

# Chapter2

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## 1 Chapter 2 (Hull): Futures Market Mechanics

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### 1.1 Futures Market Mechanics

Overview of topics in these notes:

- Clearing houses (FCMs, brokers, etc)
- Margin
  - initial (original)
  - maintenance (variation)
- Cointegration

#### 1.1.1 Clearinghouse:

- Tasked with balancing all futures transactions/money flows
- Read Williams paper on *Origins of Futures Markets*
- Modern futures exchange a prime example of spontaneous order
- **CH:** separate corp. or dept. associated with each exchange
- CH Roles:
  - Matches and reconciles all futures transactions
  - Assures financial integrity of transactions
  - Provides mechanism for delivery
- CH becomes obligor to every futures contract (reduces/manages counterparty risk)
- CH becomes party to and guarantees delivery
- Only members of exchanges can be clearing members (CM)
- CMs deposit large sum of money into a guarantee fund
  - usually must purchase shares of the corp.
  - the guarantee fund is a reserve in case of trader default/bankruptcy
- Exchange members who are not CMs must clear trades through a CM and pay a fee for service
- CMs are large/financially sound companies
- Maintains market stability and promotes a secure public image
- Pit trading vs LOB
- Traders matched through the brokers in pit, or through the LOB
- CH then becomes the counterparty to each futures contract
  - CH is long to the shorts

- CH is short to the longs
- CH has no net position (aside from clerical errors)
  - \* has a so-called *flat book*
- This allows traders to originate and close out positions w/o search for counterparty
- CH transforms forward markets to be impersonal and easy to negotiate
- Traders can hold their positions for long durations while the otherside may turnover very often

### 1.1.2 Margin Accounting

- CH also performs a banking function
- Every trader must have an account w/ an FCM (possibly through an IB)
- For every trade, traders must deposit money called initial (original) margin
  - Serves as a performance bond
  - Both long and short must post margin
  - Usually around 10% of position (depends on trader, and volatility of the asset)
  - Brokers can require additional margin beyond exchange margin levels if necessary
- After initial margin, traders must often post additional deposits to keep a minimum margin level (usually 75% or 80% of initial margin)
  - Varies by contract (volatility)
- Initial (original) and maintenance (variation) margin applies to members of the clearing corp., who in turn apply it to FCMs, and FCMs duplicate this for their customers (IBs, traders)
  - FCMs only need to post on their net positions
  - FCMs can deposit excess margin in interest bearing securities (a non-trivial source of income)
- Margin accounting has the following functions:
  - guarantee performance on futures contracts
  - allows source of funds for daily settlement
  - provides the financial integrity of the system

### 1.1.3 Marking-to-Market

- **Settlement price:** final price at the closing bell each day
  - Each delivery month of each contract has a daily settlement price
  - If a trader's position lost money for that day's trading session (depreciated in value) the CH debits the trader's account that day
  - If the trader's position appreciates the CH credits the trader's account that day
  - Also called *collects* and *pays*
  - This process is called *marking-to-market*

**Q:** What economic (risk management) role does it play?

**Example:** two traders in Corn futures

- Long/Short 5000 bushel contract at \$2.75 per bushel
- Initial margin: \$2000

**Flow of Money Between Accounts** Day

Settlement Price

Trader A (Long)Cumulative Profits

Trader A (Long)Equity in Account

Trader B (Short)Cumulative Profits

Trader B (Short)Equity in Account

1

\$2.75

0

\$2,000

0

\$2,000

2

\$2.77

+100

\$2,100

-100

\$1,900

3

\$2.78

+150

\$2,150

-150

\$1,850

4

\$2.71

-200

\$1,800

+200

\$2,200

Let's see some numbers in Python!

```
[1]: import numpy as np
```

```
contractSize = 5000                                # bushels
prc = np.array([2.75, 2.77, 2.78, 2.71]) # dollars per bushel
```

```
[2]: prc
```

```
[2]: array([2.75, 2.77, 2.78, 2.71])
```

```
[3]: prcDiff = np.diff(prc)
prcDiff
```

```
[3]: array([ 0.02,  0.01, -0.07])
```

```
[4]: cashFlows = prcDiff * contractSize
```

```
[5]: np.cumsum(cashFlows)
```

```
[5]: array([ 100.,  150., -200.])
```

Let's see a longer/more complete simulation!

```
[6]: class MarginAccount(object):
    def __init__(self, spot_price, init_margin, var_margin, num_contracts,
        units):
        self.__ref_price = spot_price
        self.__init_margin = init_margin
        self.__var_margin = var_margin
        self.__num_contracts = num_contracts
        self.__units = units
        self.__equity = init_margin
        self.__capital = init_margin
        self.__profit = 0.0
        self.__cum_profit = 0.0
        self.__margin_call = 0.0

    def show(self):
        print("Settlement Price: \t{0:.2f}".format(self.__ref_price))
        print("Profit: \t\t{0:.2f}".format(self.__profit))
        print("Cumulative Profit: \t{0:.2f}".format(self.__cum_profit))
        print("Capital: \t\t{0:.2f}".format(self.__capital))
        print("Equity: \t\t{0:.2f}".format(self.__equity))
        print("Margin Call: \t\t{0:.2f}".format(self.__margin_call))
        print("\n")

    def update(self, spot_price):
        self.__profit = (spot_price - self.__ref_price) * (self.__num_contracts
        * self.__units)
        self.__cum_profit += self.__profit
```

```

        self.__equity = self.__capital + self.__cum_profit

        if self.__equity <= self.__var_margin:
            self.__margin_call = self.__init_margin - self.__equity
        else:
            self.__margin_call = 0.0

        self.__capital += self.__margin_call
        self.__ref_price = spot_price

## Main function

spot0 = 2.75
spot_t = [2.76, 2.73, 2.68, 2.67, 2.69, 2.64, 2.62, 2.63, 2.67]
units = 5000
num_contracts = 1
init_margin = 2000.0
var_margin = 1750.0

acc = MarginAccount(spot0, init_margin, var_margin, num_contracts, units)

for i, spot in enumerate(spot_t):
    acc.update(spot)
    print("Day t={0:d}".format(i+1))
    print("-----")
    acc.show()

```

Day t=1

-----

Settlement Price:	2.76
Profit:	50.00
Cumulative Profit:	50.00
Capital:	2000.00
Equity:	2050.00
Margin Call:	0.00

Day t=2

-----

Settlement Price:	2.73
Profit:	-150.00
Cumulative Profit:	-100.00
Capital:	2000.00
Equity:	1900.00
Margin Call:	0.00

Day t=3

-----

Settlement Price:	2.68
Profit:	-250.00
Cumulative Profit:	-350.00
Capital:	2350.00
Equity:	1650.00
Margin Call:	350.00

Day t=4

-----

Settlement Price:	2.67
Profit:	-50.00
Cumulative Profit:	-400.00
Capital:	2350.00
Equity:	1950.00
Margin Call:	0.00

Day t=5

-----

Settlement Price:	2.69
Profit:	100.00
Cumulative Profit:	-300.00
Capital:	2350.00
Equity:	2050.00
Margin Call:	0.00

Day t=6

-----

Settlement Price:	2.64
Profit:	-250.00
Cumulative Profit:	-550.00
Capital:	2350.00
Equity:	1800.00
Margin Call:	0.00

Day t=7

-----

Settlement Price:	2.62
Profit:	-100.00
Cumulative Profit:	-650.00
Capital:	2650.00
Equity:	1700.00

Margin Call: 300.00

Day t=8

-----

Settlement Price:	2.63
Profit:	50.00
Cumulative Profit:	-600.00
Capital:	2650.00
Equity:	2050.00
Margin Call:	0.00

Day t=9

-----

Settlement Price:	2.67
Profit:	200.00
Cumulative Profit:	-400.00
Capital:	2650.00
Equity:	2250.00
Margin Call:	0.00

**Margin Calls** When trader's equity in margin account falls below maintenance level, she receives a margin call from her broker/FCM

### Margin Call and Capital Withdrawal

- 5000 bushel corn contract (long) at \$2.75 per bushel
- Maintenance margin level is \$1,750
- See the actual contract specs: [CME Corn Contract Specifications](#)

Day

Settlement Price

Cumulative Profits

Capital

Equity in Account

1

\$2.75

\$0

\$2,000

\$2,000

2

2.76  
 +50  
 2,000  
 2,050  
 3  
 2.73  
 -150  
 2,000  
 1,900  
 4  
 2.68  
 -350  
 2,000  
 1,650  
 Margin Call of \$350  
 -350  
 2,350  
 2,000

### **Example of Capital Withdrawal**

Day  
 Settlement Price  
 Cumulative Profits  
 Capital  
 Equity in Account  
 1  
 2.75  
 0  
 2,000  
 2,000  
 2  
 2.85  
 +500



2,000

2,500

Capital withdrawal of \$500

+500

1,500

2,000

[ ]: