity / Squeeze

- Float: portion of total asset pool available for trade.
  - In stocks, it is the number of outstanding shares, minus restricted shares, possibly minus unrestricted shares held by key blockholders.
  - Key concept for theories of the internet stock bubble & crash.
    - Many internet stocks initially floated a very small fraction of total shares; vast majority of holdings were restricted.
    - Also a small supply of shares for shorting.
    - Therefore the price does not reflect the “market” perception of value.
    - Crash follows the release of a mass of unrestricted shares onto the market.
- Liquidity is a slightly different concept.
  - A small float is likely to lead to low liquidity. Raises search costs.
  - But not necessarily: internet stocks were very liquid.
- Squeeze arises when some parties have a need to obtain the asset within a short period of time.
  - Illiquidity increases the likelihood of a squeeze developing.
  - Primarily associated with futures contracts and designated delivery types and locations.

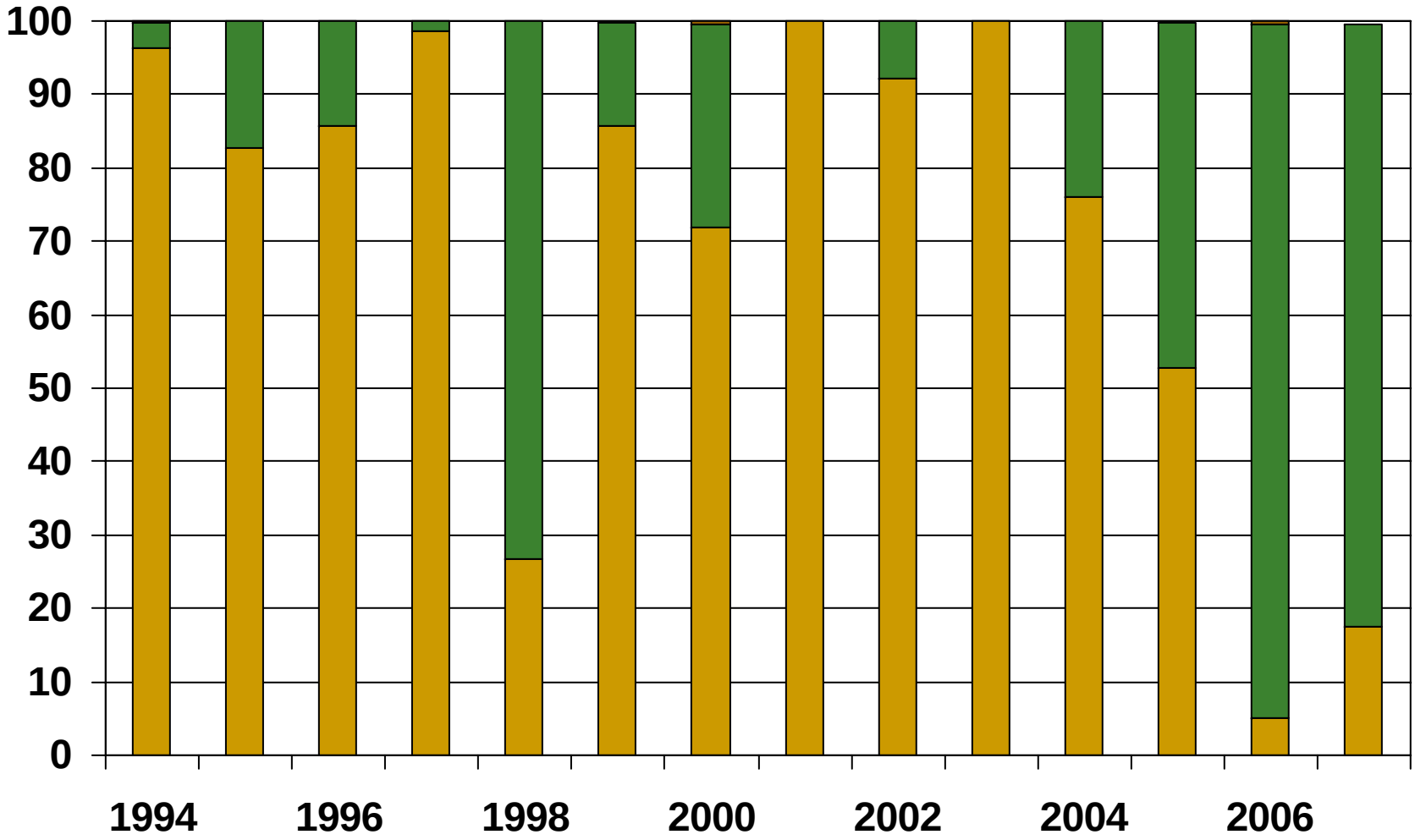
Float in the SO2 market

- Allocations to shorts is the first problem.
  - Allocating the allowances to “shorts” reduces the parties looking to trade, thins the market.
- Free allocations is the second problem.
  - Asset is held on the books at a zero tax basis; i.e., value or “income” has been received, but not recognized on the accounting statement.
  - When the allowance is used, the value is realized, but only at the same time as the realization of a liability, the need to emit.
  - Suppose the current market price of the allowances increases above the “fundamental” value. Suppose further that we can confidently predict the price will deflate again to its fundamental value. An allowance holder who is “banking” that allowance should sell the asset, planning to repurchase at a later date when the price has returned to fundamentals.
  - Realizes a taxable gain today equal to (i) the difference between the market price and the fundamental value, plus (ii) the market price less the zero basis. This accelerates the tax paid on the freely allocated allowance. The future need to emit is a liability that will be realized in the form of the repurchase of the allowance at the then prevailing market price.
  - Speculative gain from arbitrage is hit by an extra tax burden in the form of acceleration of tax.
- Allocations to regulated entities is the third problem.
  - Zero incentive to maximize the value of their bank via speculative trading.

Float in the SO2 market (cont.)

- Fundamentals explanations interact with the problems of float.
  - CAIR causes a sudden decrease of banked allowances available for trade.
  - PRB disruptions creates specific utilities with an immediate demand to cover: Allegheny.
- Other factors.
  - SO2 futures markets are being created.
    - December 04, the Chicago Climate Exchange announces plans to begin futures trading in SO2.
    - February 05, the NYMEX Board approves plans to begin futures trading in SO2.
    - Suppliers of liquidity to these markets require an inventory of allowances to do their business.
  - Commodity funds look to environmental markets.

Percent of Auctioned Allowances Sold to Financials



A theory in search of evidence.

Implications for CO2 market design.

- Give attention to maintaining a large float and plenty of liquidity.
- Front load allocations to assure a bank.
  - This was done in the SO2 market, but needs to be replicated in the CO2 market.
- Do not allocate allowances to natural shorts; i.e., encourage speculators!
  - In the EU-ETS, this has been implemented effectively by setting the power sector allocations net short with other sectors net long.
- No free allocations.
- Create a regular market; i.e., regular auctions.
- Structure the market to impede squeezes.
  - Enable “market” bids.
  - Allow “when-issued” trading.
  - Role here for a “carbon market efficiency board.”
- Require transparency: oversight and reporting of positions.

The End

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