Lecture 1
Introduction

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Top ten greatest trades

Rank	Trader	Position	Year
1	John Paulson	Against subprime	2008
2	Jesse Livermore	Against US equity	1929
3	John Templeton	Long Japan	1960s–1990s
4	George Soros	Against UK pound	1992
5	Paul Tudor Jones	Short Black Monday	1987
6	Andrew Hall	Long oil	2003
7	David Tepper	Long financials	2009
8	Jim Chanos	Short Enron	2001
9	Jim Rogers	Long commodities	1990s–
10	Louis Bacon	Long oil, short equity	1990

At least half are derivatives trades

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PAULSON'S BET AGAINST SUBPRIME

Paulson's subprime view

- John Paulson is an investment banker, not a macro-investor.
- He runs a hedge fund that specializes in risk arbitrage.
- But in 2007 he was convinced of a US housing bubble.
- How can you bet on this view?

Betting on Paulson's view

- You can't short real estate.
- You can't even short sell mortgages.
- You might be able to short mortgage-backed securities (MBS).
- But is there an easier way to trade on Paulson's view?

Credit default swaps

- Credit default swaps (CDS) pay off when an entity defaults.
- CDS is commonly used to insure against default on bonds.
  - Similar to fire insurance on your own house.
  - If house burns down, insurance contract pays off.
- However, you can still buy CDS without being long a bond.
  - Similar to fire insurance on neighbor's house.

Paulson's profits

- Paulson's hedge fund purchased CDS on subprime MBS.
- They also shorted the ABX index and, later, bank stocks.
- How did these bets eventually turn out?
- Paulson's hedge fund ended up $15 billion in 2007.
  - He took home around $4 billion himself.

ARE DERIVATIVES JUST FOR SPECULATION?

What is a derivative?

- A derivative is a financial instrument whose value is derived from the value of an underlying asset.

- *Example:* exchange option on two thoroughbreds:

$$\text{Payoff} = \begin{cases} \text{Horse 1} & \text{if Horse 1 is better than Horse 2} \\ \text{Horse 2} & \text{otherwise} \end{cases}$$

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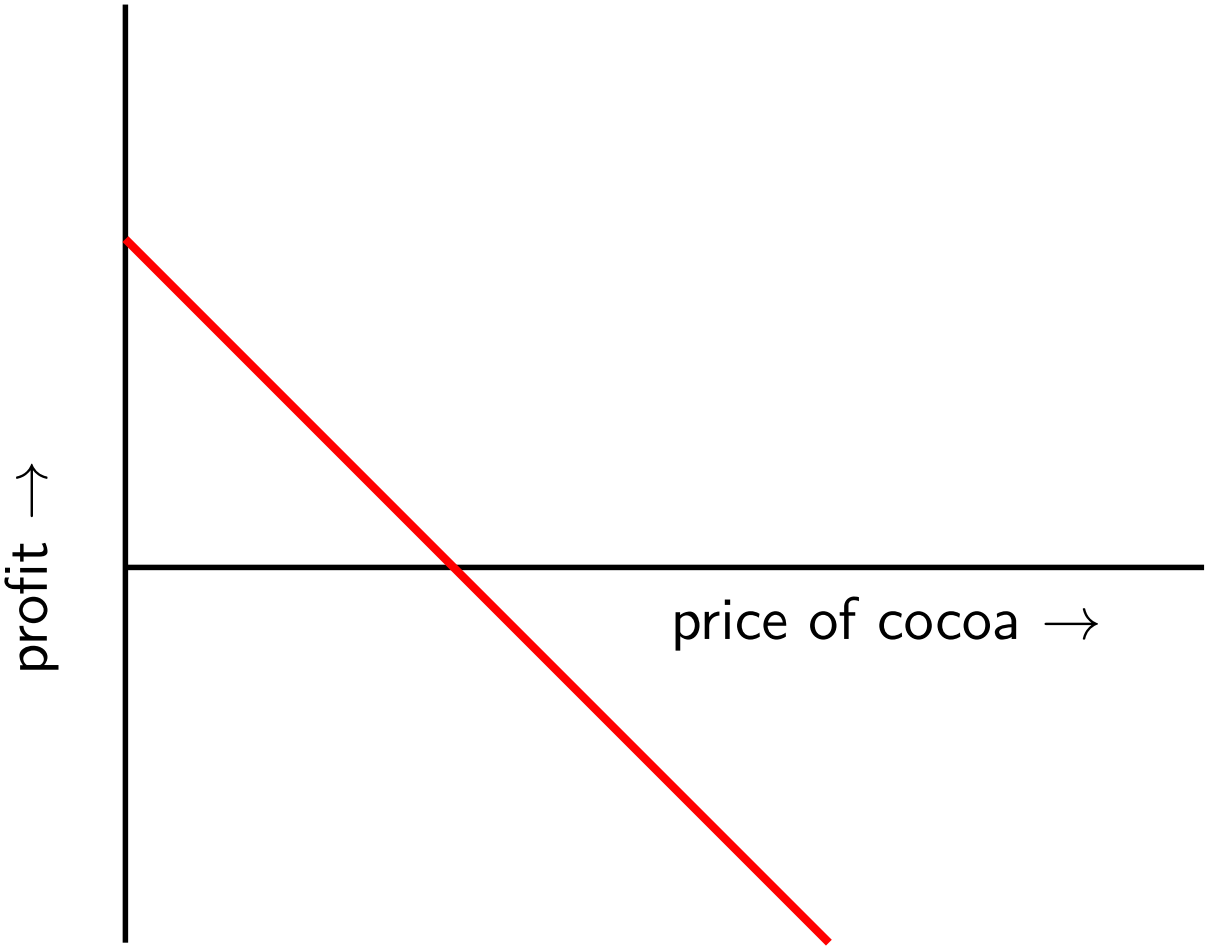
Common types of derivatives

1. Forwards
2. Futures
3. Swaps
4. Call options
5. Put options

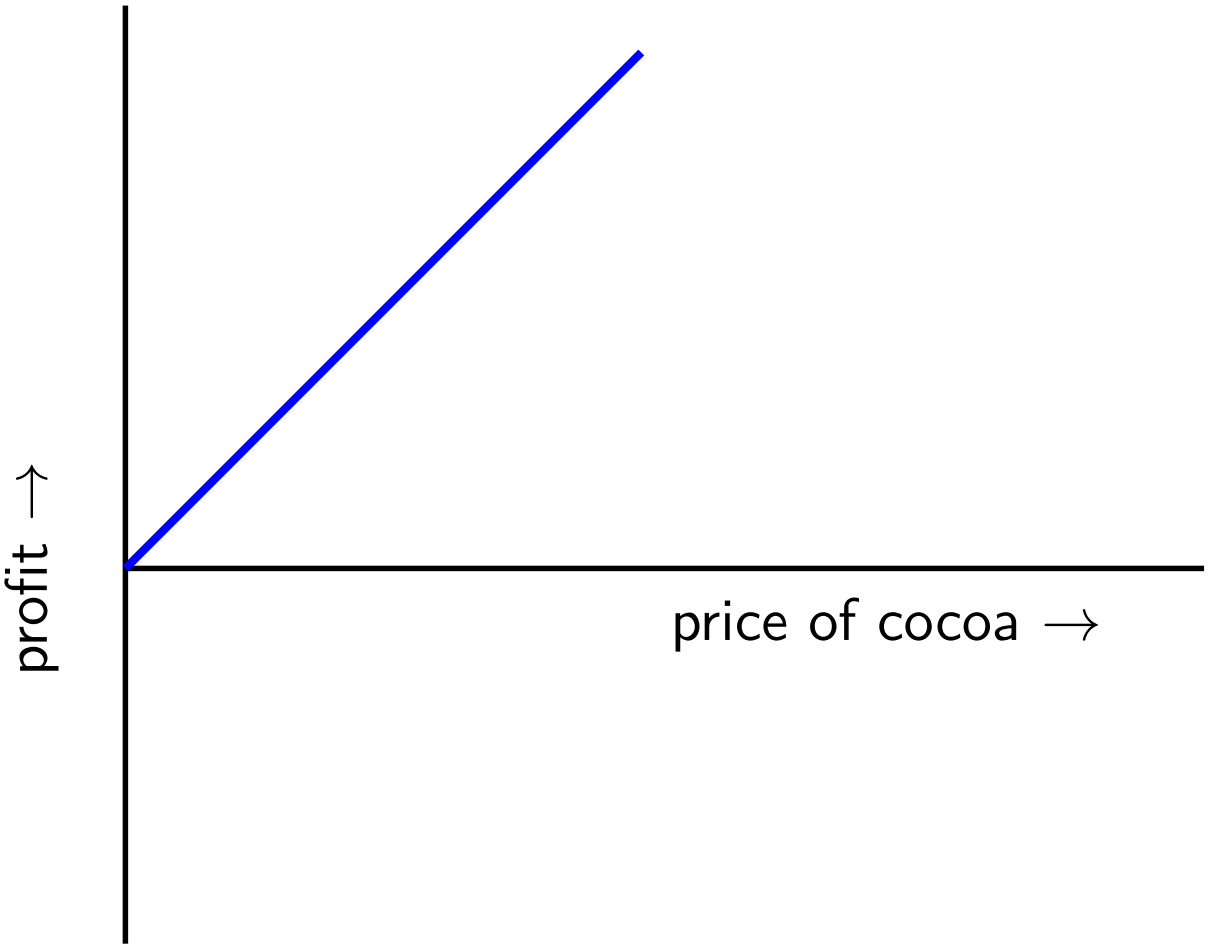
Common underlying assets

1. Stocks.
2. Commodities.
3. Currencies.
4. Interest rates.
5. Loans.

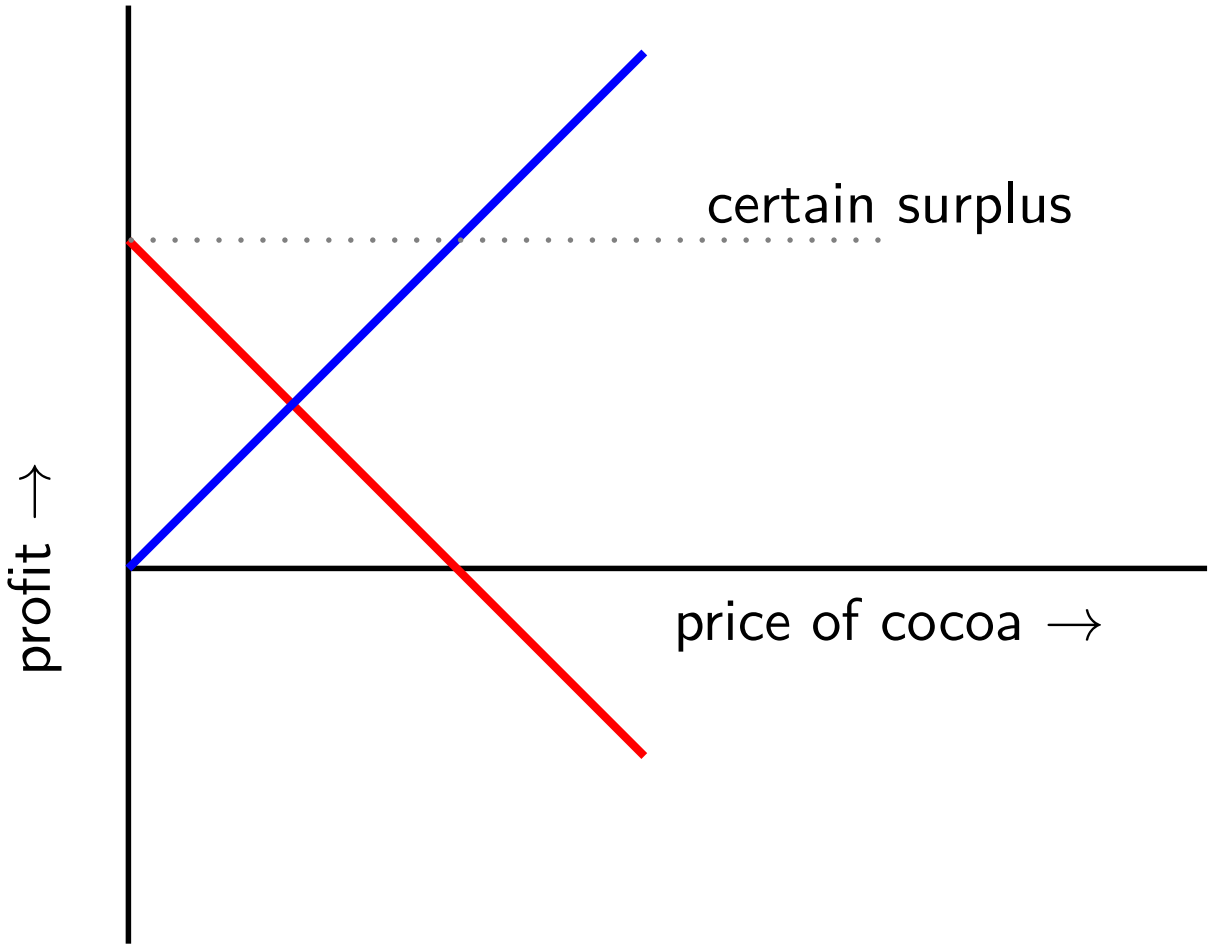
Hershey's unhedged exposure



Cocoa producer's unhedged exposure



Opportunity arises to share risks



Basic idea behind forward contract

- Hershey and the producer can lock-in a price for cocoa.
- This will fully insure both of them against cocoa price risk.
- Moreover, Hershey can keep chocolate bar prices stable.

Roadmap: forward contracts

1. **Definitions and payoffs**
2. Basic risk management
3. Interest rates
4. Summary

Forward contracts

- A forward contract is an agreement to buy or sell an asset at a future date at a price specified today (called the forward price).

Agriculture

INDEX	UNITS	PRICE	CHANGE	%CHANGE	CONTRACT	TIME (EST)
C 1:COM **Corn (CBOT)**	USd/bu.	389.25	+13.75	+3.66%	Mar 2020	1/17/2020
W 1:COM **Wheat (CBOT)**	USd/bu.	570.50	+5.25	+0.93%	Mar 2020	1/17/2020
CC1:COM **Cocoa (ICE)**	USD/MT	2,797.00	+85.00	+3.13%	Mar 2020	1/17/2020

Forward contract details

- Every forward contract has a buyer and a seller:
  - Buyer (long) is obligated to pay the forward price.
  - Seller (short) is obligated to sell at the forward price.
- Typically, no money is exchanged when the contract is initiated.
- Contracts are usually cash-settled on the expiration date.

Contract payoffs

- The payoff to a derivative is its cash flow or value at expiration.

- The payoff to a long forward contract is:

$$X_T = S_T - F_{t,T}$$

where:

T = expiration date in years (timeline).

t = origination date (usually $t = 0$ or "today").

S_T = price of the underlying asset at date T.

$F_{t,T}$ = forward price agreed upon at date t for date T.

Practice problem

Today's spot price of cocoa is $S_0 = \$2,500$ per ton. The one-year forward price for cocoa is $F_{0,1} = \$2,750$. A buyer and seller agree to enter a forward contract for one ton of cocoa.

1. Assume the future spot price is $S_1 = \$2,600$. Calculate the payoff to the long and short parties.

2. Plot a payoff diagram for the long forward. What is the minimum and maximum payoff?

3. Plot a payoff diagram for the short forward. What is the minimum and maximum payoff?

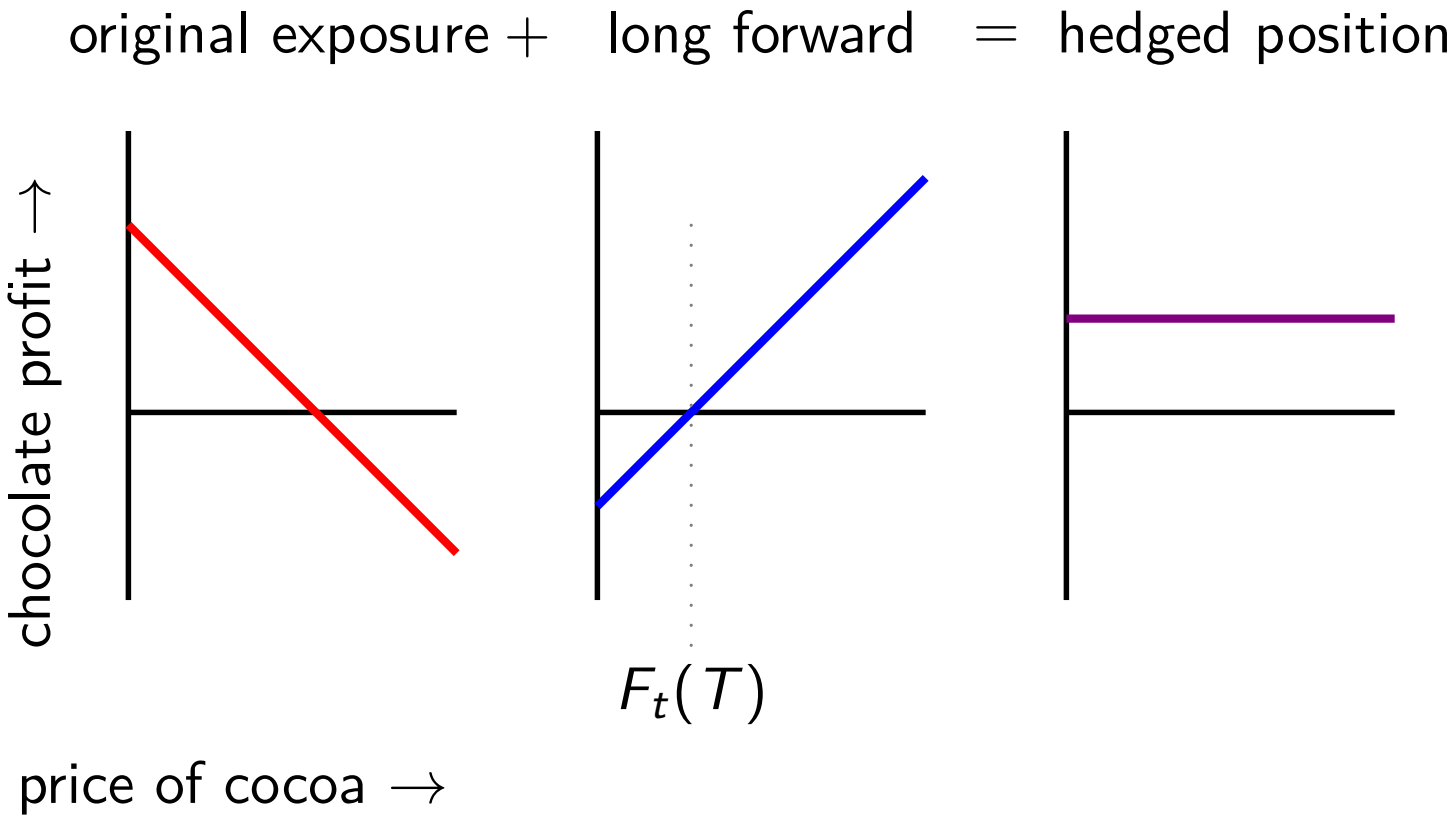
Practice problem scratch paper

Practice problem scratch paper

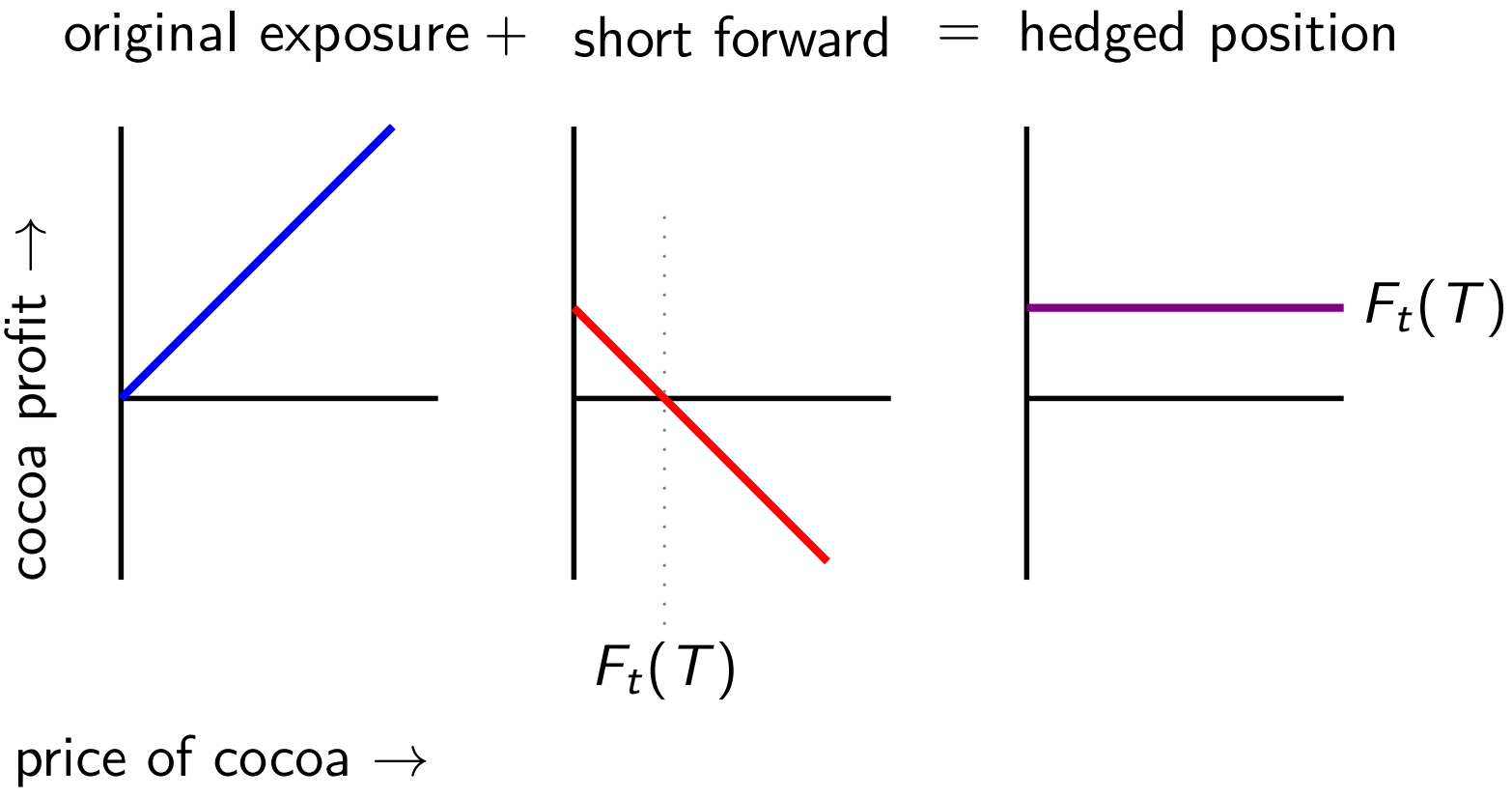
Roadmap: the basics of forward contracts

1. Definitions and payoffs
2. **Basic risk management**
3. Interest rates
4. Summary

Hershey's hedged exposure



Cocoa producer's hedged exposure



Practice problem

A farmer is planning to grow one ton of cocoa. She will sell her crop one year from today. The cost of producing cocoa is $S_0 = \$2,300$ per ton, payable in one year.

1. Is the farmer long or short cocoa? Plot the farmer's unhedged profit as a function of S_1.

2. The one-year forward price is $F_{0,1} = \$2,600$. Plot the payoff diagram of the long forward contract.

3. How should the farmer hedge using forwards? What is her hedged profit if $S_1 = \$2,000$? $S_1 = \$2,600$?

Practice problem scratch paper

Practice problem scratch paper

Roadmap: the basics of forward contracts

1. Definitions and payoffs
2. Basic risk management
3. **Interest rates**
4. Summary

Technical note on interest rates

- Throughout the semester, we will assume there is a single continuously compounded (c.c.) risk-free interest rate of r.
- Discounting risk-free cash flows using c.c:

$$\text{PV}_t(\$1) = e^{-r(T-t)}$$

- Converting n-times per annum compounded rate r^* to c.c. rate:

$$r = n \cdot \log\left(1 + \frac{r^*}{n}\right)$$

Practice problem

The c.c. risk-free interest rate is $r = 0.05$. What is the price of a risk-free zero-coupon bond that pays \$100 in five years?

Practice problem scratch paper

Practice problem

The price of a risk-free zero-coupon bond that pays \$500 in ten years is \$400. What is the c.c. risk-free interest rate?

Practice problem scratch paper

Practice problem

The semi-annually compounded risk-free rate is 0.10. What is the equivalent continuously compounded risk-free rate?

Practice problem scratch paper

Roadmap: the basics of forward contracts

1. Definitions and payoffs
2. Basic risk management
3. Interest rates
4. **Summary**

Summary

- A forward contract is an agreement to buy or sell an asset at a future date at the forward price.
- Date T payoff of long forward originated at date 0:

$$X_T = S_T - F_{0,T}.$$

- Forwards can be used to hedge input and output price risk.
- Date 0 price of risk-free \$1 payoff at date T is e^{-rT}.

References

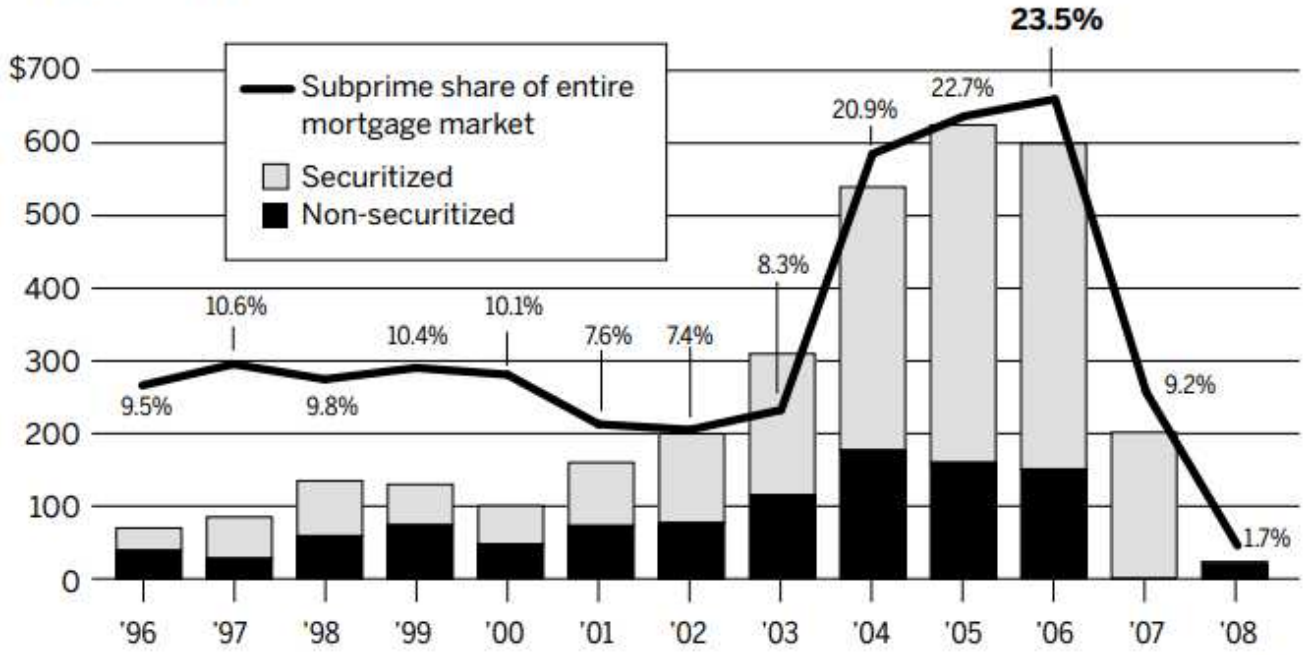
- Textbook chapters 2.1, 4.1, 4.2, and appendix B.2.
- John Paulson article is in the Wall Street Journal.
- Gary Gorton article is in the Wall Street Journal.
- Subprime mortgage info from US government and NY Fed.
- Slides are created using code on my Github.

Subprime time

Subprime Mortgage Originations

In 2006, $600 billion of subprime loans were originated, most of which were securitized. That year, subprime lending accounted for 23.5% of all mortgage originations.

IN BILLIONS OF DOLLARS



NOTE: Percent securitized is defined as subprime securities issued divided by originations in a given year. In 2007, securities issued exceeded originations.

SOURCE: Inside Mortgage Finance

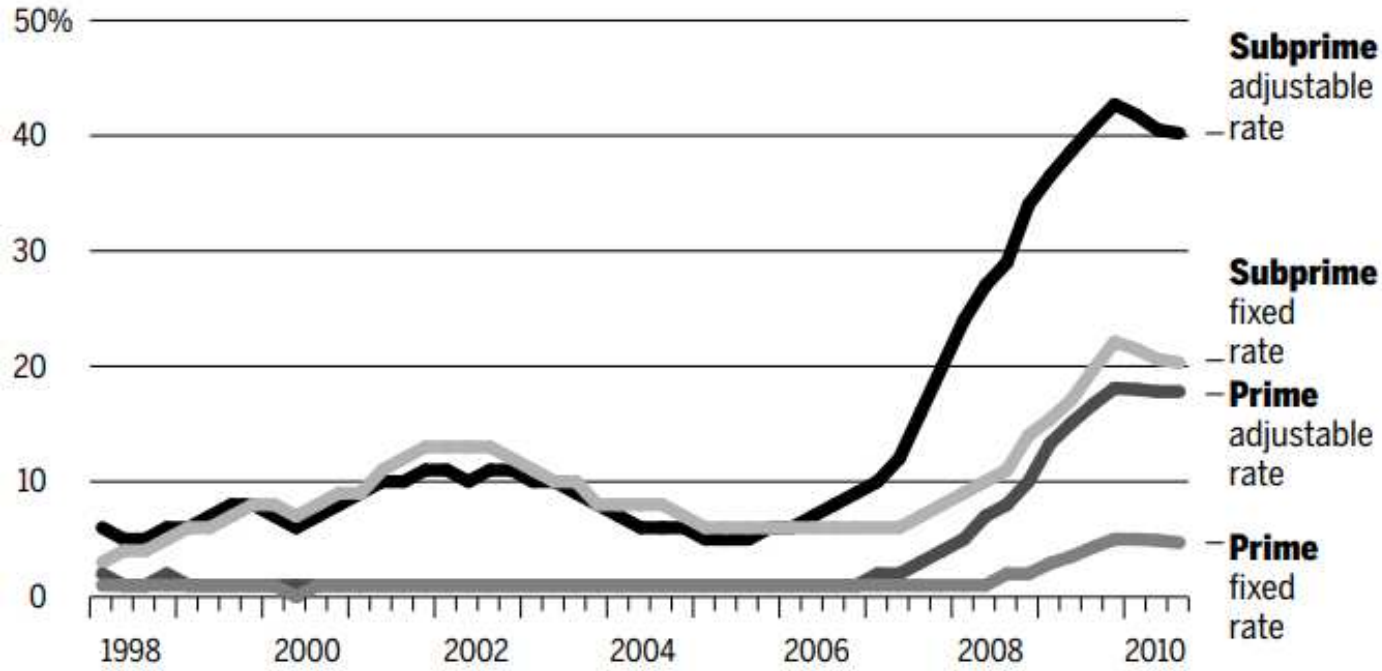
Return

Suprime default rate

Mortgage Delinquencies by Loan Type

Serious delinquencies started earlier and were substantially higher among subprime adjustable-rate loans, compared with other loan types.

IN PERCENT, BY TYPE



NOTE: Serious delinquencies include mortgages 90 days or more past due and those in foreclosure.
SOURCE: Mortgage Bankers Association National Delinquency Survey

ABS index performance

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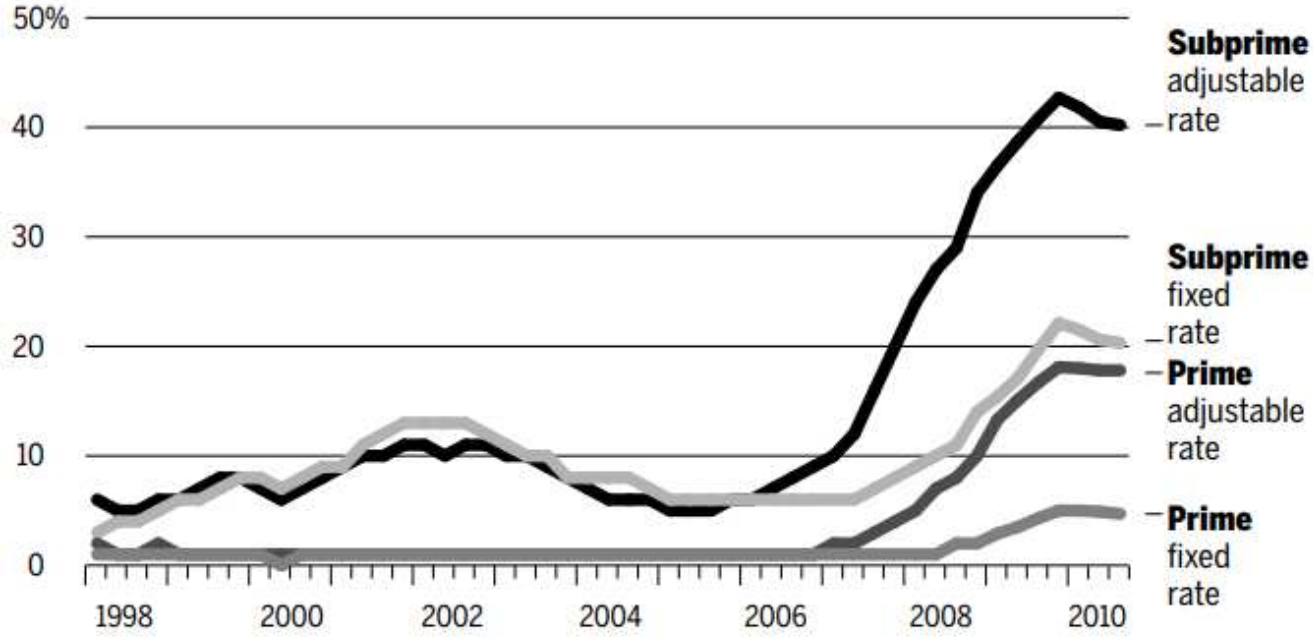

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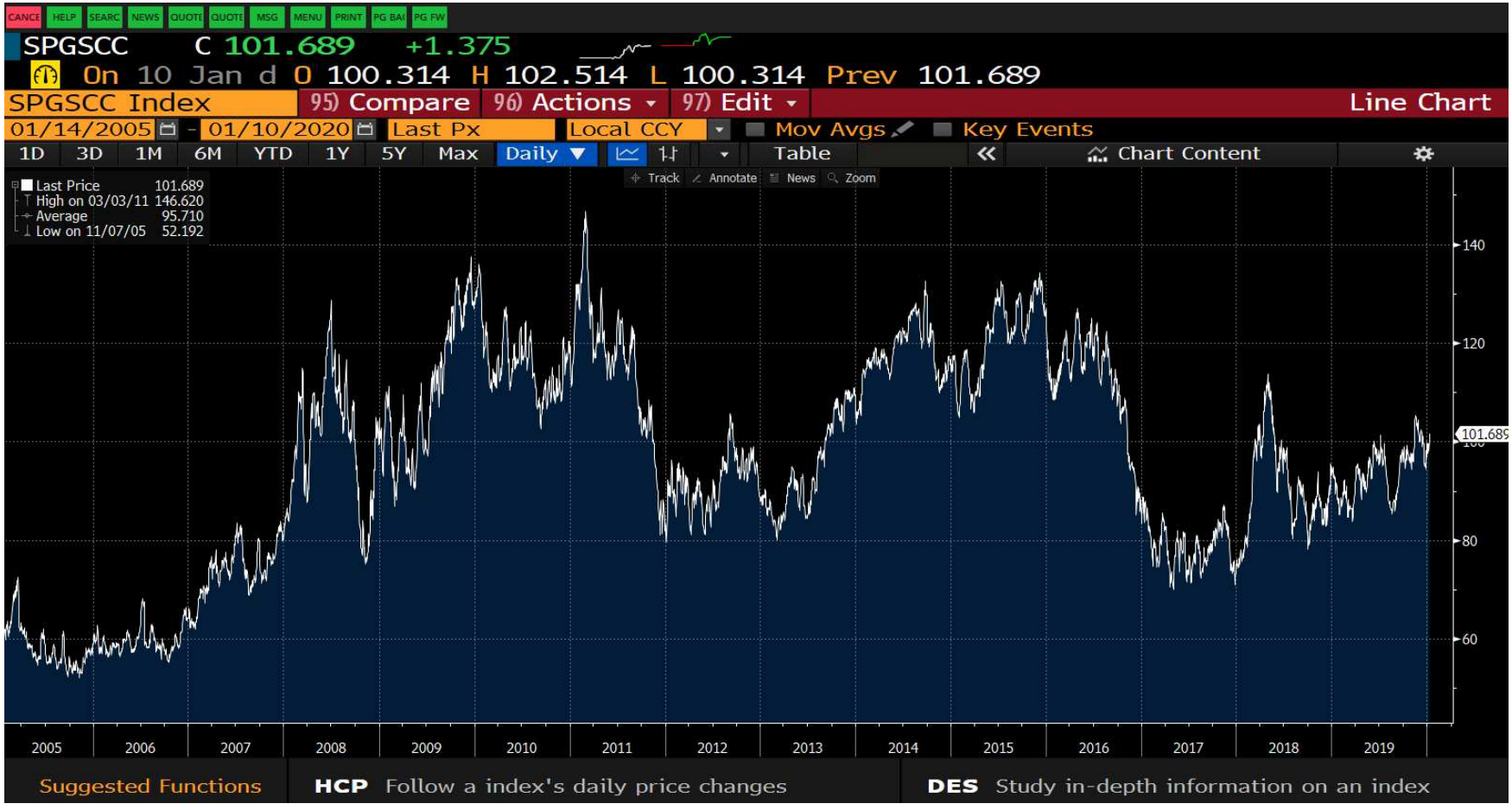
Return

Cocoa spot price



Return

Timeline

Return

- S_t spot.
- $F_{t,T}$ set.
- \$0 exchanged.

- S_T spot.
- $X_T = S_T - F_{t,T}$ to long.
- $-X_T = F_{t,T} - S_T$ to short.