Before-and-after analysis:

An application of structural break testing to the determination of economic damages.

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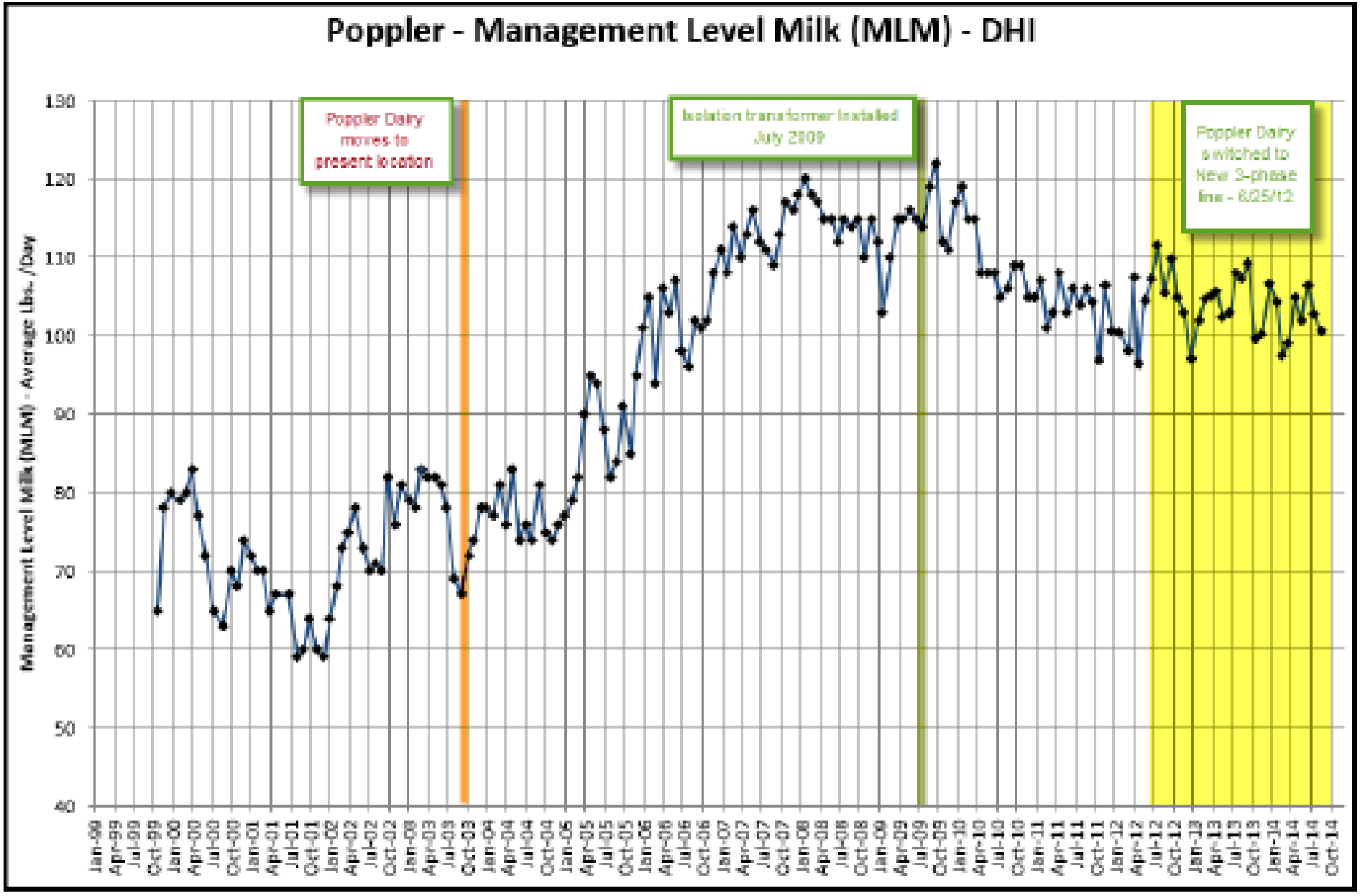
2018 ASSA Annual Meeting

Outline


Poppler - Management Level Milk (MLM) - DHI
Management Level Milk (MLM) - Average Lbs. /Day
Poppler Dairy moves to present location
Isolation transformer installed July 2009
Poppler Dairy switched to New 3-phase line - 8/25/12
130
120
110
100
90
80
70
60
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Jan-99
Apr-99
Jul-99
Oct-99
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Jul-14
Oct-14

Motivation

- Before-and-after method is highly reliable and widely accepted, BUT it is not fool proof
- Tomlin and Merrell (2006) demonstrate, "simple" forms of the before-and-after method may yield "phantom" damages
- The simplistic approach, however, may run into three problems that we label:
  - the overt omitted variable problem
  - the multiple comparisons problem
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Nevada Bob's Golf of Nebraska, Inc. counterclaimed that the plaintiff denied its right of first refusal to lease and occupy adjacent space

- Nevada Bob's expert estimated lost profit by simply calculating profit per square foot at the alternative location
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  - *"The expert assumed that the only difference between the two locations was the square footage"*
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Solution to the latent omitted variable problem

- To account for an unobserved factors we must allow for multiple unknown breakpoints
- Bai (1997) and Bai and Perron (1998) further extend the Quandt-Andrews test to allow for multiple unknown breakpoints
- Perron (2006) recommends
  - Double maximum test to determine if any breaks are present
  - Sequential test starting at some value of greater than zero to determine the number of breakpoints

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Dairy Litigation

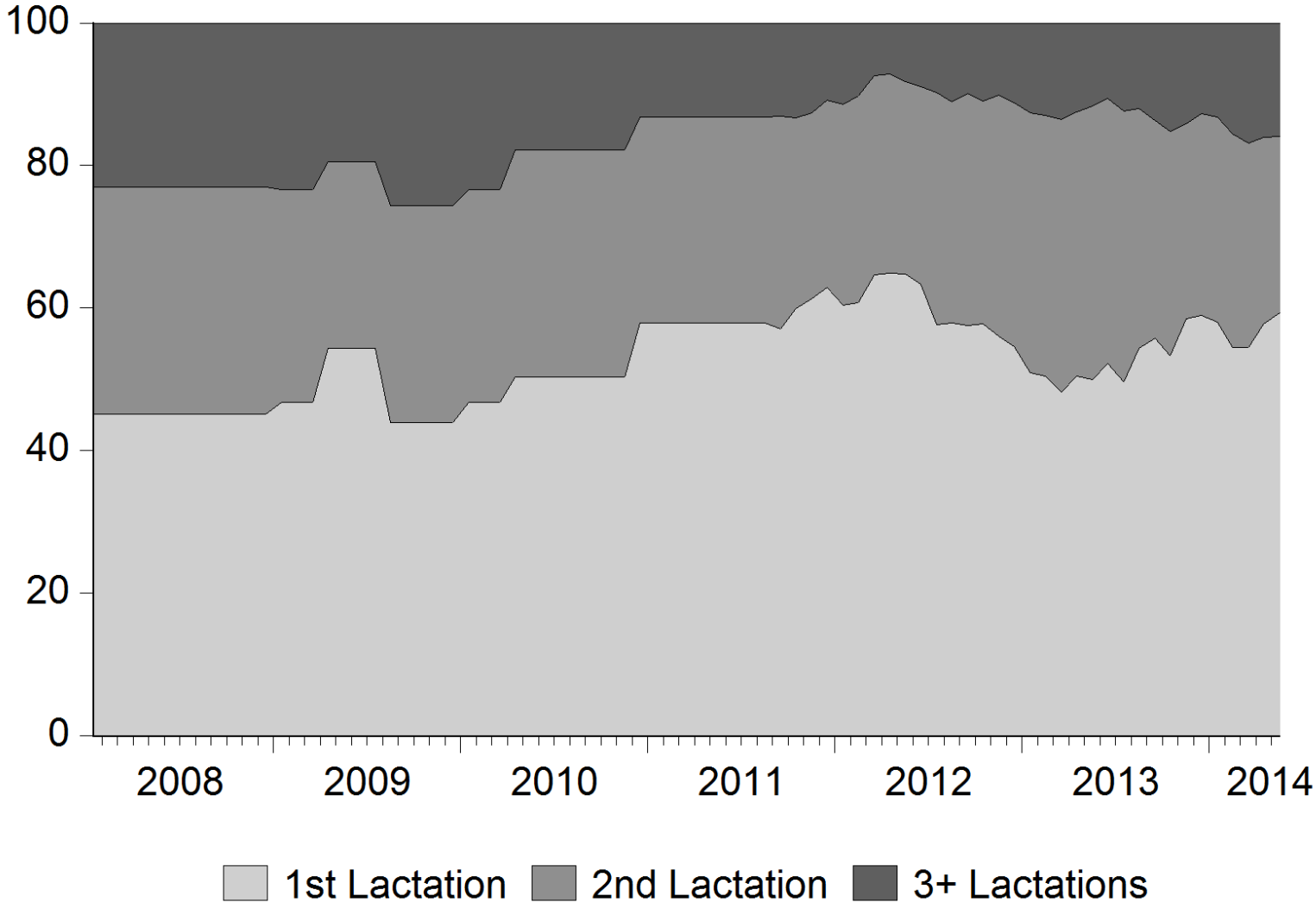
In this case, the dairy claimed their business was harmed by stray voltage, and sued electrical utility. The court found in favor the dairy ordered repairs and awarded damages.

- A partial remedy was implemented July 2009
- The definitive remedy was implemented June 2012

Modeling the Damage Period

- Dependent Variable
  - MHA Annualized average monthly production per cow
- Breaking Regressors
  - Constant
    - Trend Deterministic time trend
- Non-breaking Regressors
  - L1 Percent of heard that has had only on calf

Percent of herd in 1st, 2nd or 3rd+ lactation



Modeling the Damage Period

- Preform the double maximum structural break testing procedure as suggested by Perron (2006) with
  - trimming is set to 20%
  - maximum number of breaks set to 3
  - WDMax test statistic = 24.344 (C.V. = 12.15)
- Number of Breaks
  - Significant F-statistic largest breaks: 3
  - UDmax = 19.97 (C.V. = 11.16) determined breaks: 2
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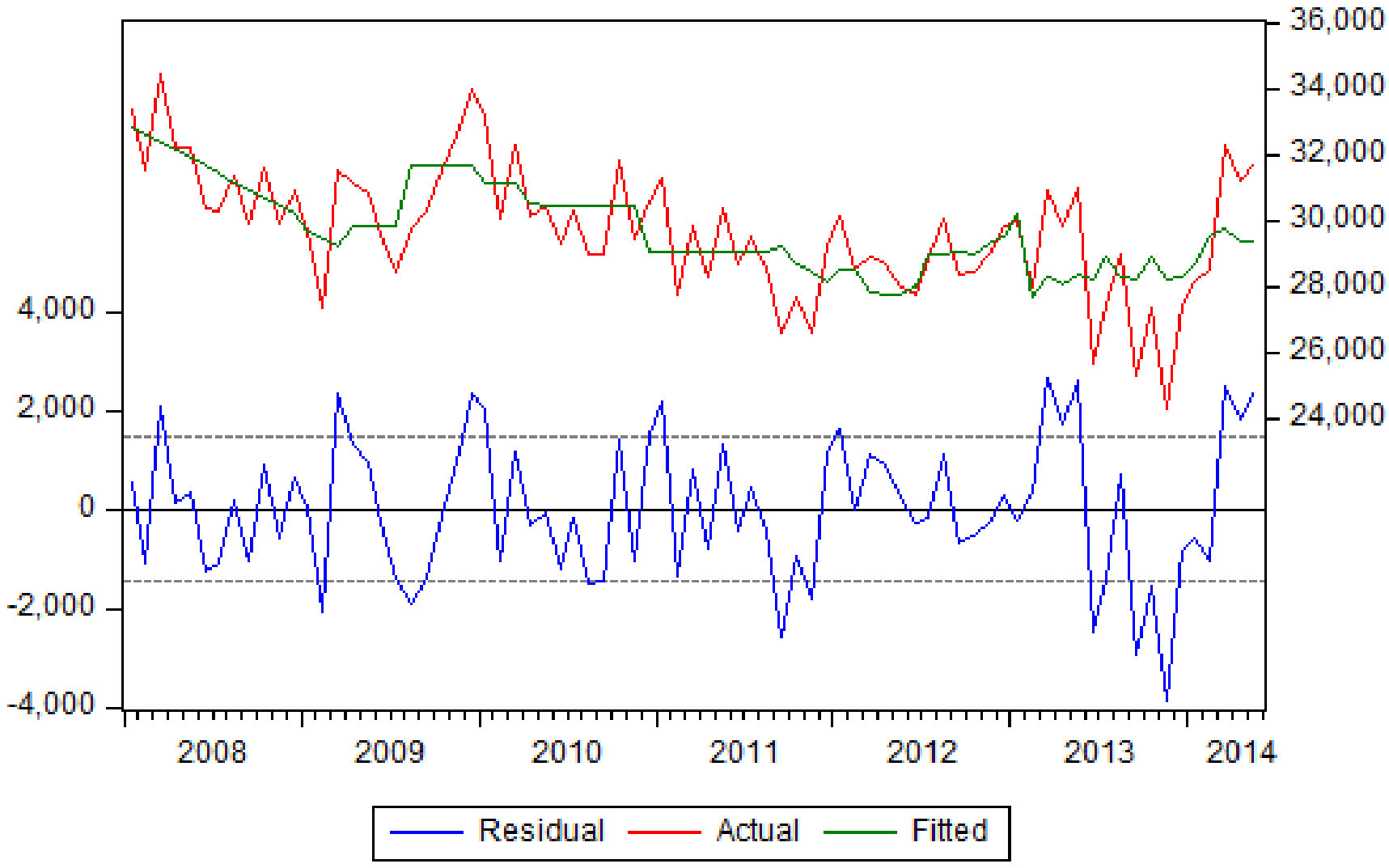
Trend with Breaks Full Model Fit



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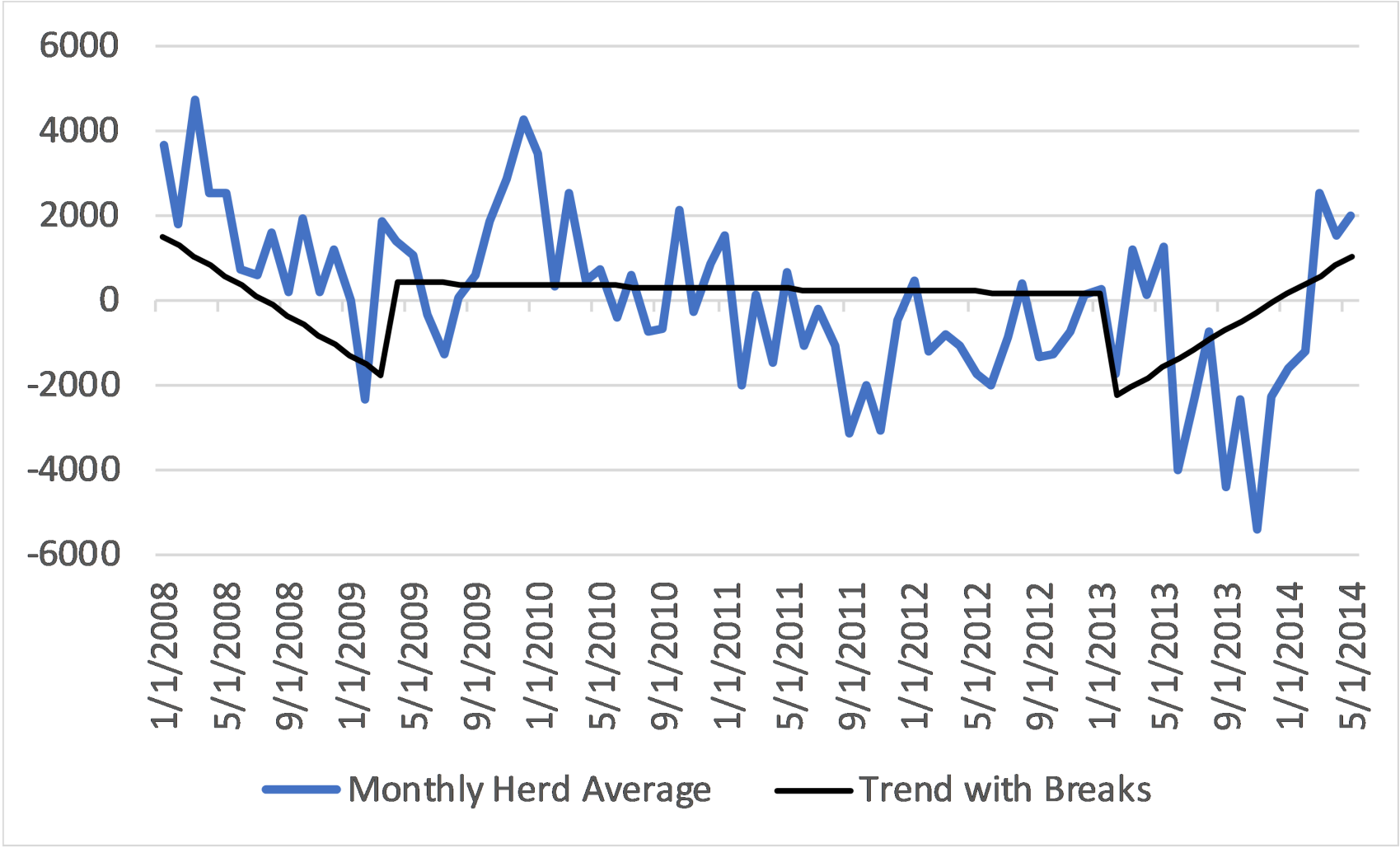

Three objections to structural break analysis

1. Post hoc ergo propter hoc fallacy
2. Nearly simultaneous causal events
3. Causal lag

Post hoc ergo propter hoc

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  - Structural break analysis relies on timing evidence
  - This line of reasoning may well suffer either the post hoc ergo propter hoc or the cum hoc ergo propter hoc fallacies.
- Answer
  - All before-and-after analysis relies on timing evidence (see e.g. Young v. Hickory Business Furniture 2000).
  - Structural break analysis allows for control of
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  - This challenge is most apparent when working with annual data
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  - Breakpoint should not necessarily be expected to occur in the same time period as the hypothesized causal event
  - Causal lag can be determined through non-statistical supporting evidence/testimony

Causal lag

- Objection
  - 'A' may cause 'B,' but does so with a lag or
  - The effect, 'B,' may happen gradually
- Answer
  - Breakpoint should not necessarily be expected to occur in the same time period as the hypothesized causal event
  - Causal lag can be determined through non-statistical supporting evidence/testimony

Final thoughts

- It is not possible to use inferential statistics, absent a statistically designed experiment, to establish a causal relationship between variables with absolute certainty
- However, as Gaughan states,
  - *"[E]ven in the liability phase [of a trial], there can also be important economic and financial issues for which the expert [economist] may provide evidence" Gaughan (2009, 54)*
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