

UNIVERSITY OF ILLINOIS  
AT URBANA-CHAMPAIGN

# ***Bubbles in Food Commodity Markets: Four Decades of Evidence***

***Xiaoli L. Etienne, Scott H. Irwin, and  
Philip Garcia***



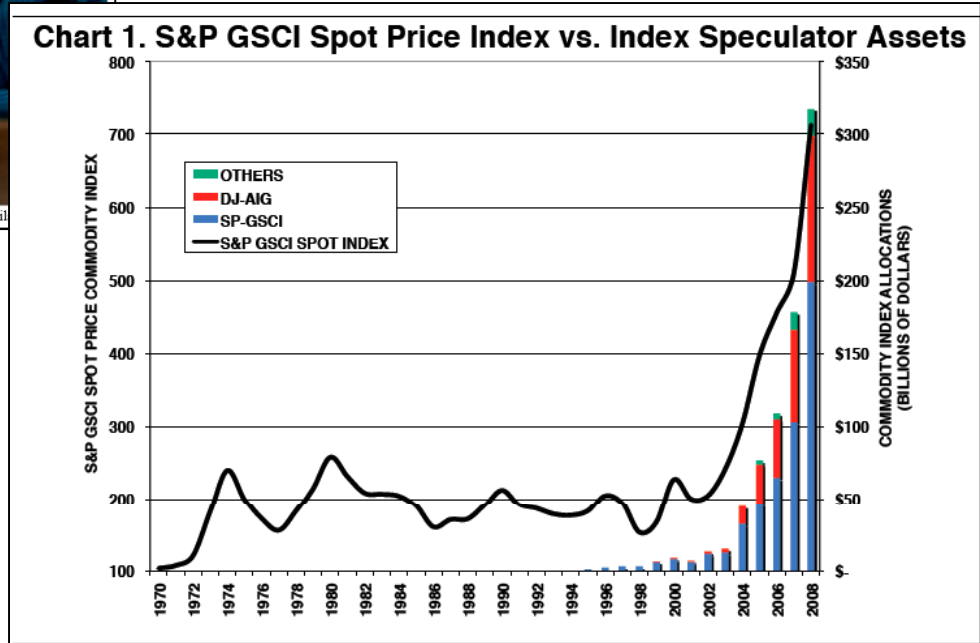
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# "The Masters Hypothesis"



Mark Williams

<http://www.nytimes.com/2008/09/11/washington/11speculate.html>



<http://www.loe.org/images/content/080919/Act1.pdf>



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Policy Brief

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**Alarm or rather false alarm? A literature review of empirical research studies into financial speculation with agricultural commodities**

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An evaluation of 35 research papers into the impact of financial speculation on agricultural commodities markets has revealed: The vast majority of studies did not confirm the concerns that prevail in public discourse. The current state of knowledge indicates only a few, and weak, findings that verify the assumption that the rise in financial speculation in recent years has increased (1) the level or (2) the volatility of agricultural commodity prices. Instead, those developments have rather been caused by fundamental factors in the real economy. This is why the majority of academic studies are not in favor but against (3) enacting regulatory barriers to market entry. Transaction taxes or position limits are described as involving high risks. Various studies explicitly warn against overregulation, which would impair rather than improve the functionality of agricultural markets. Seen in this light, the alarmism about financial speculation should be classified as a false alarm: Those who desire to effectively combat hunger in the world have to take real-economy precautions to ensure that food supplies will match the envisaged increasing demands.

New players have entered the futures markets for agricultural commodities over the last ten years. Commodity Index Traders (CITs) are heavily engaged in a business model that consists of permanently covering long positions that are continually rolled forward. Without building their own inventories, CITs contribute to hedge agricultural producers against mark-down risks.

This recent development has given rise to the suspicion that CITs could be causally responsible for the dramatic price events in 2007/8, 2010/11 and 2012. In view of global hunger revolts there was a great deal of conjecture among theoreticians and practitioners that CIT-conditioned financial speculation with agricultural commodities prompted rapid food price rises that notably affected people suffering from extreme poverty.

This suspicion has sparked an intense international discussion that has already entailed regulatory actions. The US, for instance, has introduced position limits, while Europe is updating the Markets in Financial Instruments Directive (MiFID). Various renowned civil society organizations (CSOs)

in Germany have mounted a joint public awareness campaign in this context. The CSOs demand the introduction of a transaction tax, the subjection of futures market speculators to severe position limits, and a full ban on financial speculations by CITs.

The CSOs commissioned their own studies (Pies 2012) to increase the efficiency of their demands. These groups assert that a "scientific evaluation" of available data provides "overwhelming evidence" that financial speculation causes and exacerbates hunger in the world.

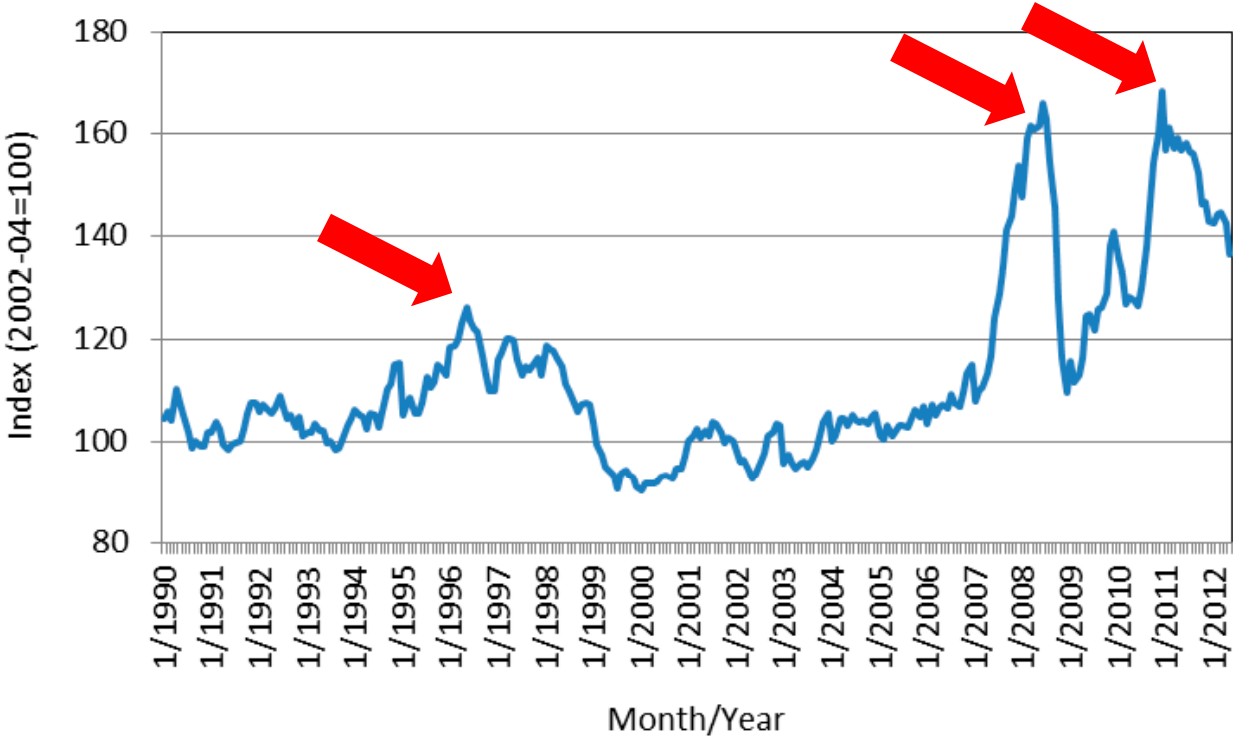
Those statements have prompted strong responses. To give but one example: Thilo Bode, executive manager of foodwatch, asserts that banks, with their speculative futures market transactions, are "hungermakers". Within a few months, Bode attended no less than three publicly-documented debates where holders of economics chairs pointed out that his claims contradicted the state of the art in research (FAZ 2012, Handelsblatt 2012, Süddeutsche Zeitung 2012). The CSOs, however, maintain their view that scientific evidence is on their side (ettac 2012).

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“The current state of knowledge indicates only a few, and weak, findings that verify the assumption that the rise in financial speculation in recent years has increased (1) the level or (2) the volatility of agricultural commodity prices.....Seen in this light, the alarmism about financial speculation should be classified as a false alarm...”



# ***FAO Index of Real Food Commodity Prices, January 1990-May 2012***





## ***Previous Literature***



- **Four recent studies test for bubbles in agricultural prices**
  - Gilbert, 2010; Phillips and Yu, 2011; Gutierrez, 2012; Etienne, Irwin, and Garcia, 2012
  - Use “right-tail ADF” bubble tests developed recently by Phillips et al.
  - Detect and date-stamp bubbles by determining whether prices deviate from a random walk and become mildly explosive
  - Mixed evidence on existence of bubbles since 2005
- **Limitations**
  - Use cash prices or nearby futures prices
  - Both may behave in “bubble-like” fashion in a rational storage model
  - Differencing nearby futures prices on roll dates may create large outliers due to contango or backwardation in term structure





## ***Present Study***



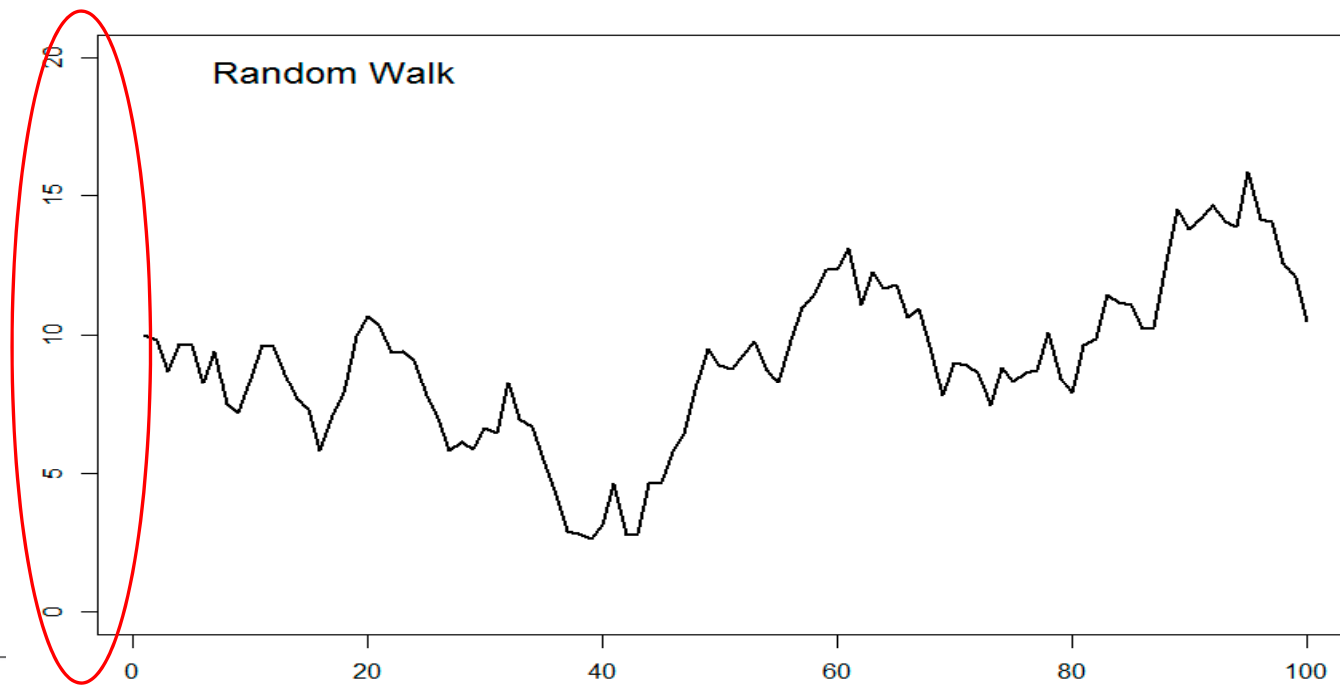
- Test whether speculative bubbles exist in 12 agricultural futures markets
  - Daily prices for individual futures contracts
  - One contract per year, typically one with highest open interest
  - Long sample: 1970-2011
  - Identify whether patterns of bubble behavior exist over time
- Phillips, Shi, and Yu (2012) test
  - Forward and backward recursive ADF tests
  - More powerful than previous tests since multiple bubbles may be detected



# Price Behavior in Non-Explosive Periods

Absent structural change, price follows a *random walk*:

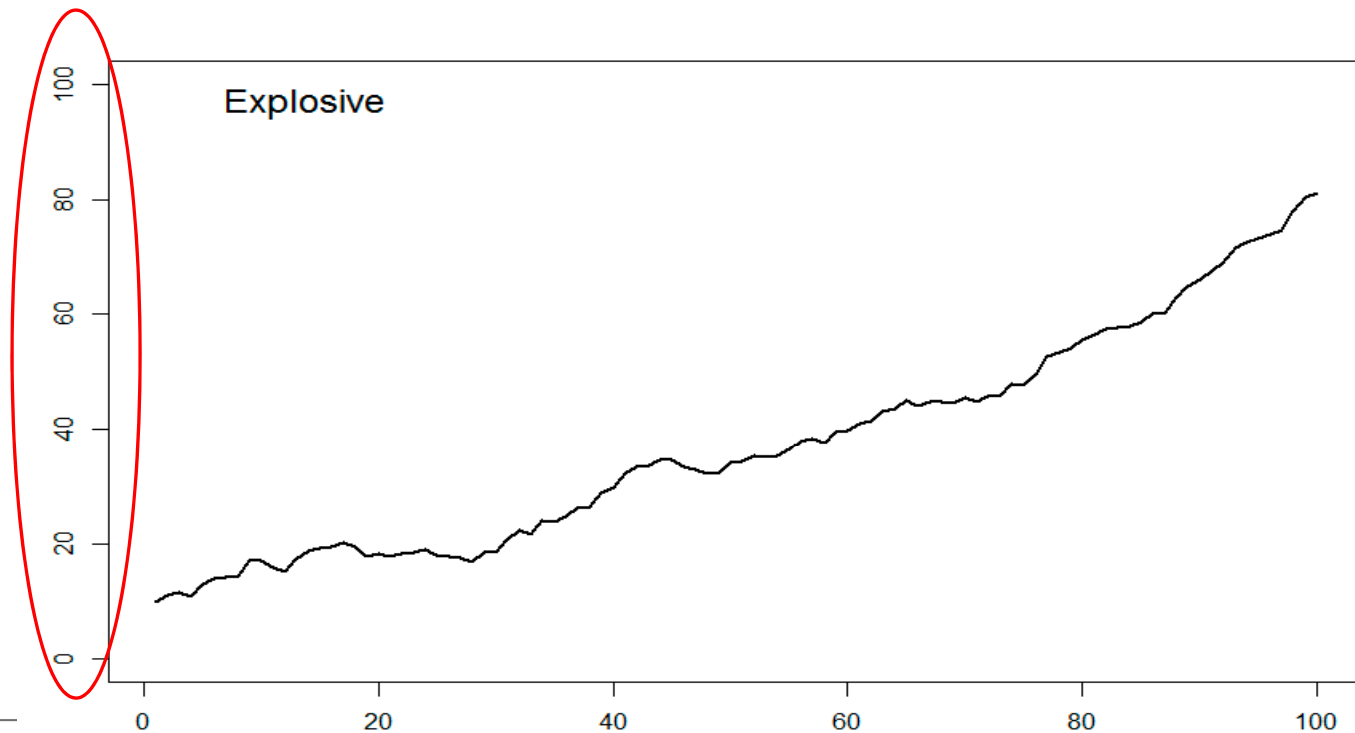
$$P_t = \delta P_{t-1} + \varepsilon_t, \text{ where } \delta = 1 \text{ \& } \varepsilon_t \sim iid N(0,1)$$



# ***What Constitutes an Explosive Period?***

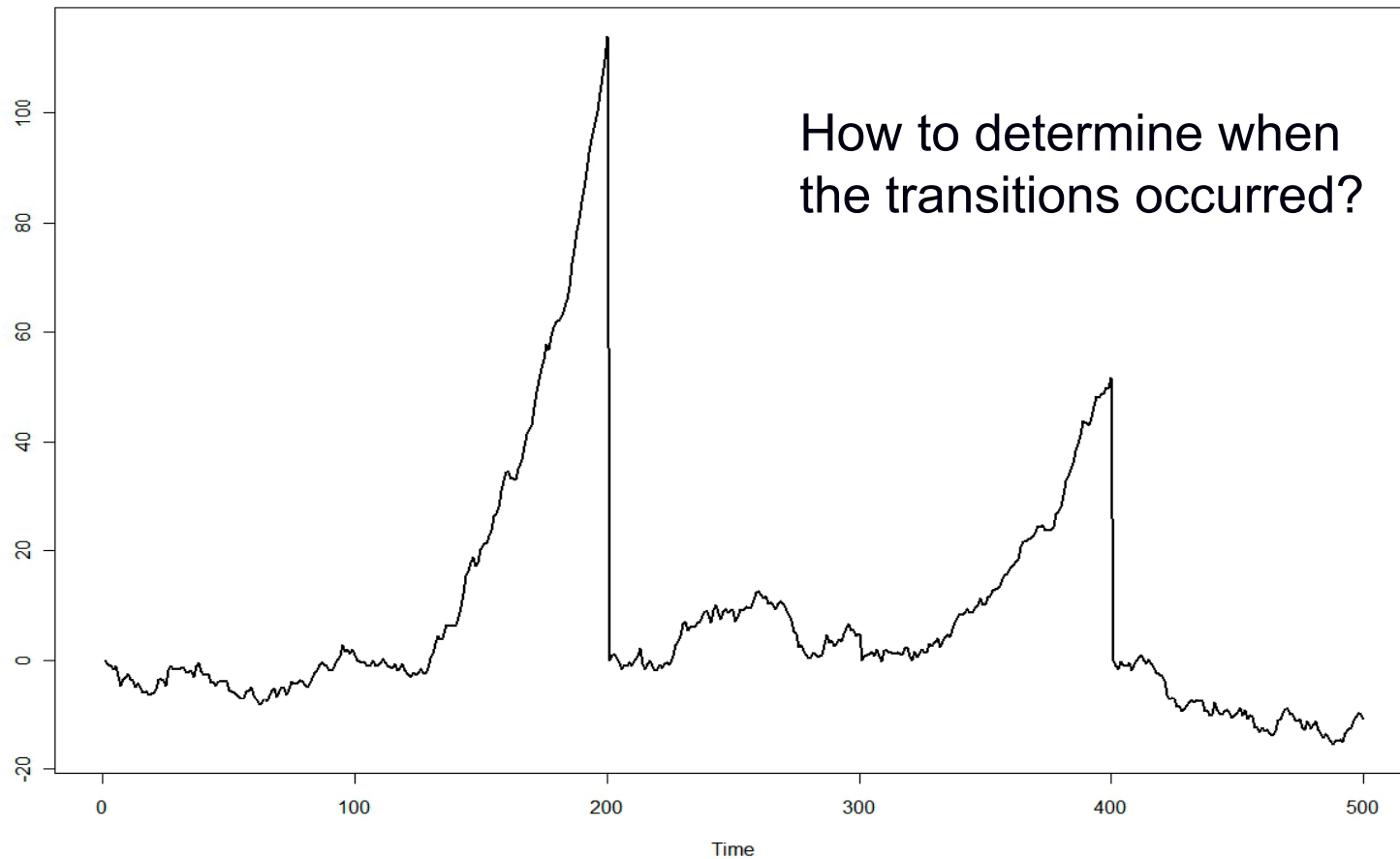
Bubble period  $\rightarrow$  price become explosive:

$$P_t = \delta P_{t-1} + \varepsilon_t, \text{ where } \delta > 1 \text{ \& } \varepsilon_t \sim iid N(0,1)$$





# **Mixed Random Walk & Explosive Processes**



# Phillips, Shi, and Yu (2012)'s Generalized Recursive Procedure (1)

Right-tailed Augmented Dickey-Fuller (ADF) Test

$$\Delta P_t = \alpha + \beta P_{t-1} + \sum_{i=1}^k \gamma^i \Delta P_{t-i} + \varepsilon_t$$

$$H_0: \beta = 0$$

vs.

$$H_1: \beta > 0$$



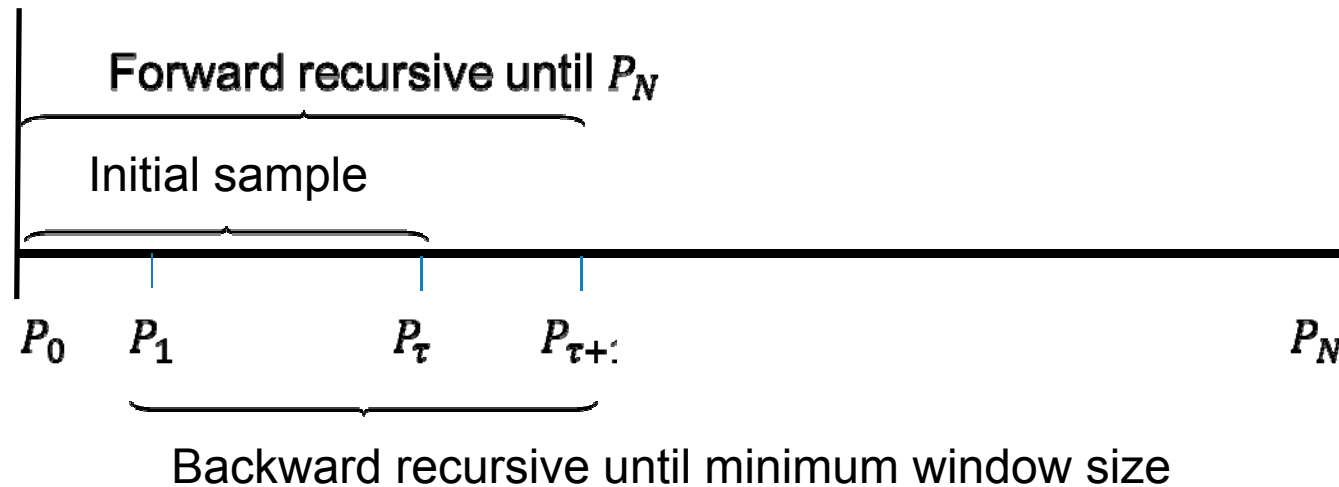
$$H_0: \delta = 1$$

vs.

$$H_1: \delta > 1$$



# Phillips, Shi, and Yu (2012)'s Generalized Recursive Procedure (2)



**For every ending point  $P_h$ , run ADF test on  $h - \tau + 1$  samples**



# ***Phillips, Shi, and Yu (2012)'s Generalized Recursive Procedure (3)***

Detecting existence of explosive periods: **Generalized Sup ADF test:**

$$GSADF = \sup(\sup(ADF_h))$$

Date-stamping explosive periods: **Sup ADF test**

$$SADF_h = \sup(ADF_1, ADF_2, \dots, ADF_{h-\tau+1})$$

$$\tilde{r}_{1e} = \inf_h \{h: SADF_h > CV_h\}, \text{ and } \tilde{r}_{1e} = \inf_h \{h: SADF_h < CV_h\}$$

- Critical values obtained from Monte Carlo simulations
- Only indicate existence of explosiveness, not magnitude

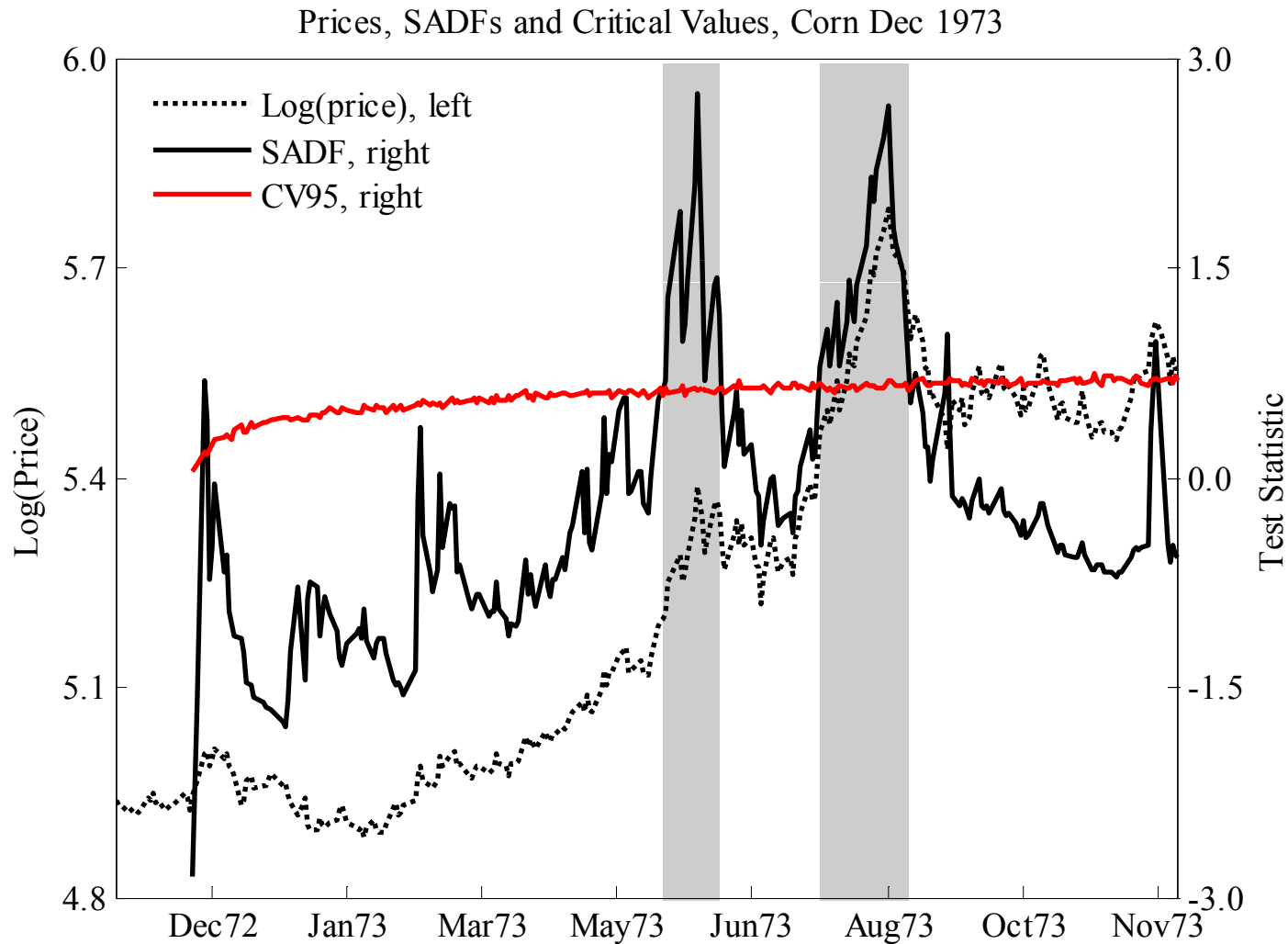


# ***Futures Data***

- **12 agricultural futures markets**
  - Grains: CBOT corn, soybeans, soybean oil, wheat, and KCBOT wheat
  - Softs: ICE cocoa, coffee, cotton, and sugar
  - Livestock: CME live cattle, feeder cattle, and live hogs
- **Data construction**
  - Daily futures prices for one individual futures contract per year over 1970-2011
  - 42 individual contracts per market
  - Each price sequence start 13 months before the contract expiration date and end on the last trading day of the month before the contract expires
  - 240-260 daily observations for each contract

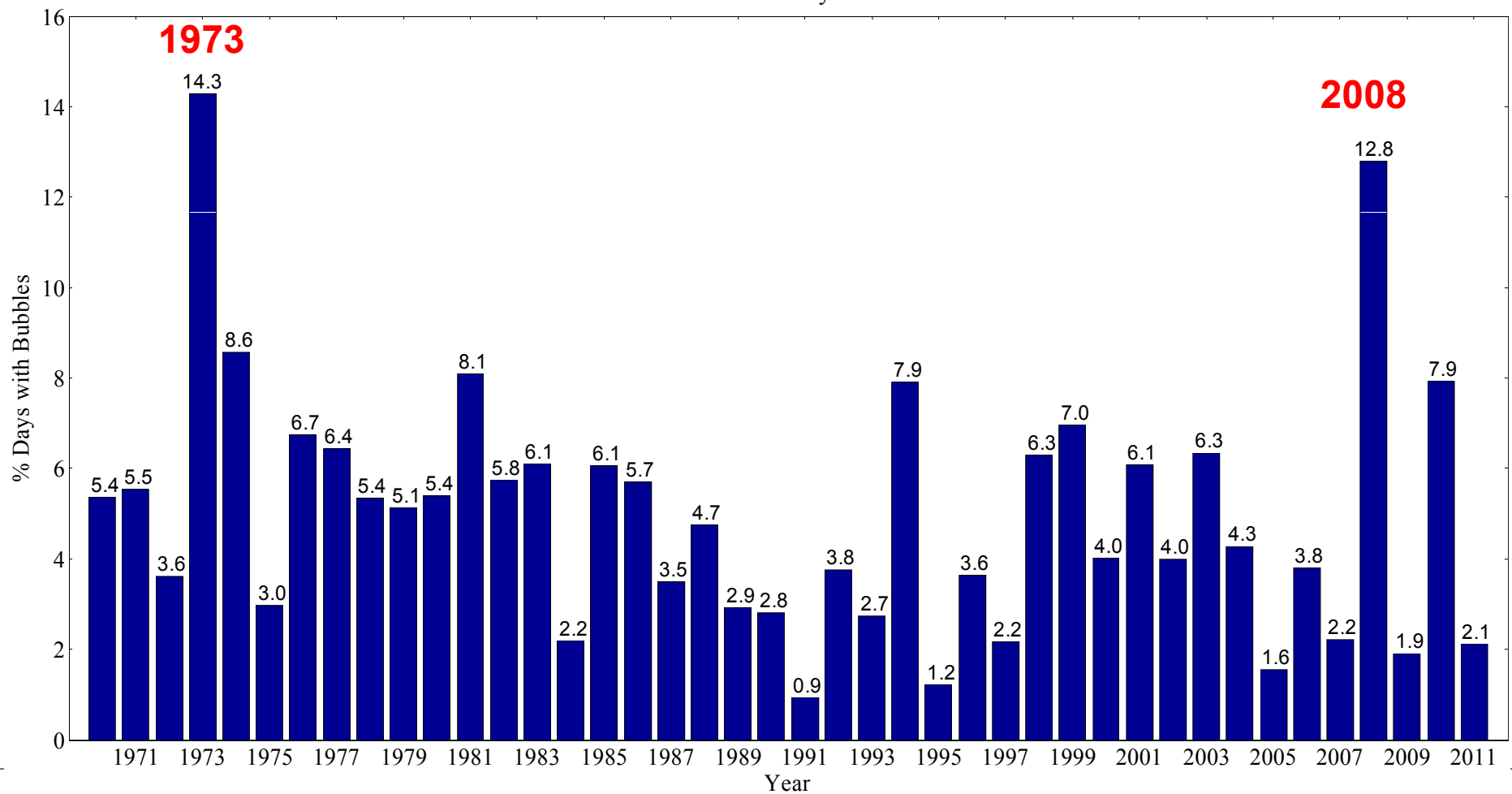


# ***Example of Bubble Test (December 1973 corn contract)***



# *Did Bubble Frequency Increase Across Time? SADF Test Results by Year*

h = 5 days



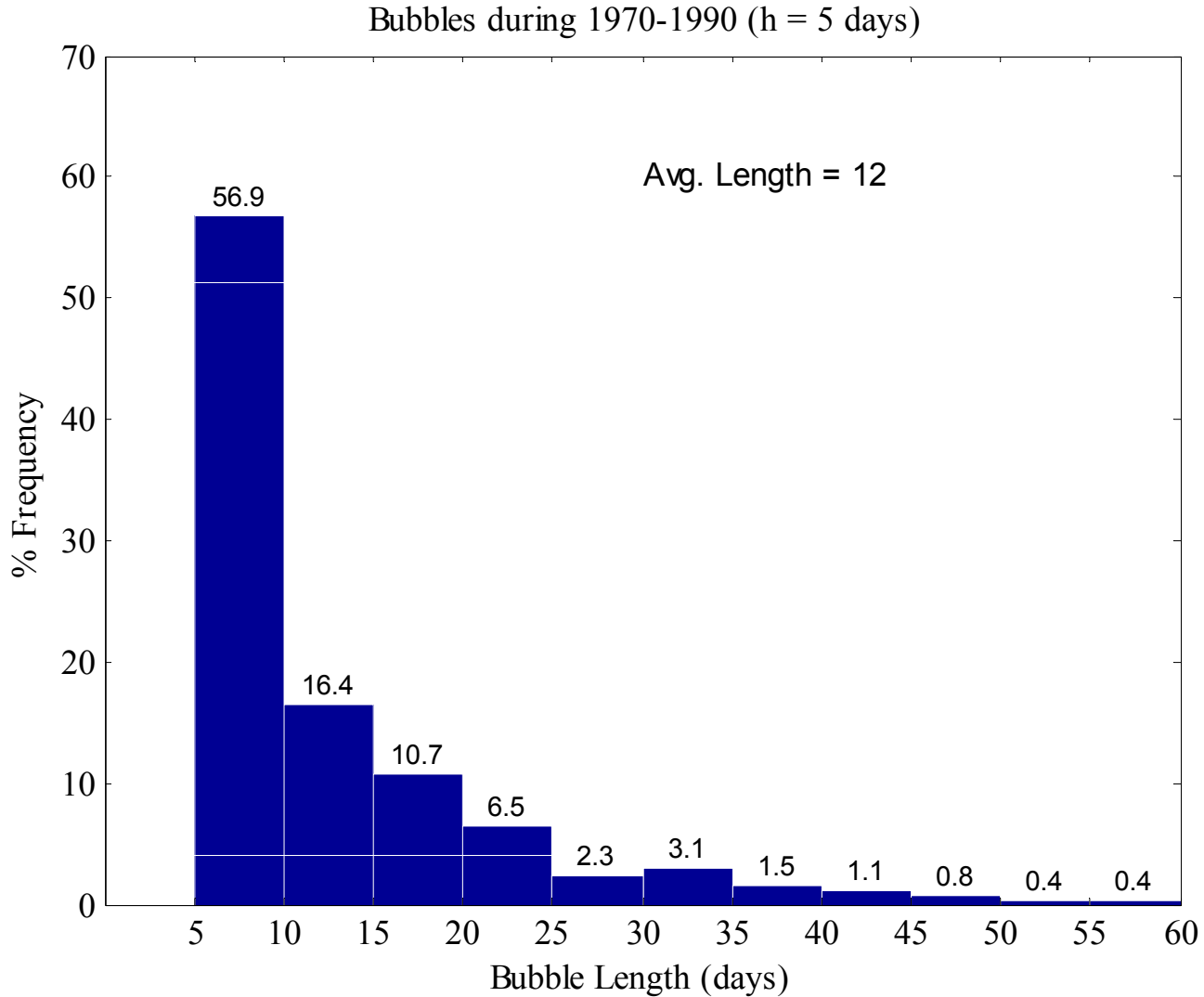
***How Frequent Were the Bubbles?  
SADF Test Results  
(% bubble days, h=5)***

	<b>Corn</b>	<b>Cotton</b>	<b>Cattle</b>	<b>Total</b>
1970-1990	6.6	6.9	2.8	5.1
1991-2011	3.0	5.5	3.9	4.0
1970-2011	4.8	6.2	3.4	4.6

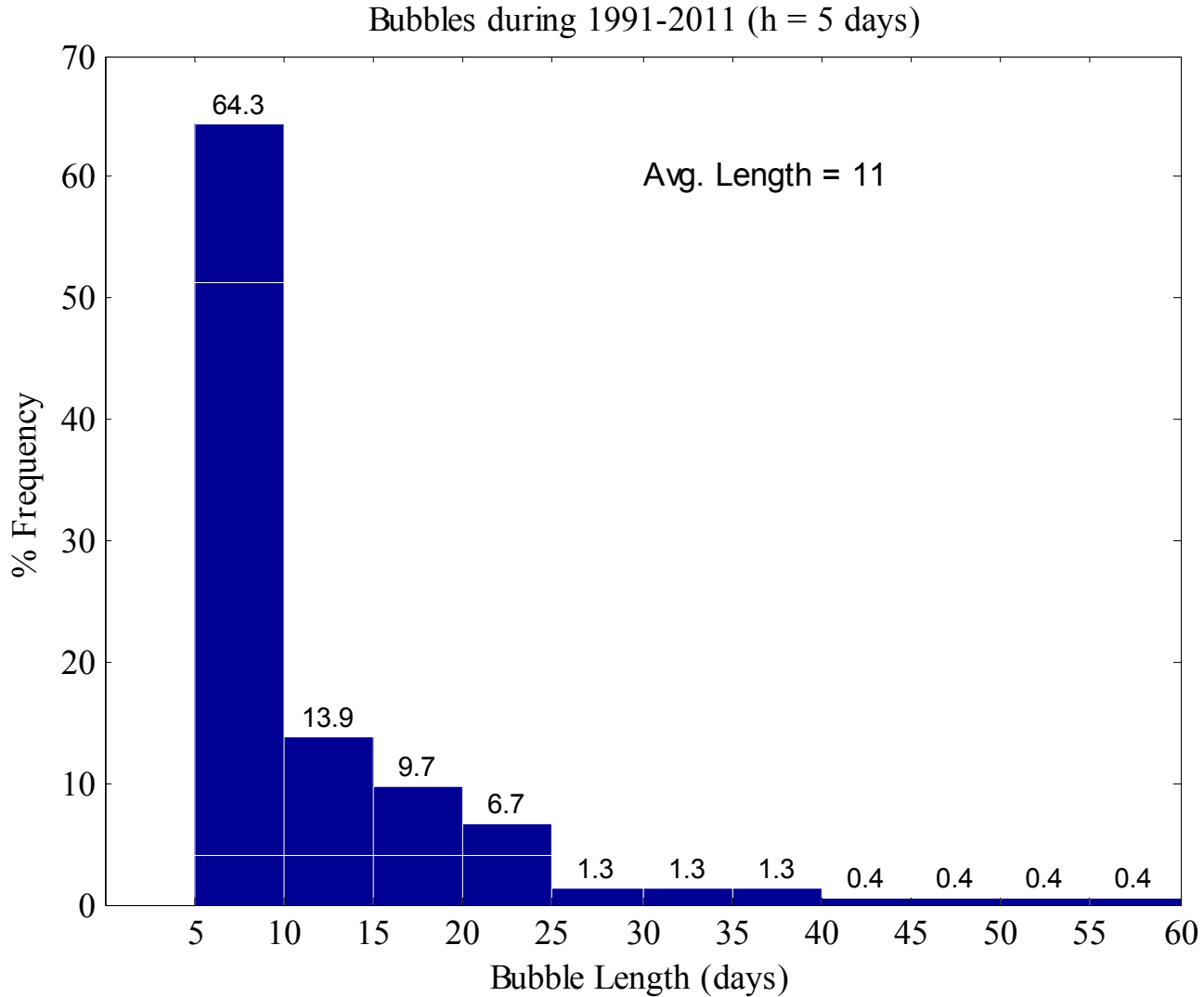




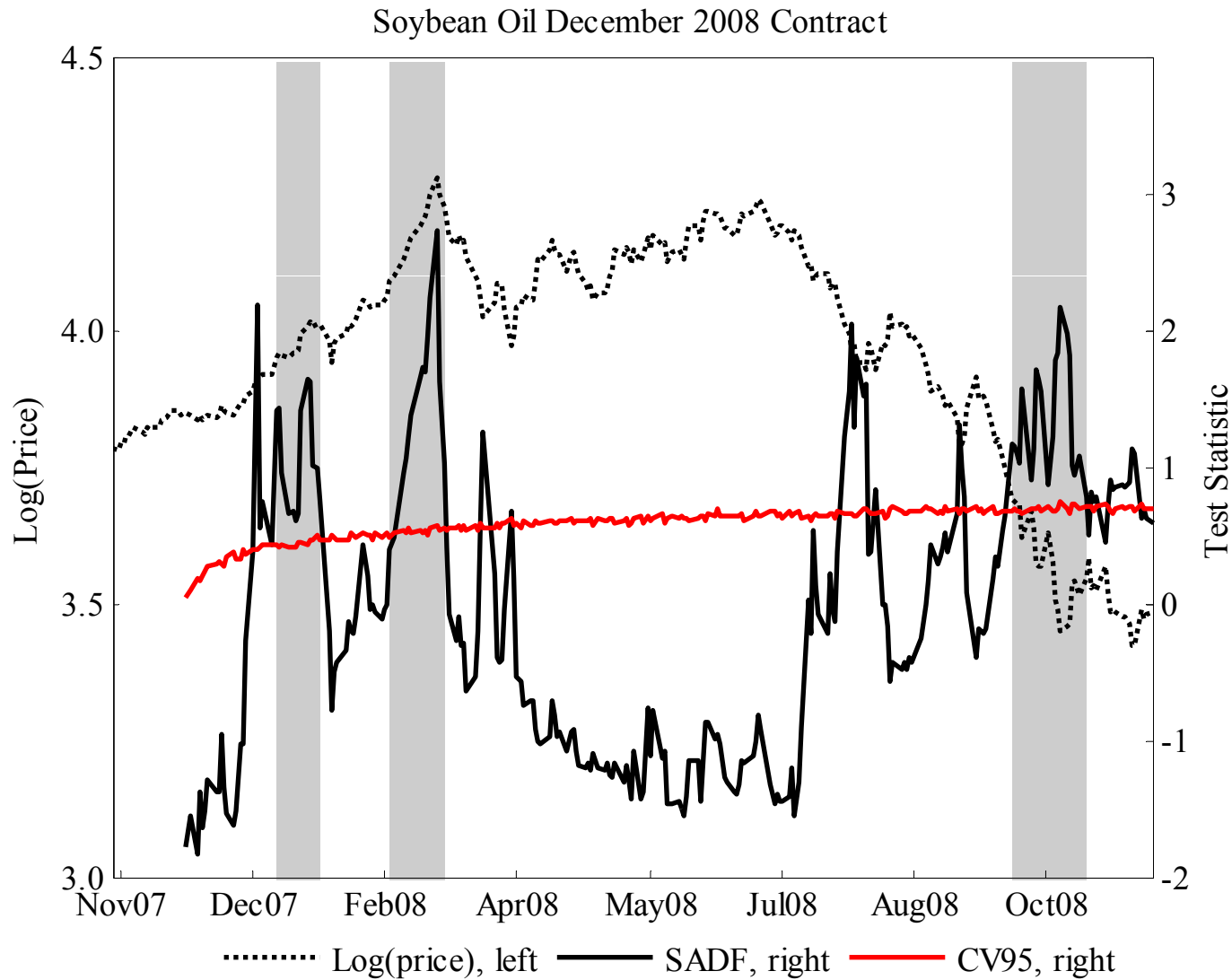
# ***How Long Were the Bubbles? SADF Test Results (1970-1990)***



# ***How Long Were the Bubbles? SADF Test Results (1991-2011)***



# How Big Were the Bubbles? Event Study



# ***How Big Were the Bubbles? Event Study Results (% returns, $h=5$ )***

	Positive Bubble			Negative Bubble		
	N	% Start to Peak	% Peak to End	N	% Start to Peak	% Peak to End
1970-1990	150	+11.5	-2.8	112	-7.7	+2.0
1991-2011	131	+8.2	-1.8	107	-6.6	+1.7

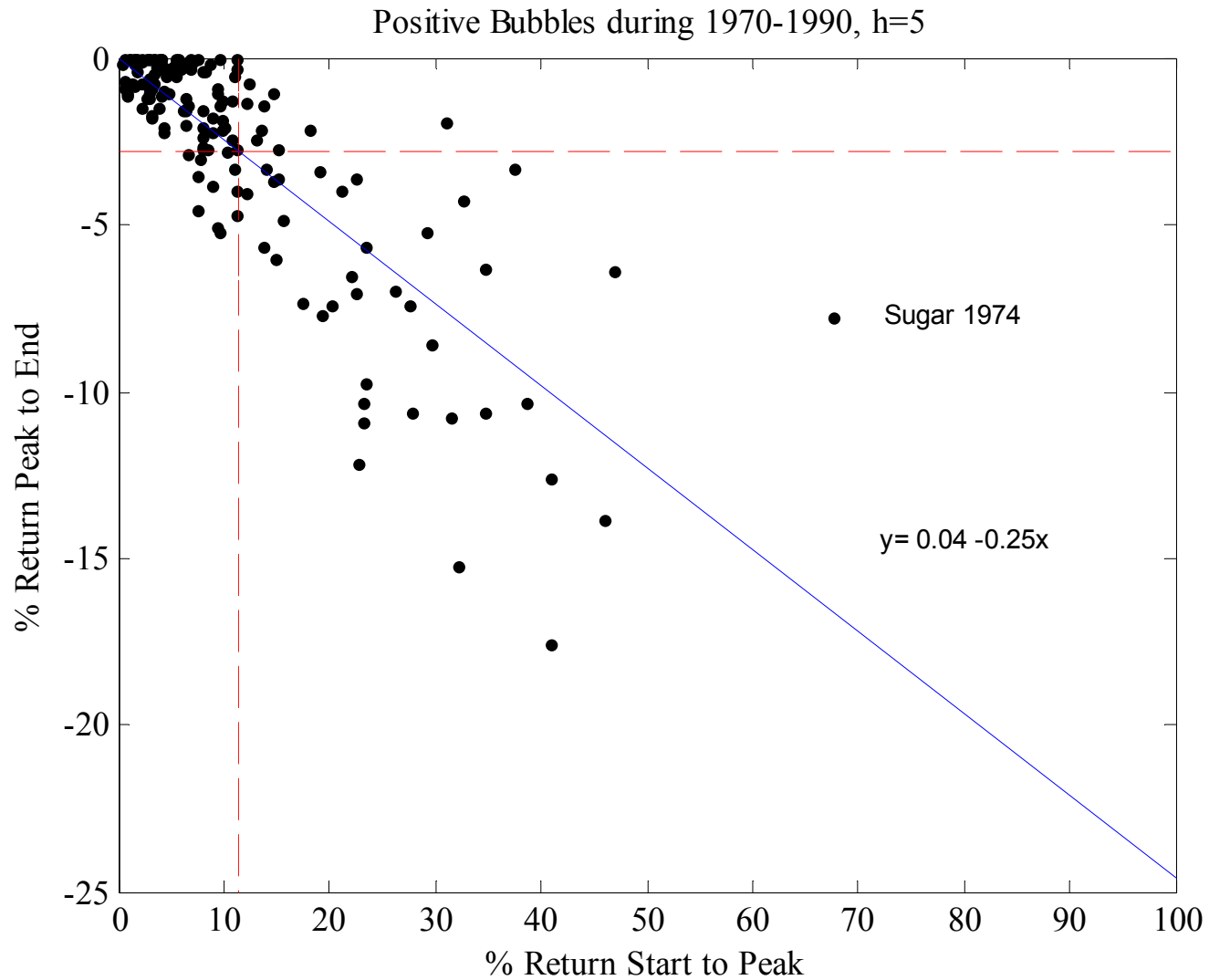


# ***How Big Were the Bubbles? Event Study Results (% returns, $h=5$ )***

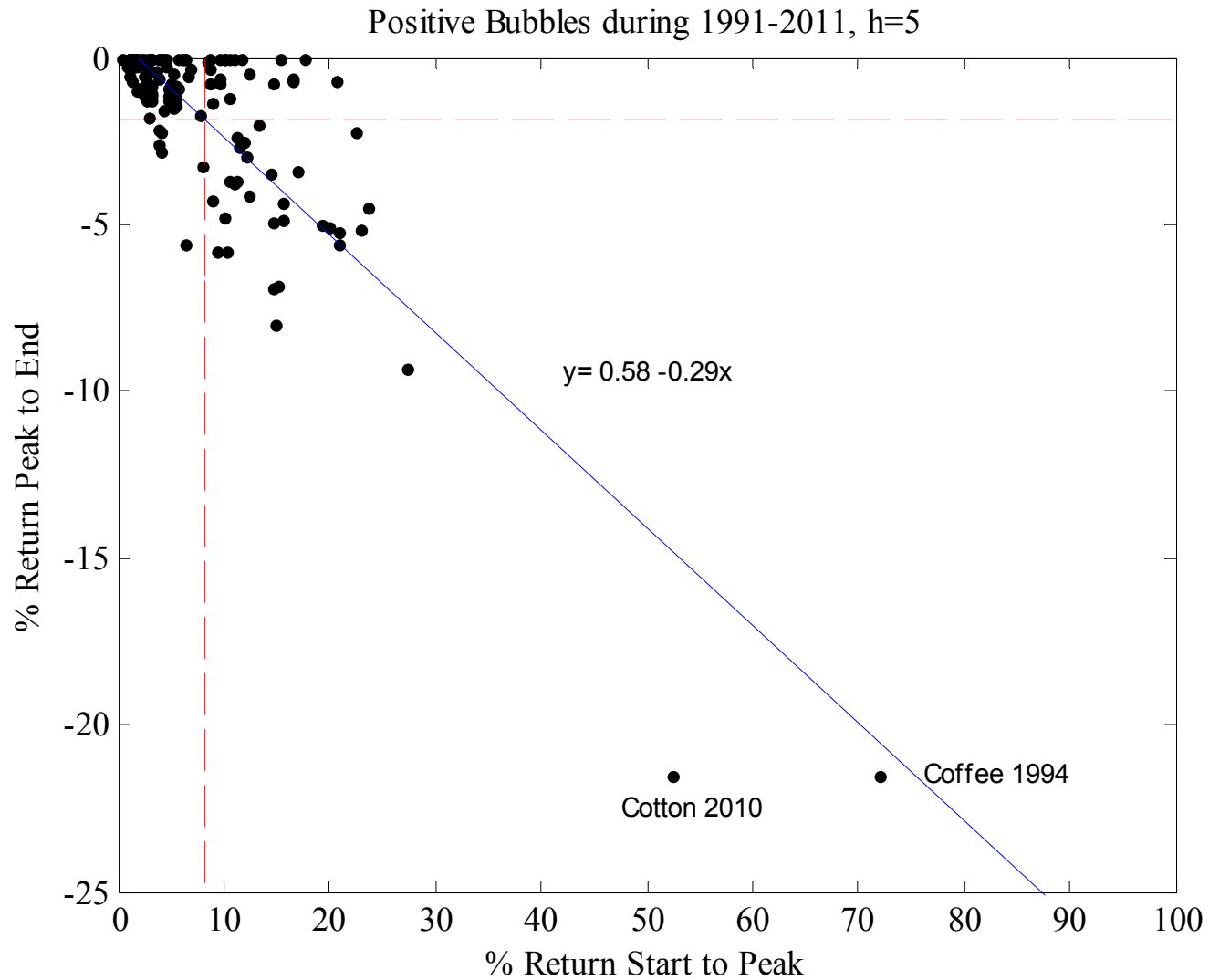
	Positive Bubble			Negative Bubble		
	N	% Start to Peak	% Peak to End	N	% Start to Peak	% Peak to End
1971-1976	58	+15.2	-3.9	24	-8.9	+2.3
2006-2011	57	+8.3	-2.1	28	-7.6	+1.9



# How Big Were the Positive Bubbles? Event Study Results (1970-1990)



# ***How Big Were the Positive Bubbles?*** ***Event Study Results (1991-2011)***





## ***Conclusions***



- All 12 agricultural markets experienced multiple bubble periods
- Bubble periods represent a small fraction of samples, typically less than 5%
- Length of bubbles is relatively short, few longer than 20 days
- Modest tendency for over-reaction and correction during bubbles, about 3%
- Declining frequency and size of bubbles between 1970s and 2000s, with one big exception—cotton in 2010





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***Thank You!!***



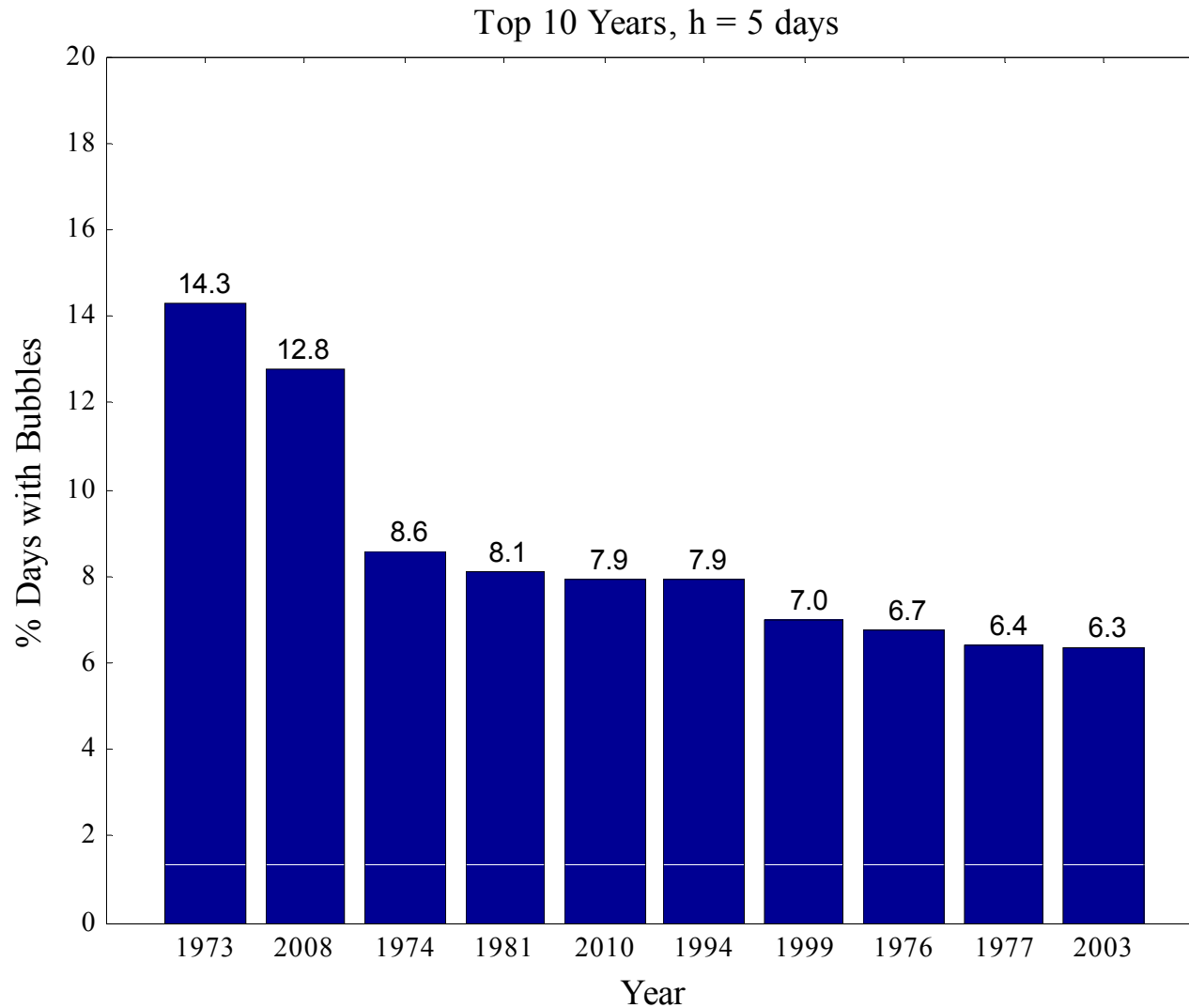
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***Were There Bubbles?  
GSADF Test Results  
(# of commodity-years w/bubbles)***

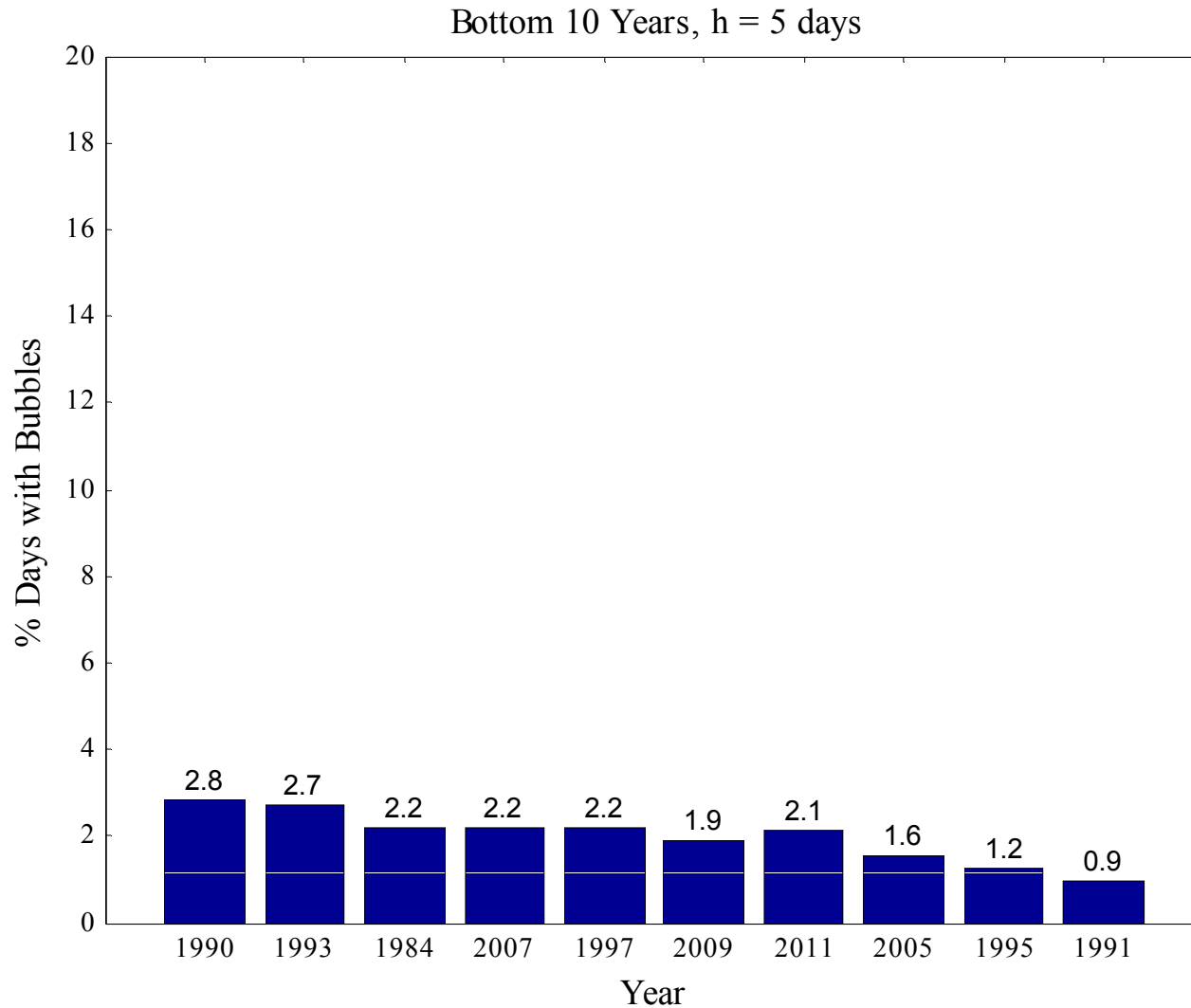
	<b>10% Sig.</b>	<b>5% Sig.</b>	<b>1% Sig.</b>	<b>Total</b>
1970-1990	13	31	50	94
1991-2011	13	27	33	73
1970-2011	26	54	83	163



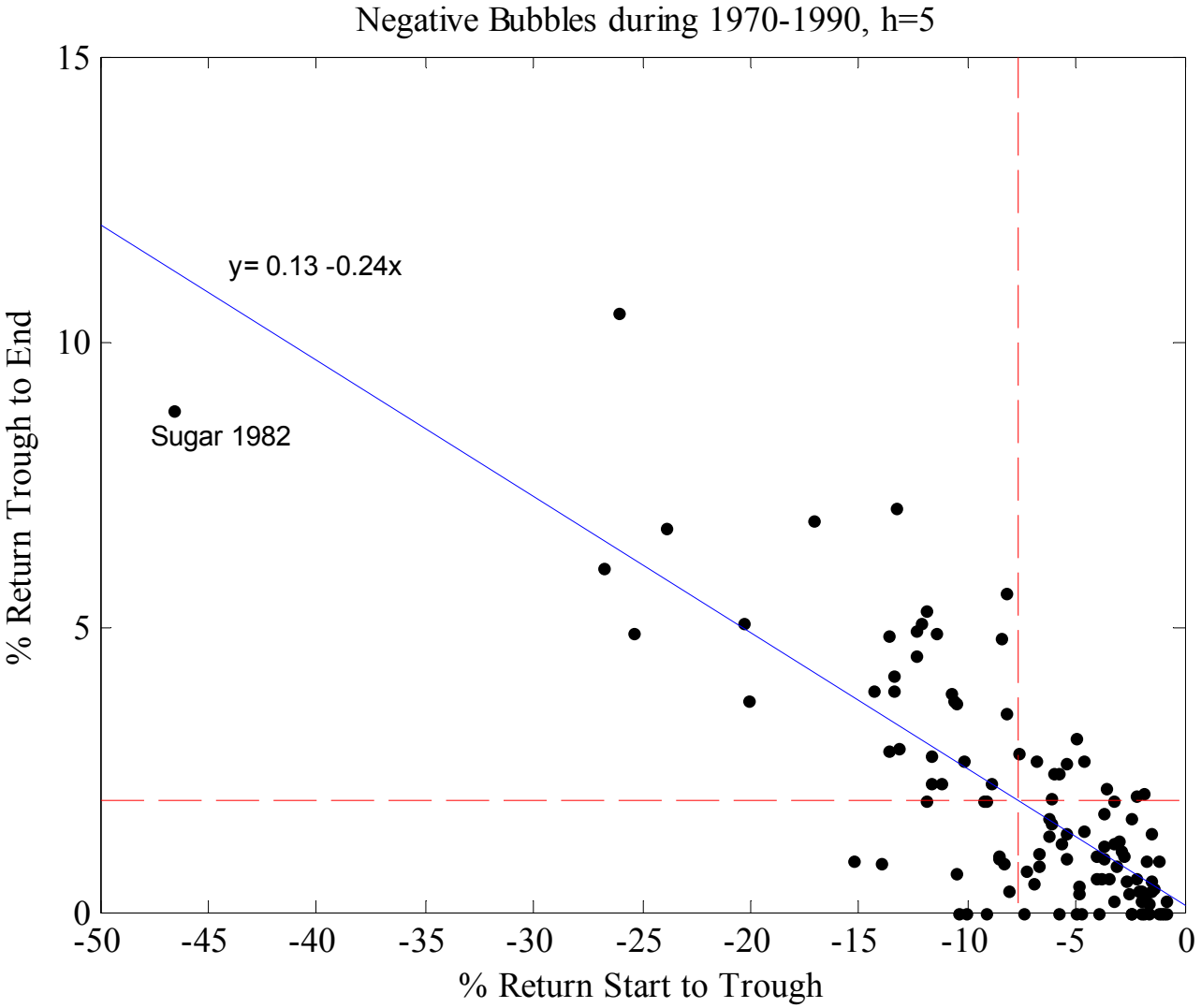
# ***Did Bubbles Cluster Across Time? SADF Test Results (top 10 years)***



# ***Did Bubbles Cluster Across Time? SADF Test Results (bottom 10 years)***



# How Big Were the Negative Bubbles? Event Study Results (1970-1990)



# ***How Big Were the Negative Bubbles? Event Study Results (1991-2011)***

