FINANCIALIZATION OF THE COMMODITY MARKETS

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Plan for the Two Lectures

- **Lecture I: Commodity Markets and their Indexes**
  - Investing in Commodities: Who? Why? How?
  - A First Look at the Futures Data
  - The Financialization Hypothesis
  - Commodity Indexes and a Restricted Form of the Financialization Hypothesis
- **Lecture II: New Indexes and their Impacts**
  - New Generation of ETFs and Indexes
  - Impact on the Term Structure of Open Interest

INTRODUCTION

- Appearance of a new class of investors who chose to take positions on commodities as a group, in order to capture profits that are not possible to obtain from traditional assets
- Emergence of the so-called financialization of commodities
- Treating commodities at the same level as stocks, bonds, real estate, etc. they promoted commodities to the rank of a

new asset class

- Heted discussion among **economists**, **policy makers** as well as in the **media**.

COMMODITIES: AS AN ASSET CLASS

- **Pricing by Equilibrium Arguments**
  - Supply / Demand
  - Inventory (Storage / Delivery)
  - Convenience yield
  - Standard Valuation Methods do not apply
    (e.g. present value of flow of future dividend)
- **Physical Markets**
  - Spot (immediate delivery) Markets
  - Forward Markets
- **Volume Explosion with Financially Settled Contracts**
  - Physical / Financial Contracts
  - Exchanges serve as **Clearing Houses**
  - Speculators *provide* **Liquidity**
- **Diversification** (*believed to be negatively correlated with stocks*)

Some Exchanges (US & Europe)

A **given commodity** is traded on **one** (or a small number of) **specialized exchange** (s)

Exchange	Location	Contracts
Chicago Board of Trade (CBOT)	Chicago	Grains, Ethanol, Metals
Chicago Mercantile Exch. (CME)	Chicago, US	Meats, Currencies, Eurodollars
Intercontinental Exch. (ICE)	Atlanta, US	Energy, Emissions, Agricultural
Kansas City Board of Trade (KCBT)	Kansas City, US	Agricultural
New York Merc. Exch. (NYMEX)	New York, US	Energy, Prec. Metals, Indust. Metals
Climex (CLIMEX)	Amsterdam, NL.	Emissions
NYSE Liffe	Europe	Agricultural
European Climate Exch. (ECX)	Europe	Emissions
London Metal Exch. (LME)	London, UK	Industrial Metals, Plastics

Gaining Exposure to Commodity

- Purchasing Physical Commodity
  - Transportation / Delivery
  - Storage /Perishability
- Purchasing Stock in Commodity Intensive Businesses
  - Indirect exposure
  - Shares of natural resource companies non-perfectly correlated with commodity prices
- Investing in Commodity Futures & Options
  - Transparency & Integrity (clearing)
  - Small initial investment (margin calls)
  - Careful Rolling (e.g. to avoid physical delivery)
- Investing in Commodity Indexes and Commodity Funds
  - Passive investment (no need for a CTA)
  - Can reconstruct *historical* performance

Original Commodity Indexes

	CRB/CCI	GSCI	Rogers RMI	DJ-AIG
Started	11957/986	1992	1998	1999
Exchange Traded	Yes	Yes	No	No
Number of Components	17	22	35	20
Energy	18%	50%	44%	31%
Metals (Gold)	24 6	12 2	21 3	29 9
Grains	18	18	21	21
Food/Fiber	30	10	11	10
Livestock	12	11	3	9

Major Commodity Indexes

Sector	Commodity	Exchange	Ticker	S&P - GSCI Weights	DJ-UBSCI Weights
Number				24	19
Total Weights				99.99%	100.00%
Energy	Oil (Brent crude)	IPE	LO	13.25%	
Energy	Oil (WTI crude)	NYM	CL	37.51%	13.75%
Energy	Oil (GasOil)	IPE	QS	4.54%	
Energy	Oil (#2 Heating)	NYM	HO	4.19%	3.65%
Energy	Natural gas	NYM	NG	4.14%	11.89%
Energy	Oil (RBOB)	NYM	RB	4.75%	3.71%
Industrial Metals	Aluminum	LME	AH	2.33%	7.00%
Industrial Metals	Copper	LME	CA	3.22%	7.31%
Industrial Metals	Lead	LME	PB	0.45%	
Industrial Metals	Nickel	LME	NI	0.78%	2.88%
Industrial Metals	Zinc	LME	ZS	0.60%	3.14%
Precious Metals	Gold	CMX	GC	3.01%	7.86%
Precious Metals	Silver	CMX	SI	0.32%	2.89%

MAJOR COMMODITY INDEXES (CONT.)

Sector	Commodity	Exchange	Ticker	S&P - GSCI Weights	DJ-UBSCI Weights
Agriculture	Cocoa	CSC	CC	0.40%	
Agriculture	Coffee ”C”	CSC	KC	0.76%	2.97%
Agriculture	Corn	CBT	C	3.55%	5.72 %
Agriculture	Cotton #2	NYC	CT	1.19%	2.27%
Agriculture	Wheat (Kansas)	KCBT	KW	0.82%	
Agriculture	Soybean oil	CBT	BO		2.88%
Agriculture	Soybeans	CBT	S	2.64%	7.60%
Agriculture	Sugar	CSC	SB	2.33%	2.99%
Agriculture	Wheat (Chicago)	CBT	W	3.90%	4.80%
Livestock	Feeder cattle	CME	FC	0.61%	
Livestock	Lean hogs	CME	LH	1.51%	2.40%
Livestock	Live cattle	CME	LC	3.19%	4.29%

IMPACT OF LONG-ONLY INDEX FUNDS

Empirical Facts

- In 2006 - 2007, index fund investment increased **from 90 billion to 200 billion** USD (source: Barclays)
- Simultaneously, **commodity prices increased 71%** as measured by the CRB index
- In 2008, commodity fund investors controlled **4.51 billion bushels** of corn, wheat and soybeans through CBOT contracts **= half** the amount in silos on 3/1/2008
- Prices declined from June 2008 through early 2009

Possible explanations

- Large scale speculative buying by index funds created a bubble, (futures prices far exceeded fundamental values)
- Some economists (**Krugman** 2008; **Pirrong** 2008; **Sanders** and **Irwin** 2008, **Hamilton** 2009, **Kilian** 2009) are **skeptic** about the "bubble theory"

> *"... Prices of commodities are set by **supply-demand**, rapid growth in emerging economies (e.g. China) increased demand and caused the 2008 surge in price. ...."*

- Still, **non-traditional investors** was deemed *disruptive* and blamed for the 2007-2008 *Food Crisis'* that is at the origin of the famous "*Casino of Hunger: How Wall Street Speculators Fueled the Global Food Crisis*".

COMMODITY INDEX INVESTING UNDER ATTACK

- Increased participation in futures markets by nontraditional investors deemed **disruptive**
- **Blamed for the 2007-2008 Food Crisis**: "*Casino of Hunger: How Wall Street Speculators Fueled the Global Food Crisis*"
- A report from **U.S. Senate Permanent Subcommittee on Investigation**

  > *"... finds that there is significant and persuasive evidence to conclude that these commodity index traders, in the aggregate, were one of the major causes of unwarranted changeshere increasesin the price of wheat futures contracts relative to the price of wheat in the cash market....."*

- **48 Agriculture Ministers** meeting in Berlin said there were

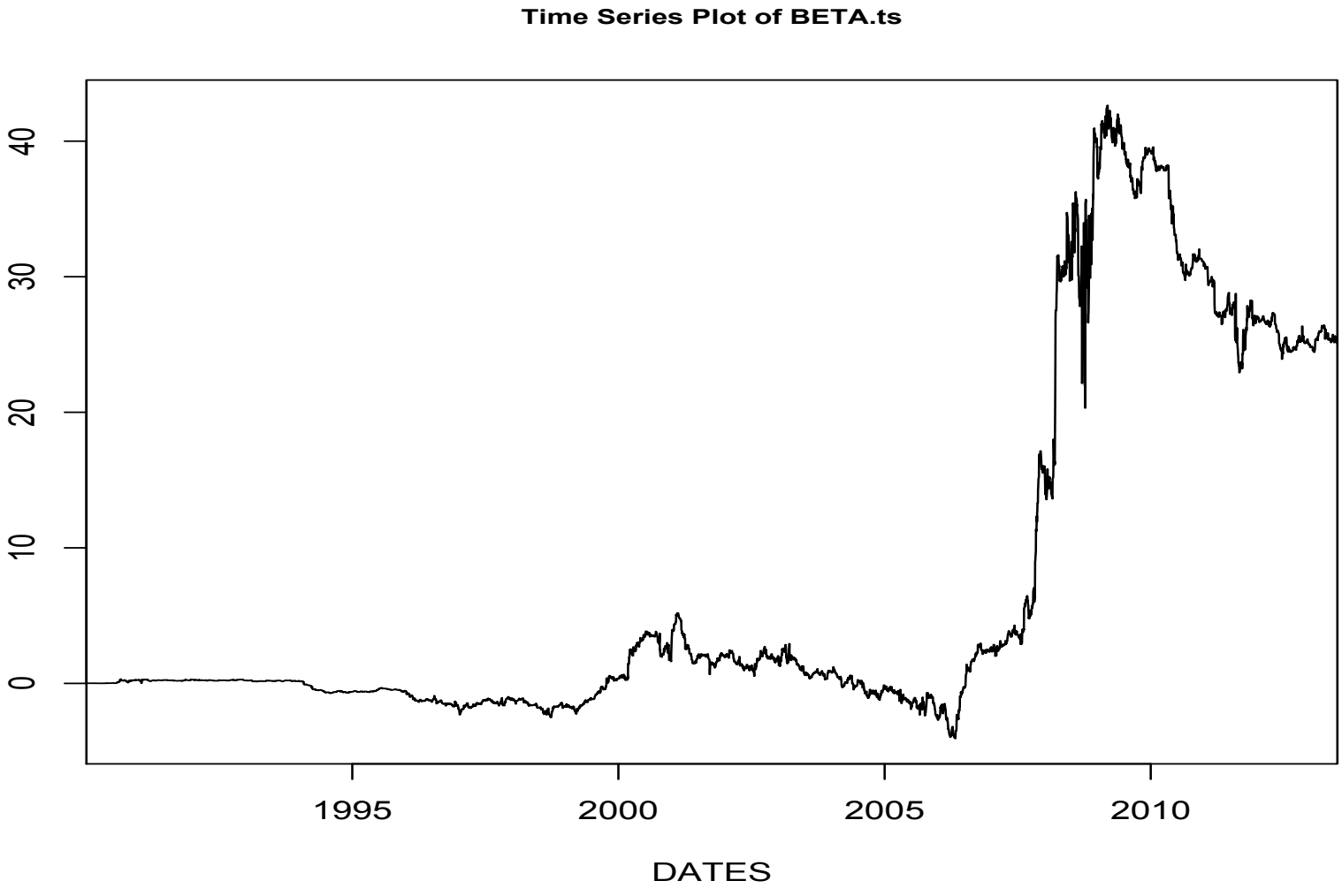
  > *"... concerned that excessive price volatility and speculation on international agricultural markets might constitute a threat to food security, according to a joint statement handed out to reporters on Jan. 22, 2011...."*

Return Correlations Are No Longer What They Used to Be

Empirical Facts

- Commodity Index trading **tightened correlations** between commodities (**Tang-Xiong** 2010)
- Scale dependent phenomenon: **Do high frequency traders see these correlation increases?**

ARE COMMODITIES UNCORRELATED WITH EQUITIES?



Instantaneous Dependence (β) of GSCI-TR returns upon S&P 500 returns

GENERALITIES ON THE COMMODITY MARKETS

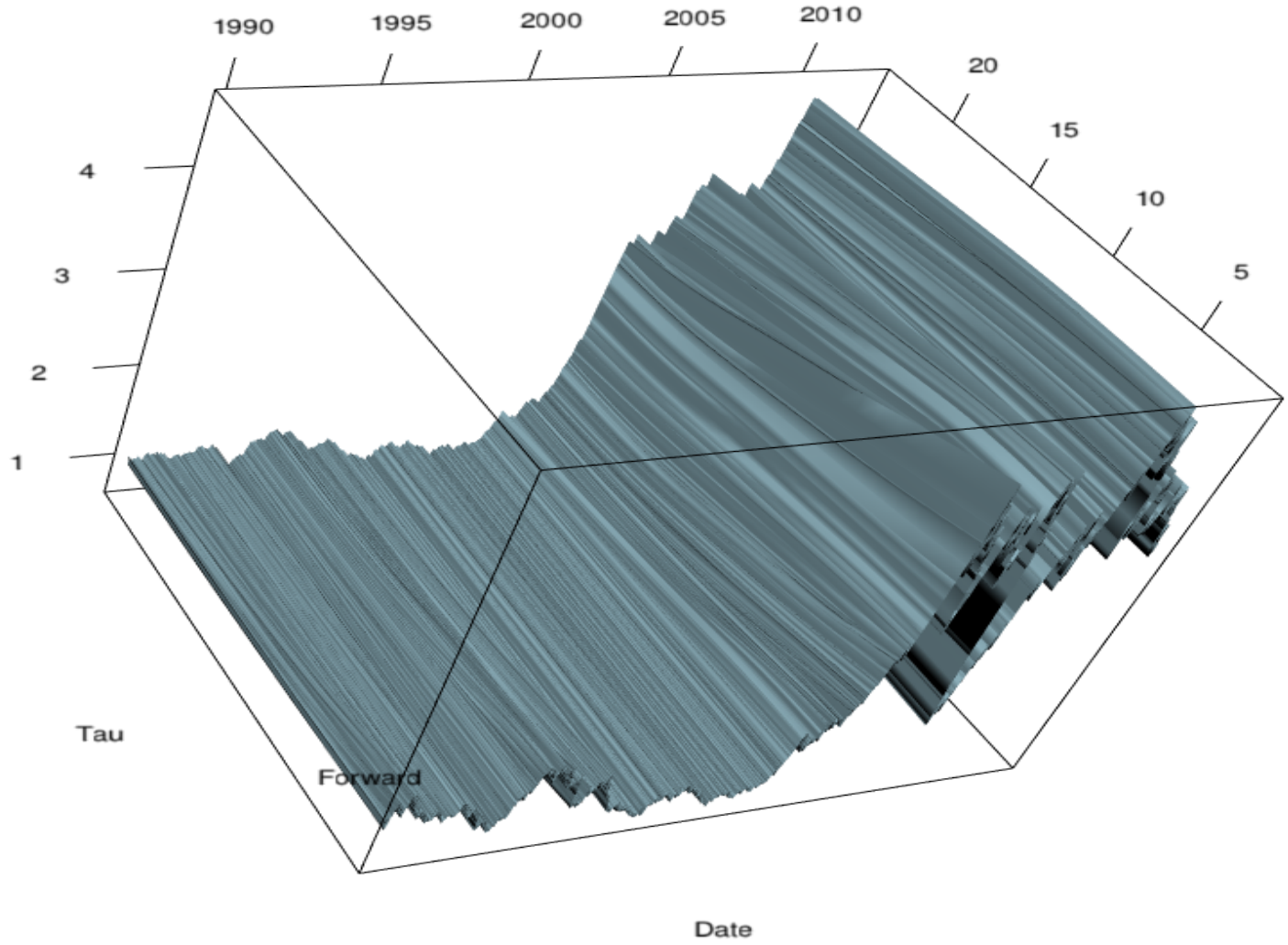


FIGURE : Surface plot of the daily forward curves for Copper between Jan 3, 1990 and July 7, 2013.

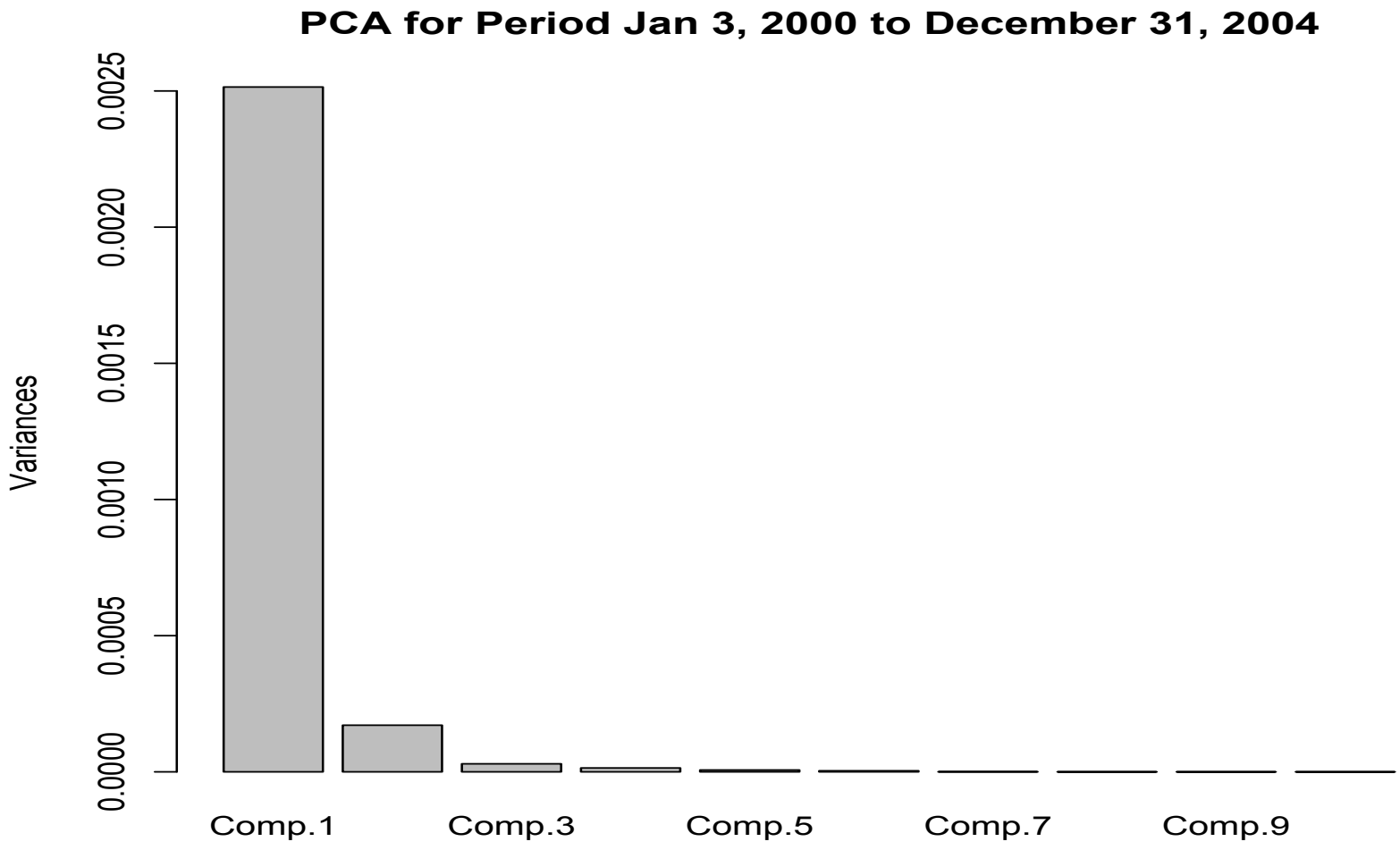
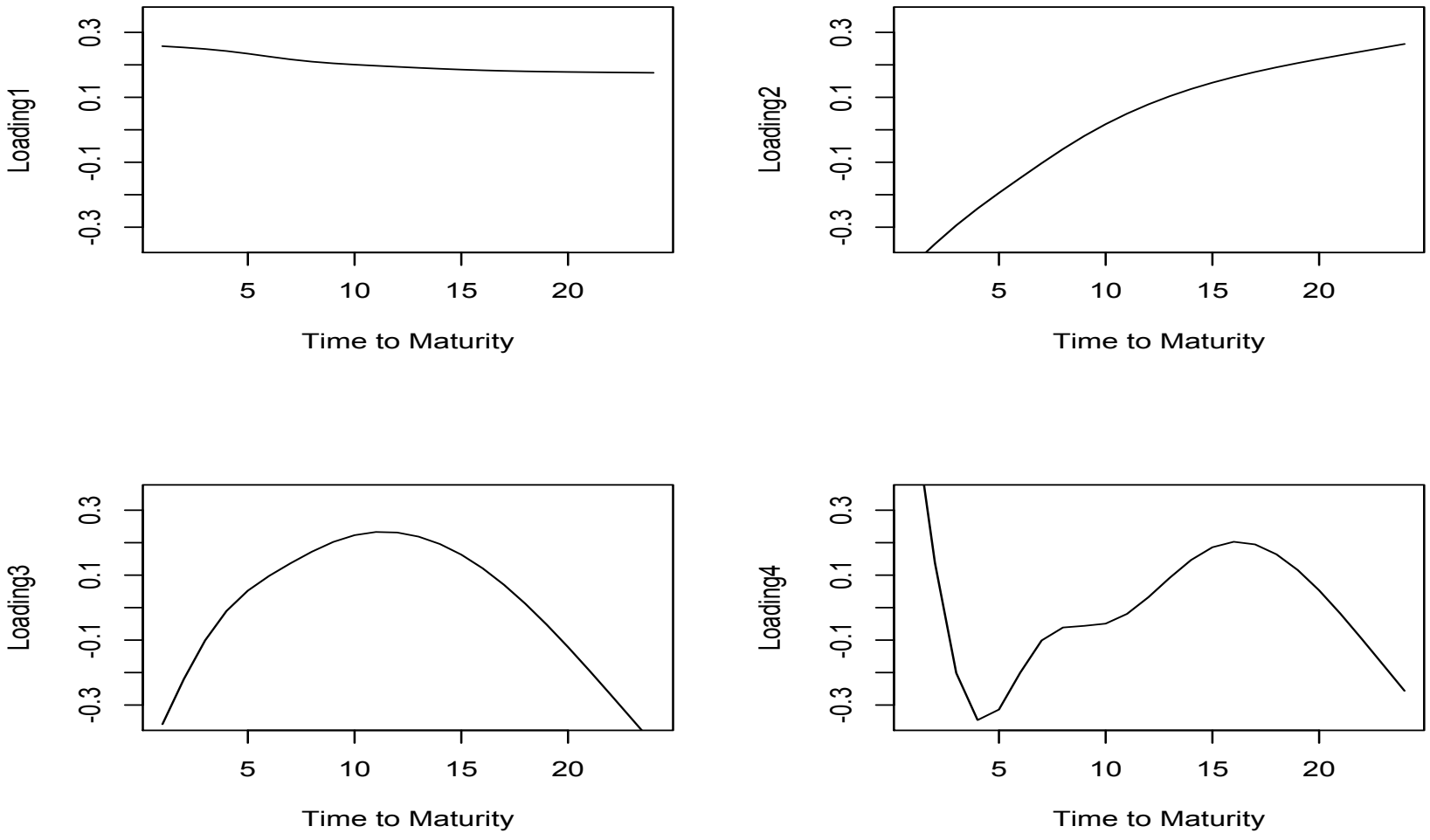


FIGURE : Proportions of the variance explained by the loadings of the PCA of the Copper forward curves for the period January 3, 2000 to December 31, 2004.

GENERALITIES ON THE COMMODITY MARKETS



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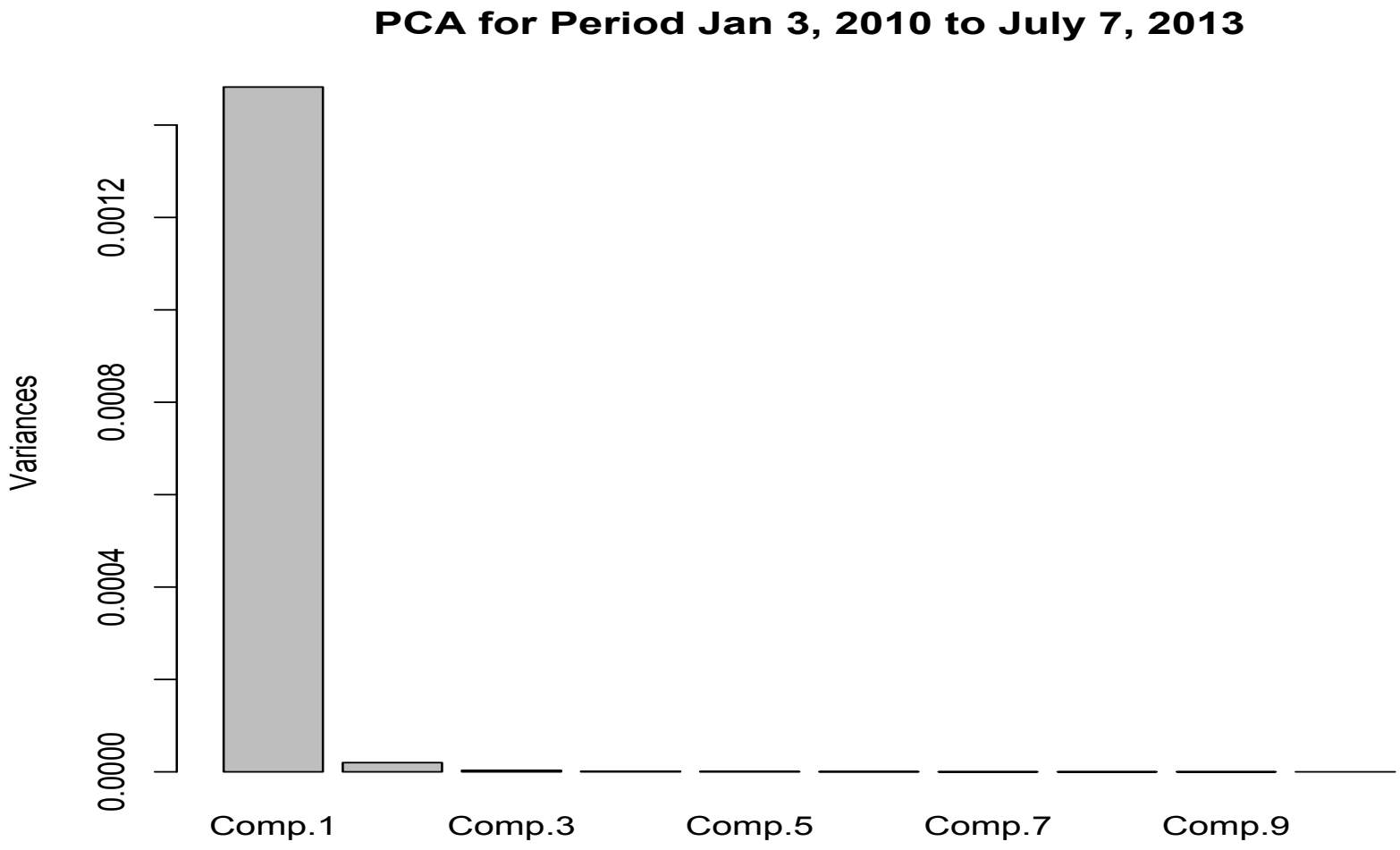

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GENERALITIES ON THE COMMODITY MARKETS

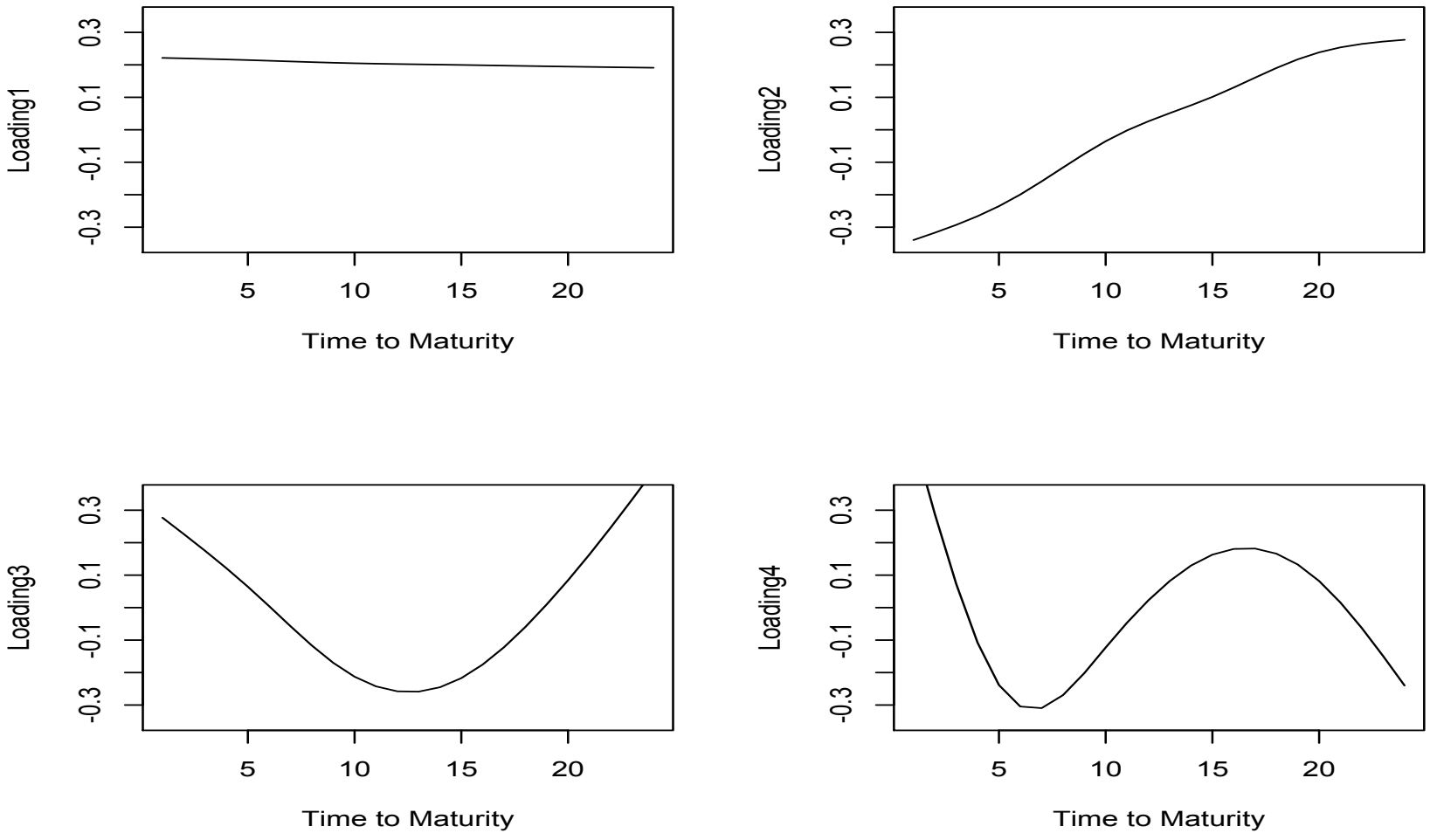


FIGURE : Loadings of the PCA of the Copper forward curves for the period January 3, 2010 to July 7, 2013.

Index Investing

The final way to gain exposure to commodity which we discuss is investing directly in

Commodity Indexes or in ***Exchange Traded Funds*** (ETFs)

tracking these indexes.

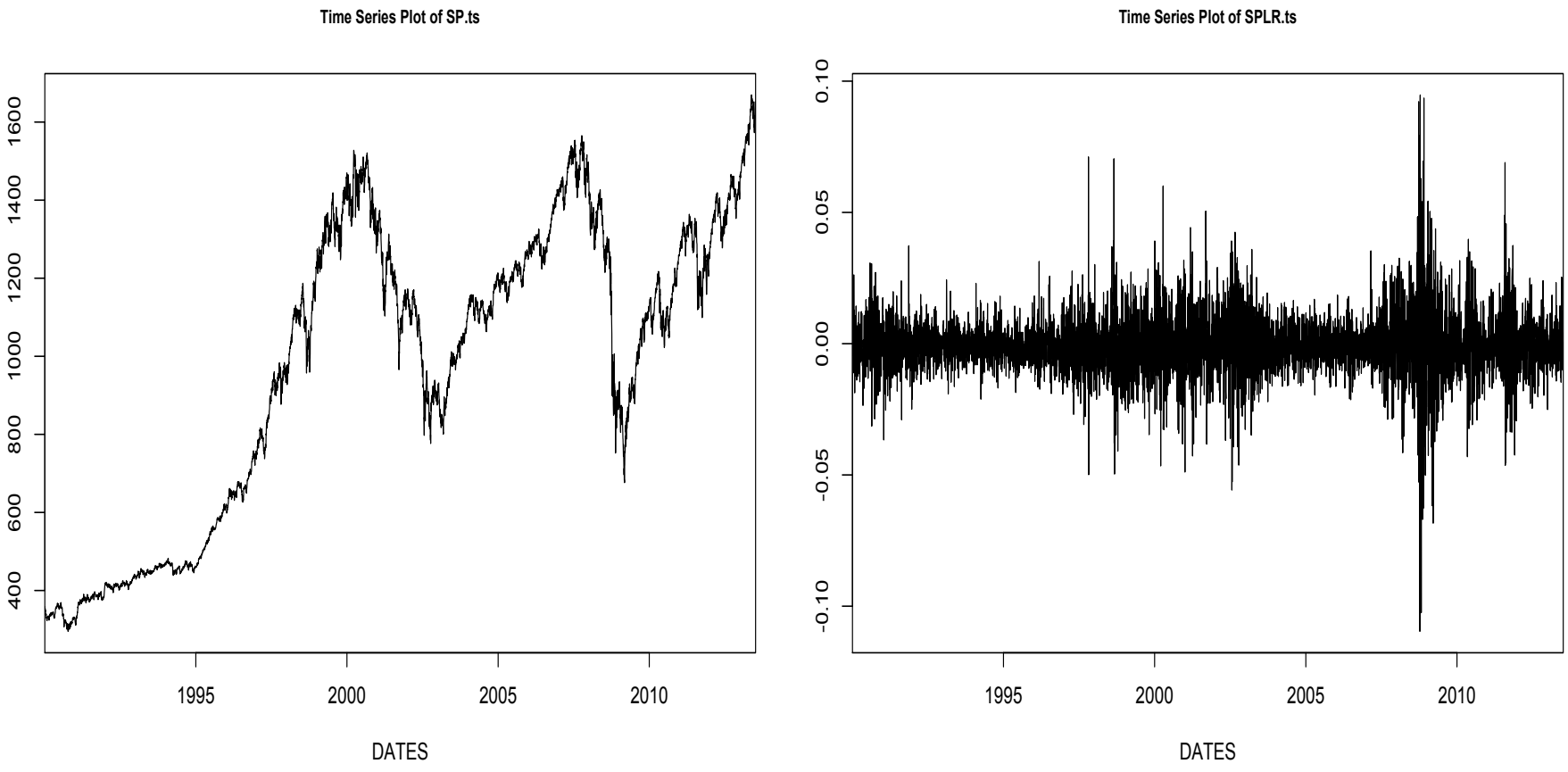
Recall the Sources of Returns on Commodity Futures Investments The total return of a commodity futures investment is from

- spot returns;
- roll yield;
- collateral returns.

small **Disclaimer**:**Understanding of forward curve dynamics** and the effect of **monthly rolls** is **vital**! Between June 2008 and March 2012 a natural gas ETF (UNG) lost **96%** of its value, with roughly

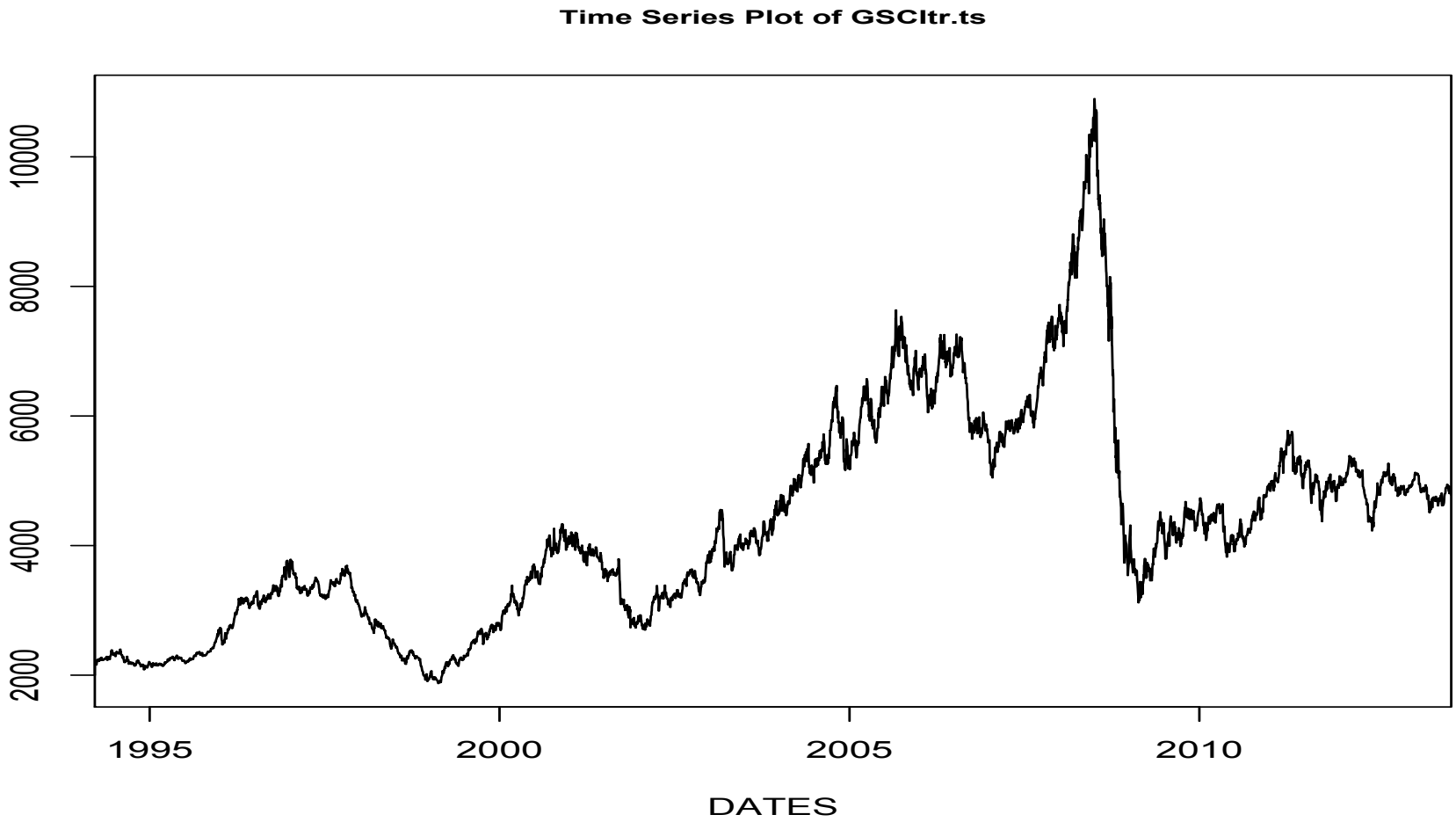
- **half** attributable to the spot price drop
- **half** to the steep contango in this period.

THE STOCK MARKET RETURNS



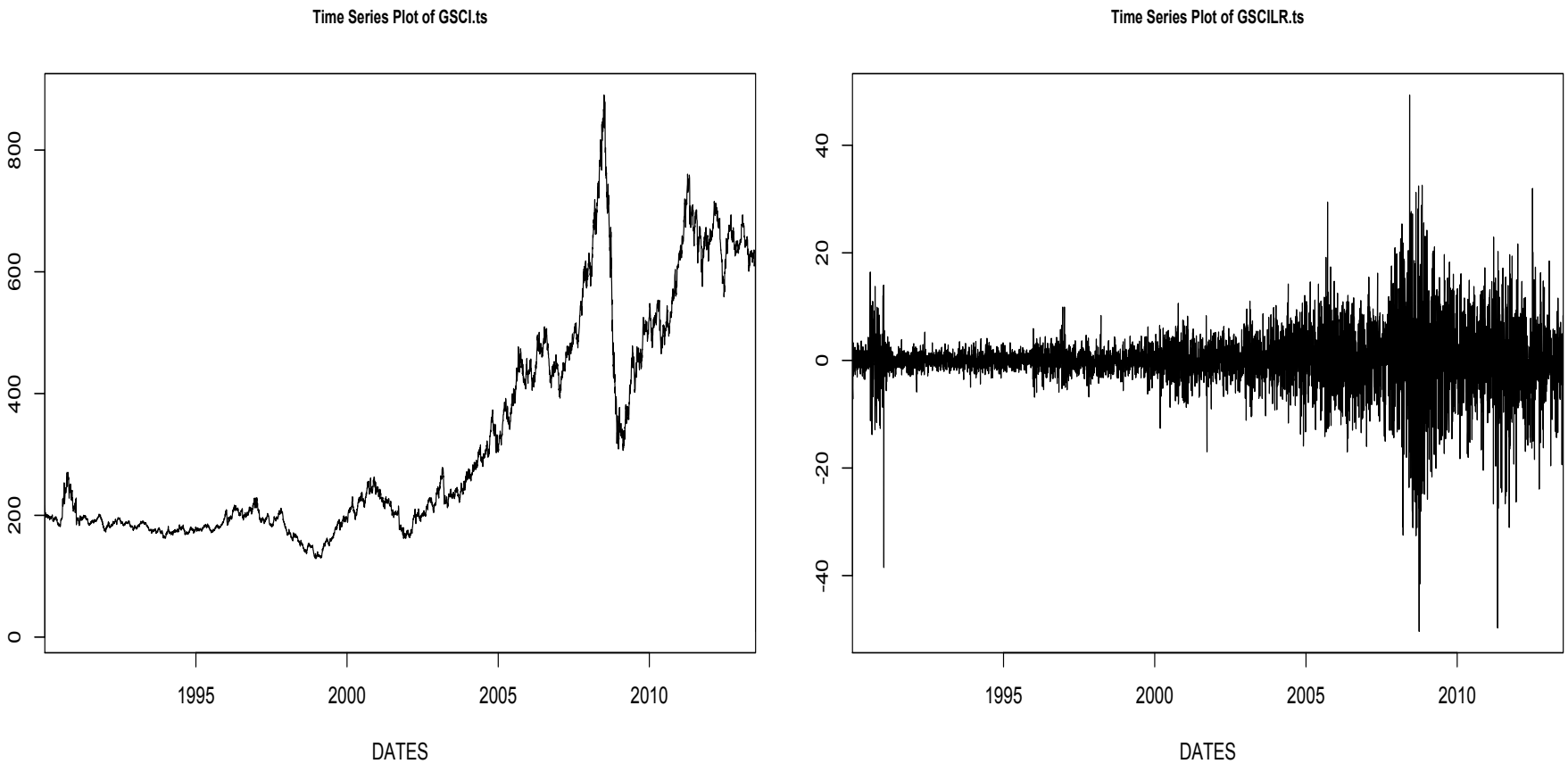
Time series plot of the S&P 500 daily closing prices (left) and of the daily log returns (right).

SP-GSCI Total Returns



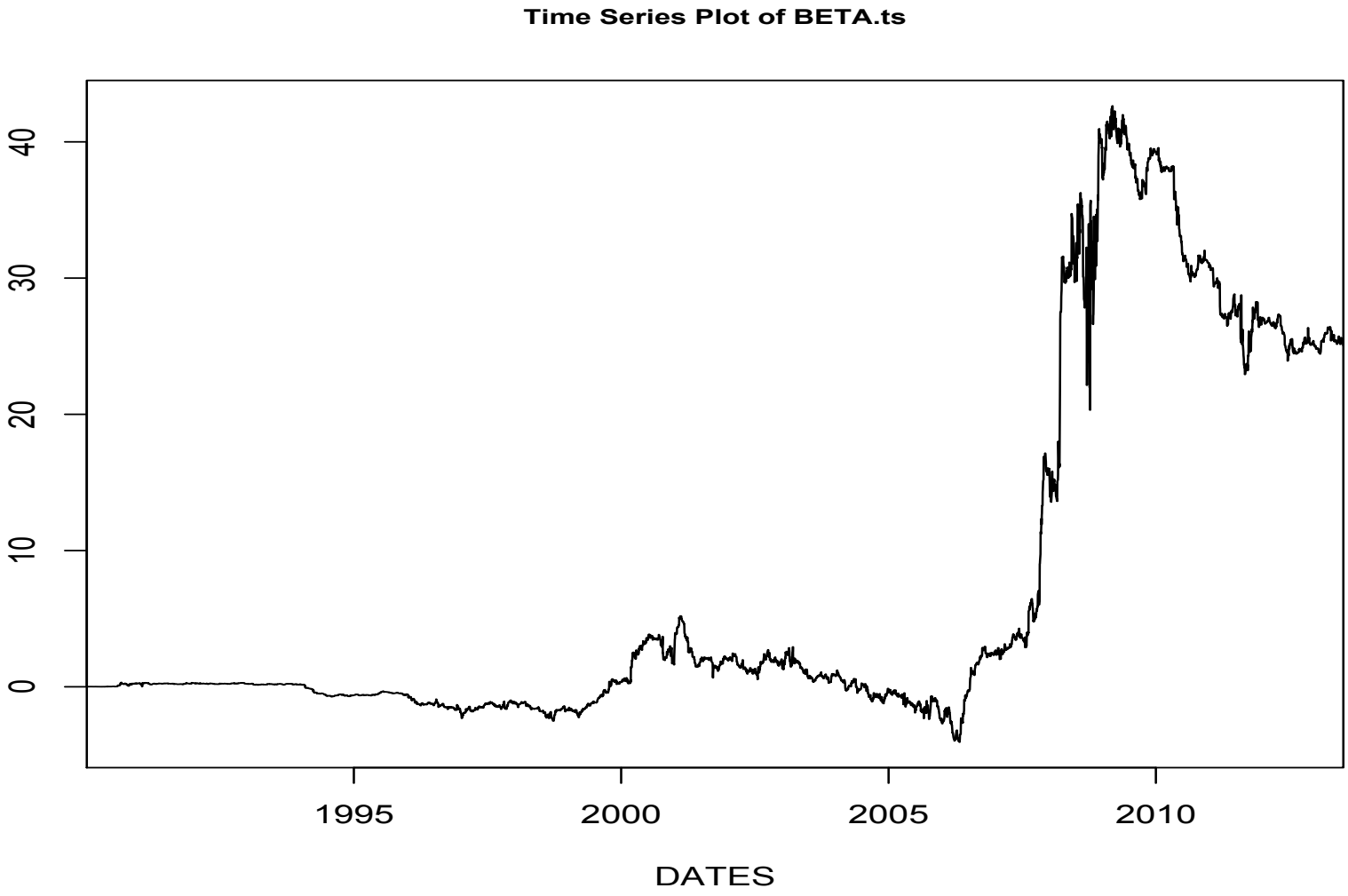
Time series plot of the GSCI Total Return daily index.

More GSCI



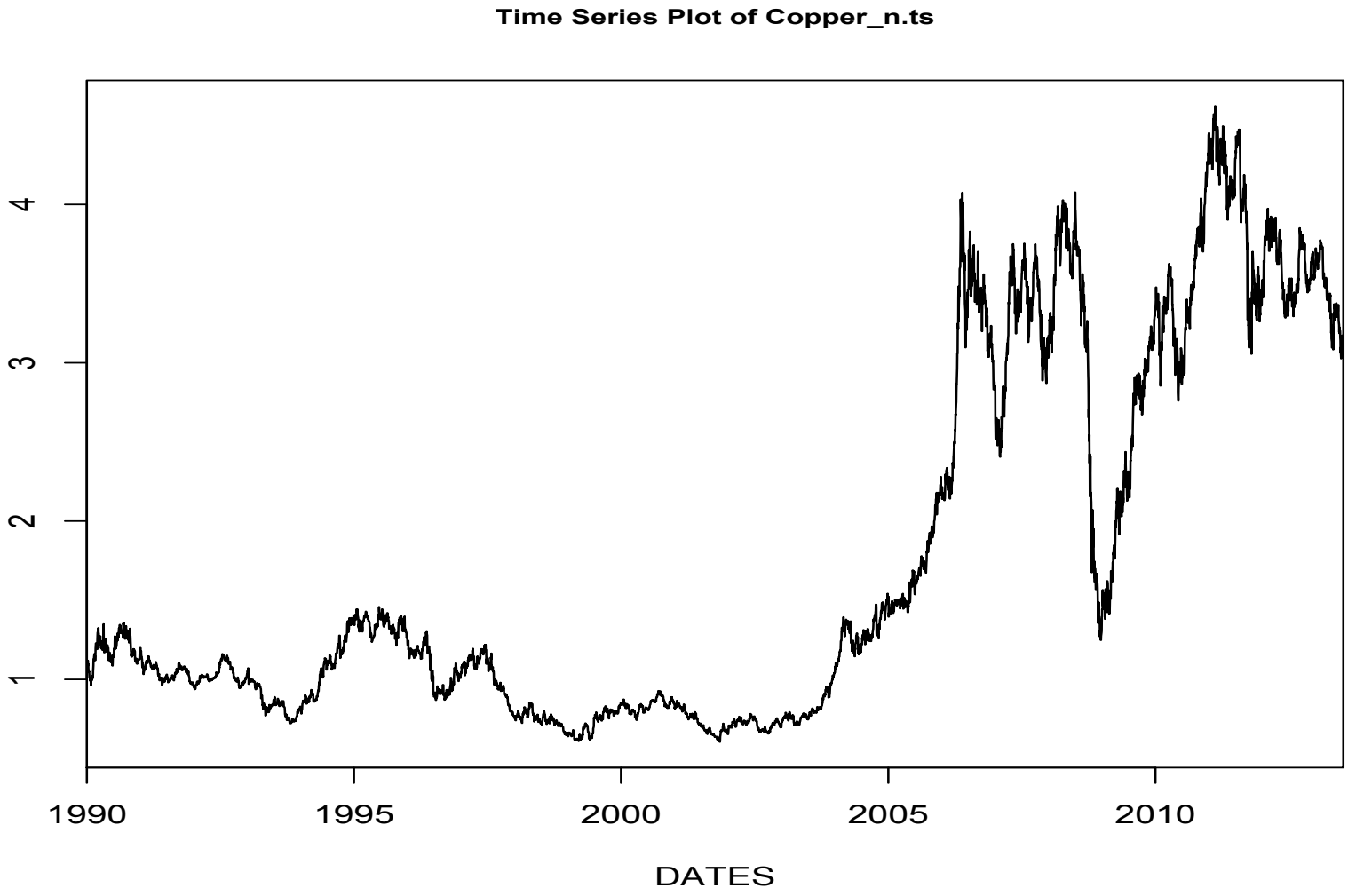
Time series plot of the GSCI daily total index (left) and of the daily total returns (right).

INSTANTANEOUS BETAS FOR GSCI / S&P500



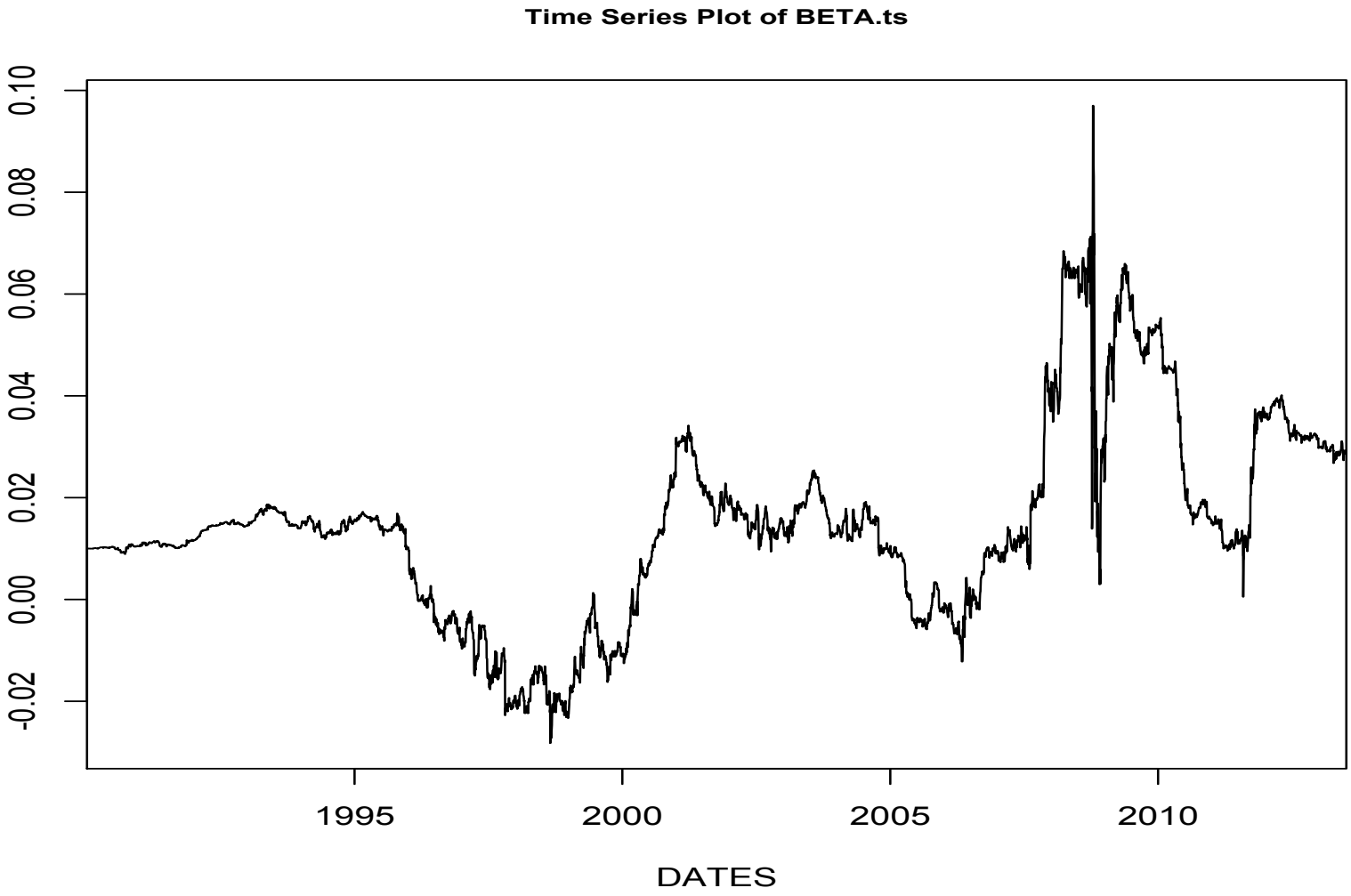
Instantaneous Dependence (β) of GSCI-TR returns upon S&P 500 returns.

Another Look at the Changes in the Mid-2000s



Time series plot of the daily price of the nearest Copper futures contract.

INSTANTANEOUS BETAS FOR COPPER / S&P500



Instantaneous Dependence (β) of Copper daily returns upon S&P 500 returns.

Pro - Financialization Papers

- **Singleton** uses data from the 2008 boom - bust in oil prices to argue that flows from institutional investors were significant in volatility increase
- **Tang** and **Xiong** use correlation coefficients computed in a *trailing sliding window* to
  - Show dramatic increase in co-movement between oil and other commodities after 2004;
  - Little or no increase with non-index commodities;
  - Same *correlation increase effect* among commodities included in the same indices.
- **Buyuksahin** and **Robe** used proprietary CFTC dataset to argue that increase in correlation between equity indices and commodities is due to the presence of *hedge funds*
- **Henderson**, **Pearson** and **Wang** use Commodity Linked Notes (CLNs) to show price impact

On the Other Side of the Divide

- Surveys by **Irwin** and **Sanders**, and **Fattouh**, **Kilian**, and **Mahadeva** argue against the claim that increased speculation in oil futures markets was an important factor in oil prices evolution.
- **Kilian** and **Murphy** argue that the 2003-2008 oil price surge was due to global demand shocks rather than speculation.
- **Hamilton** and **Wu** found no evidence in agricultural commodities that the positions of traders identified by the CFTC as *index traders* can help predict returns on the front month of futures contracts.

Information Flows

- **Tyner**, **Alghalith** and **Du et al.**, and **Sari et al.** argue for **spillovers** between energy and agricultural sectors.
- **Hu** and **Xiong** (recent tech report) find significant information flow **after 2005** from daily futures returns (**NOT spot** returns) of **copper** and **soybeans** (**NOT Oil**) to Asian (China, Japan, Hong Kong, South Korea, and Taiwan) stock markets.
- **Shockin** and **Xiong** argue via a technically involved equilibrium model that information frictions can be the source of an increase in commodity futures prices, **not driven by fundamentals**, signals strong global economic strength, possibly increasing demand.
- **Ekeland** and **Lautier** offer a similar equilibrium model for information flow in a commodity market with producers, speculators and storage.

Mathematical Models for Correlation Changes

- **Basak** and **Pavlova** extend the results of a previous paper on stocks to incorporate some of the idiosyncrasies of the commodity markets.
- **Sircar et al.** use an asymptotic expansion to uncover the increase in correlation

Recall the Sources of Returns on Commodity Futures Investments

The total return of a commodity futures investment is from

- spot returns;
- roll yield;
- collateral returns.

Could we try to improve the ROLL YIELD?

The Deutsche Bank Liquidity Commodity Index

Traditionally:

- Roll returns left to **backwardation** / **contango** transitions

New indexes:

- **Optimize the roll return**

e.g. **Deutsche Bank Commodity Index**

- if the curve is **backwardated** MOST LIKELY roll to the next month out
- if the curve is in **contango** roll further out down the curve
- Other scenarios possible due **liquidity** constraints

DB Liquidity Commodity Index (DBLCI)

- Launched in 2003
- Basis for Index Tracking Funds (DB Power Share ETFs)

	Index Weight	Contract Months	Exchange
Energy			
WTI Crude Oil	35.00%	Jan-Dec	NYMEX
Heating Oil	20.00%	Jan-Dec	NYMEX
Precious Metals			
Gold	10.00%	Dec	COMEX
Industrial Metals			
Aluminium	12.50%	Dec	LME
Grains			
Corn	11.25%	Dec	CBOT
Wheat	11.25%	Dec	CBOT

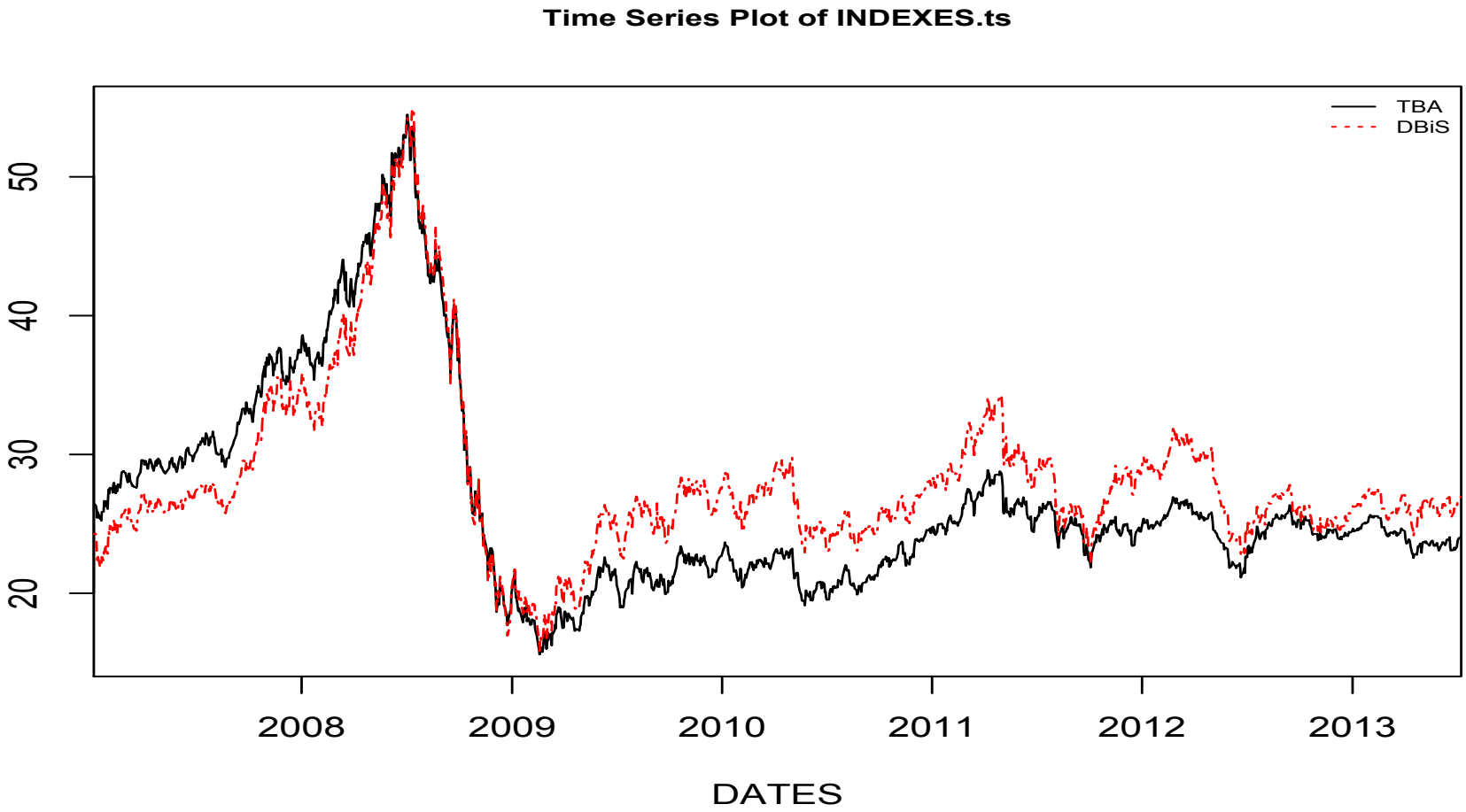
Rebalanced annually in November.

Optimum Yield Commodity Index Total Return

Index Level: 518.55
Composition as of **Aug 9, 2013, 12:00 AM**

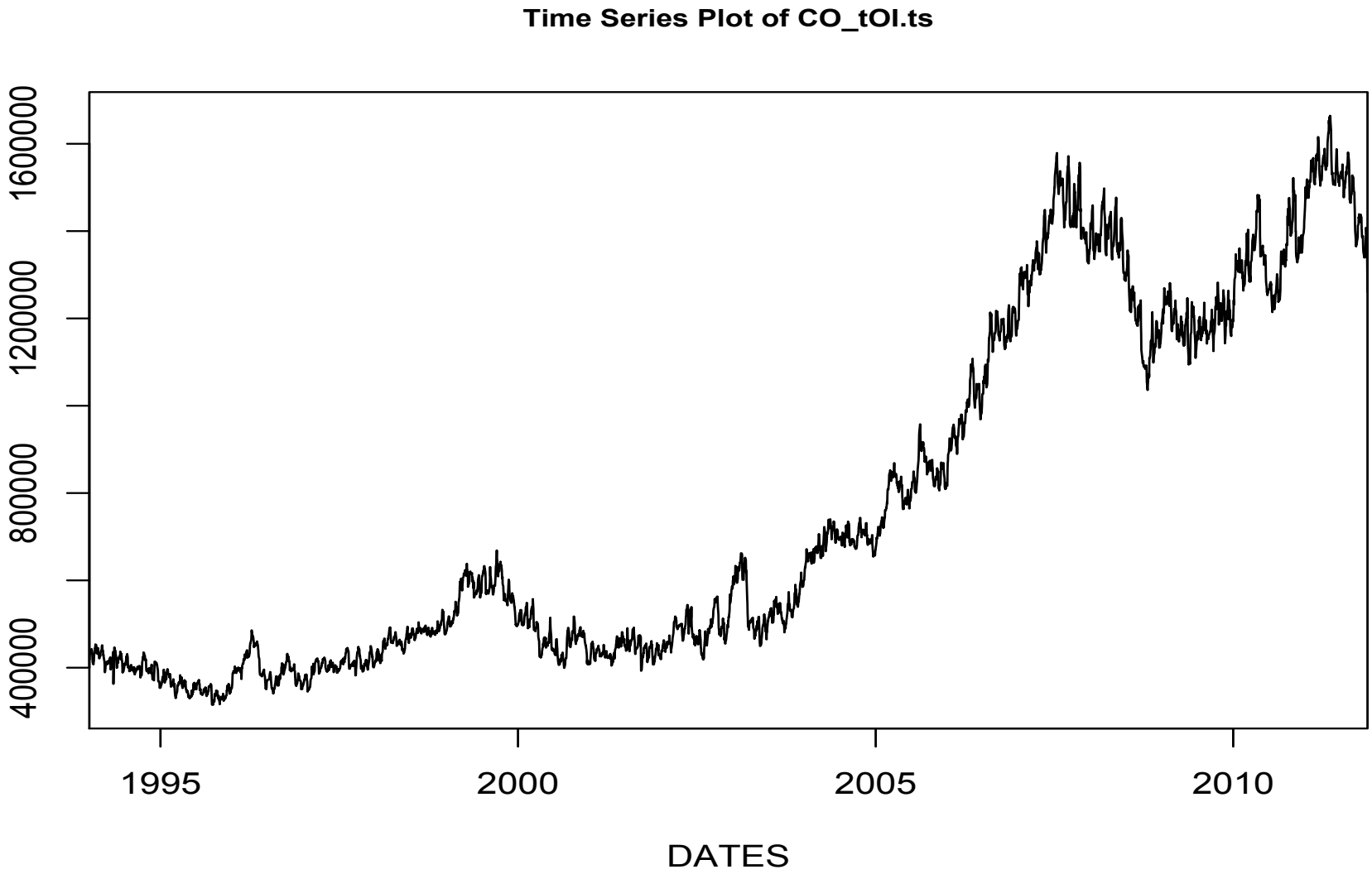
Component	Contract Date	Weight %
Aluminium	16-Oct-2013 / OCT3	4.11
Brent Crude	14-Mar-2014 / APR4	13.62
Copper - Grade A	19-Mar-2014 / MAR4	4.16
Corn	13-Dec-2013 / DEC3	4.24
Gold	28-Apr-2014 / APR4	6.39
Heating Oil	31-Mar-2014 / APR4	13.26
Light Crude	20-Jun-2014 / JUL4	14.64
Natural Gas	26-Sep-2013 / OCT3	4.88
RBOB Gasoline	31-Oct-2013 / NOV3	14.36
RBOB Gasoline	29-Nov-2013 / DEC3	0.14
Silver	27-Dec-2013 / DEC3	1.33
Soybeans	14-Nov-2013 / NOV3	5.26
Sugar #11	30-Sep-2013 / OCT3	5.21
Wheat	14-Jul-2014 / JUL4	4.10
Zinc	18-Dec-2013 / DEC3	4.28

SP-GSCI Total Returns



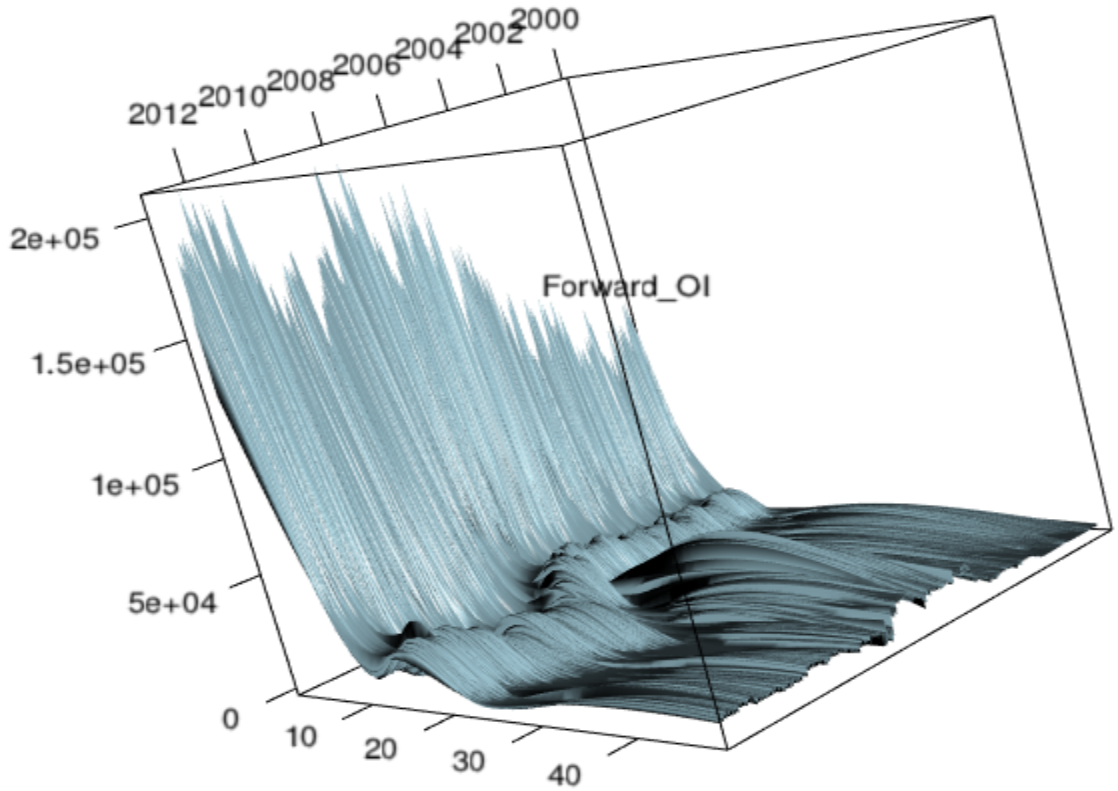
Time series plot of the daily GSCI Total Return index (black) and Deutsche Bank iShare DBiS (red)

WTI Open Interest



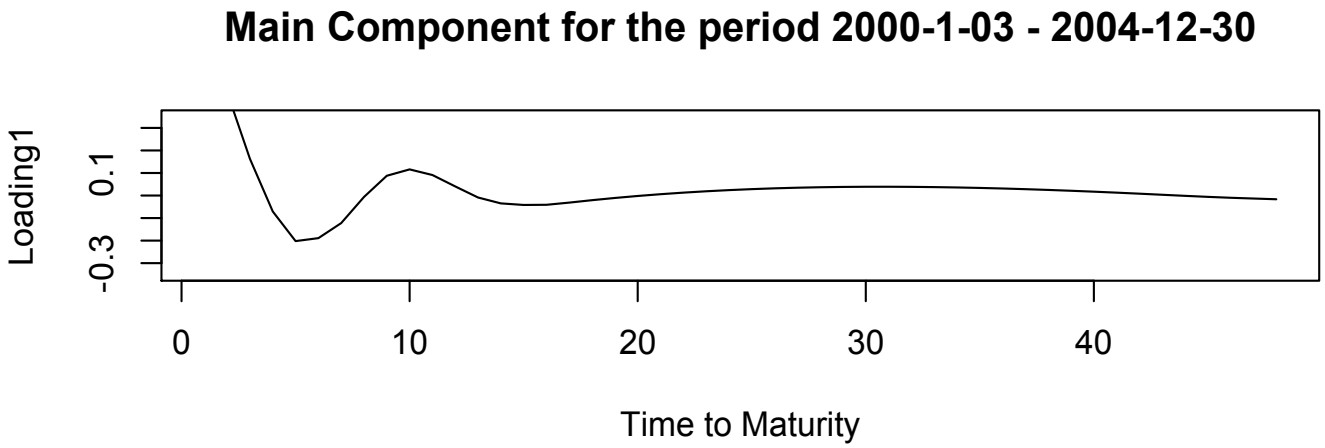
Time series plot of the daily (total) open interest in WTI Crude Oil.

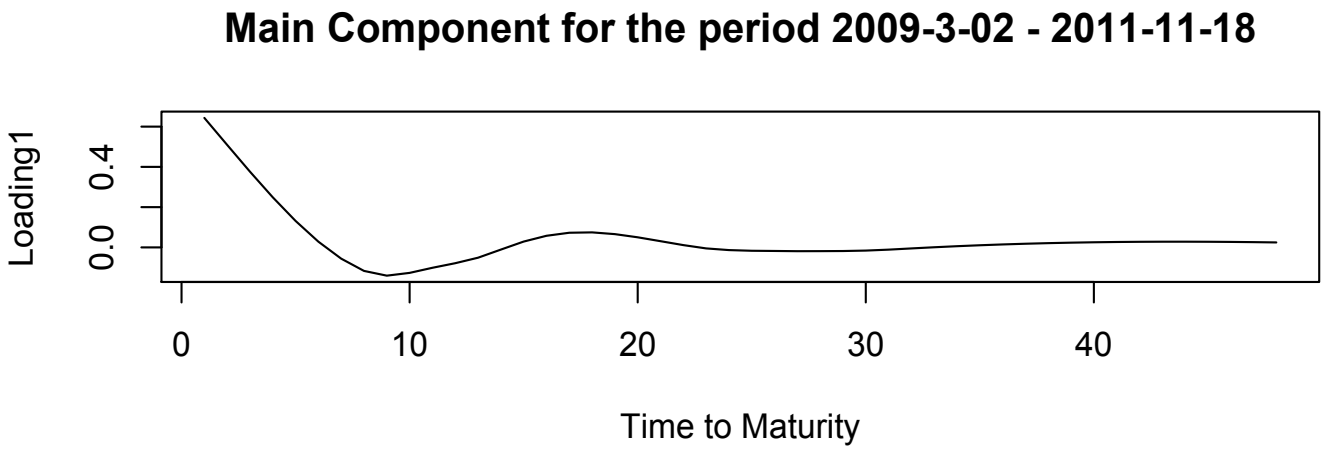
The Term Structure of WTI Open Interest



Surface plot of the daily term structure of open interest for WTI Crude Oil.

WTI Open Interest Main Factor





Comparison of the main factors of the PCAs of the daily changes in the term structure of open interest for WTI Crude Oil for the periods January 3, 2000 to December 31, 2004 (top) and March 2, 2009 to November 18, 2011 (bottom).

COPPER OPEN INTEREST

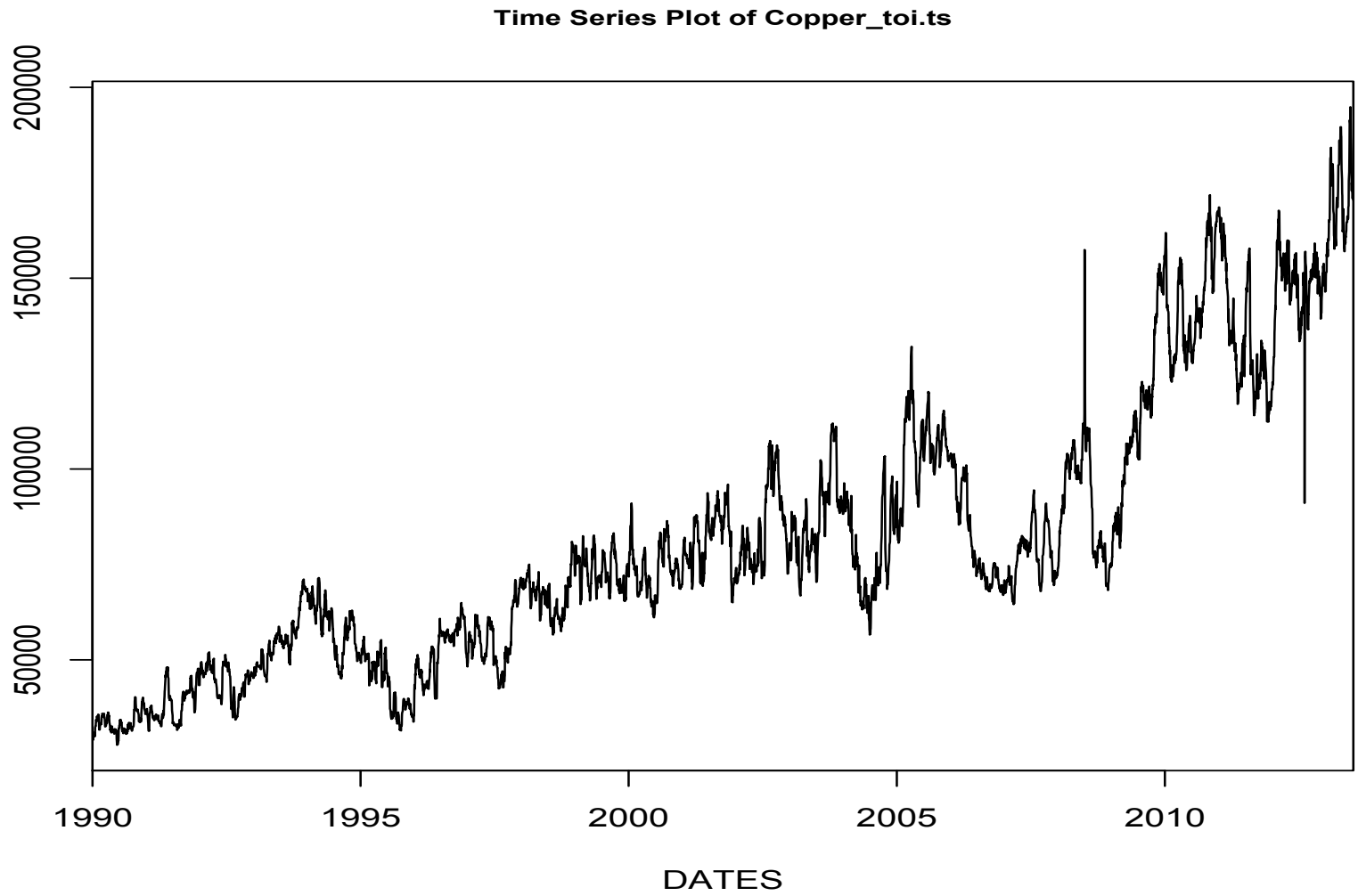


FIGURE : Time series plot of the daily open interest in Copper futures contracts.

TERM STRUCTURE OF COPPER OPEN INTEREST

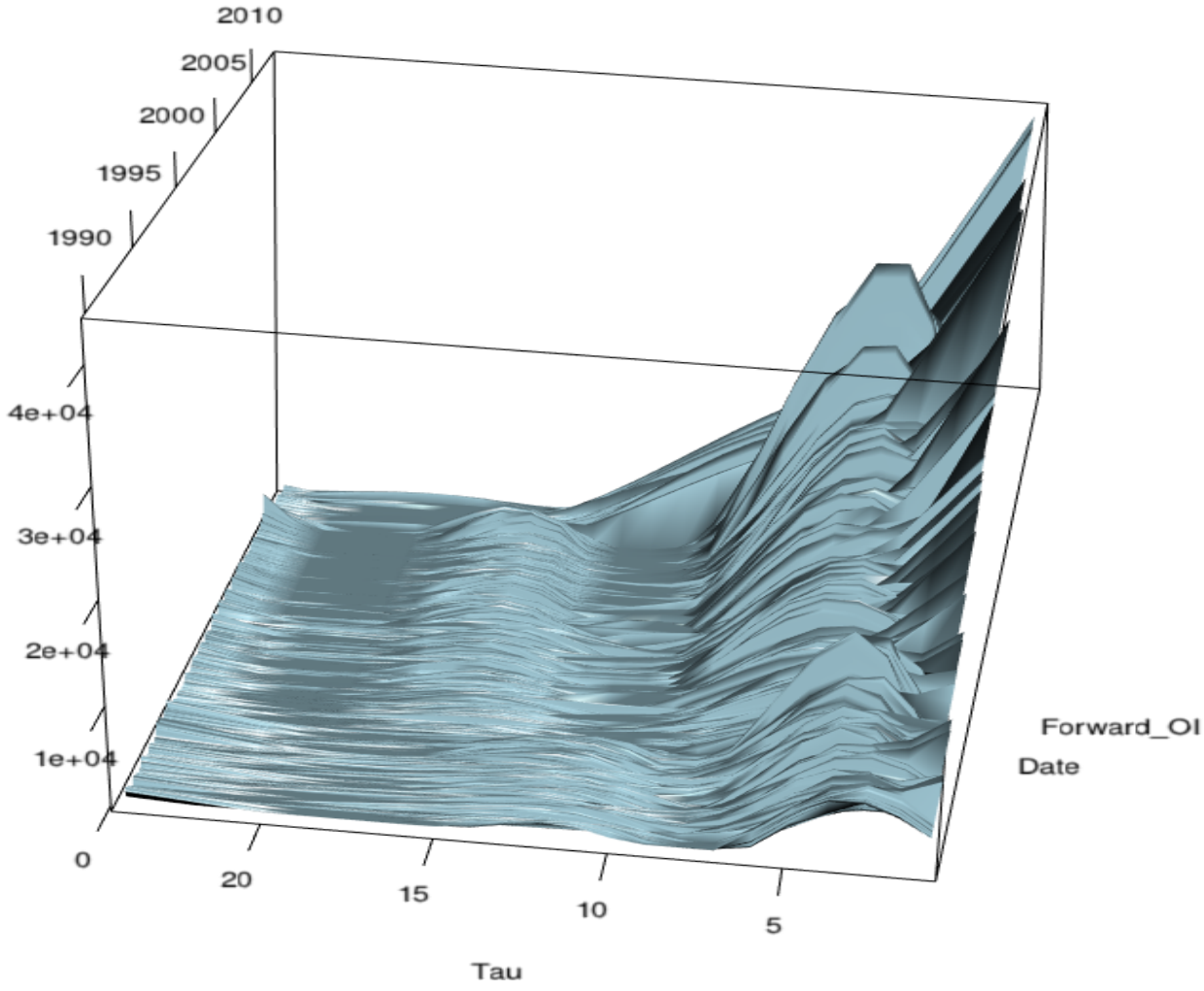


FIGURE : Surface plot of the daily forward curves for the open interest of Copper futures contracts between Jan 3, 1990 and July 7, 2013.

Main Factor over Time