Introduction to Commodities & Commodity Derivatives
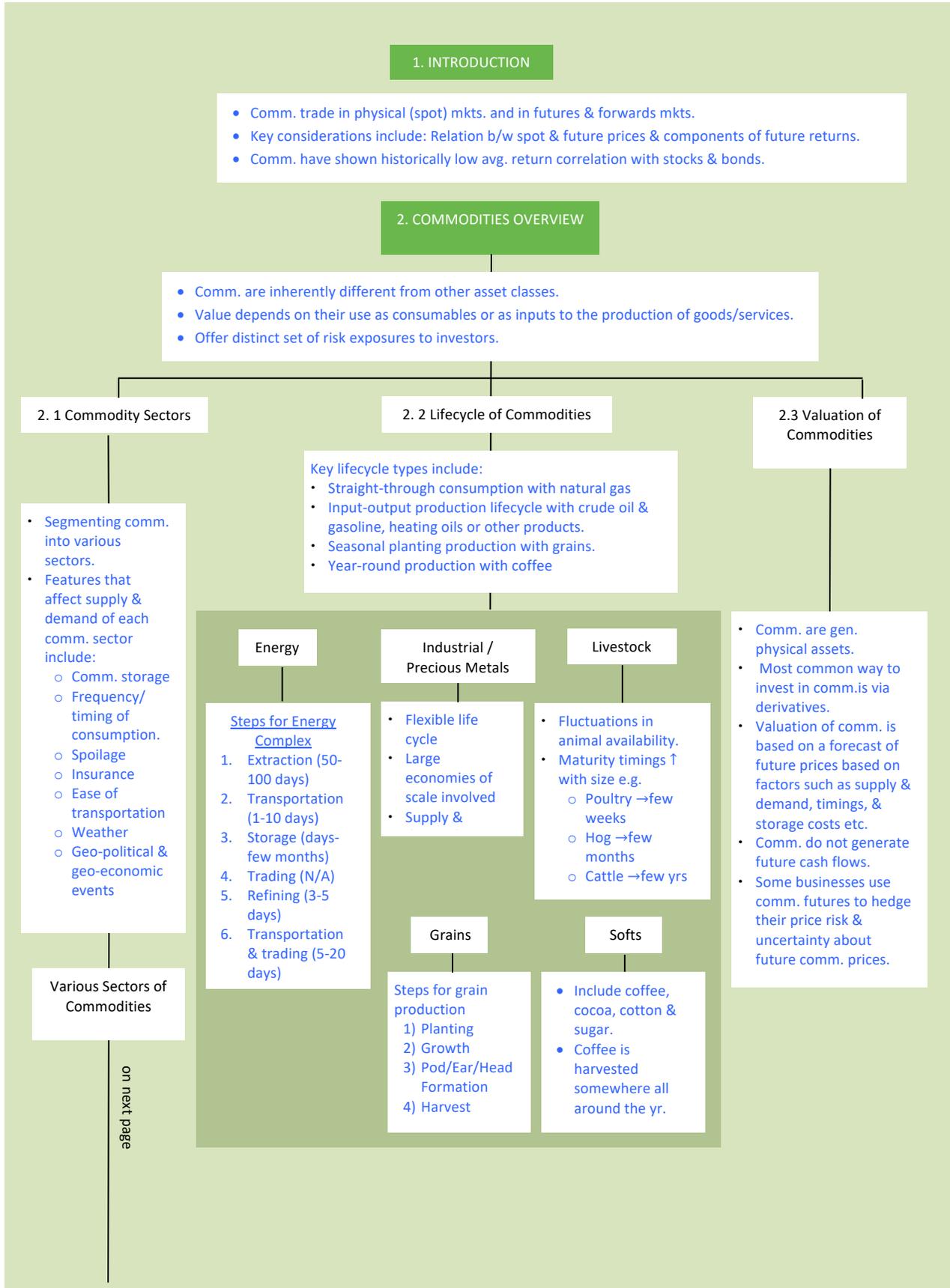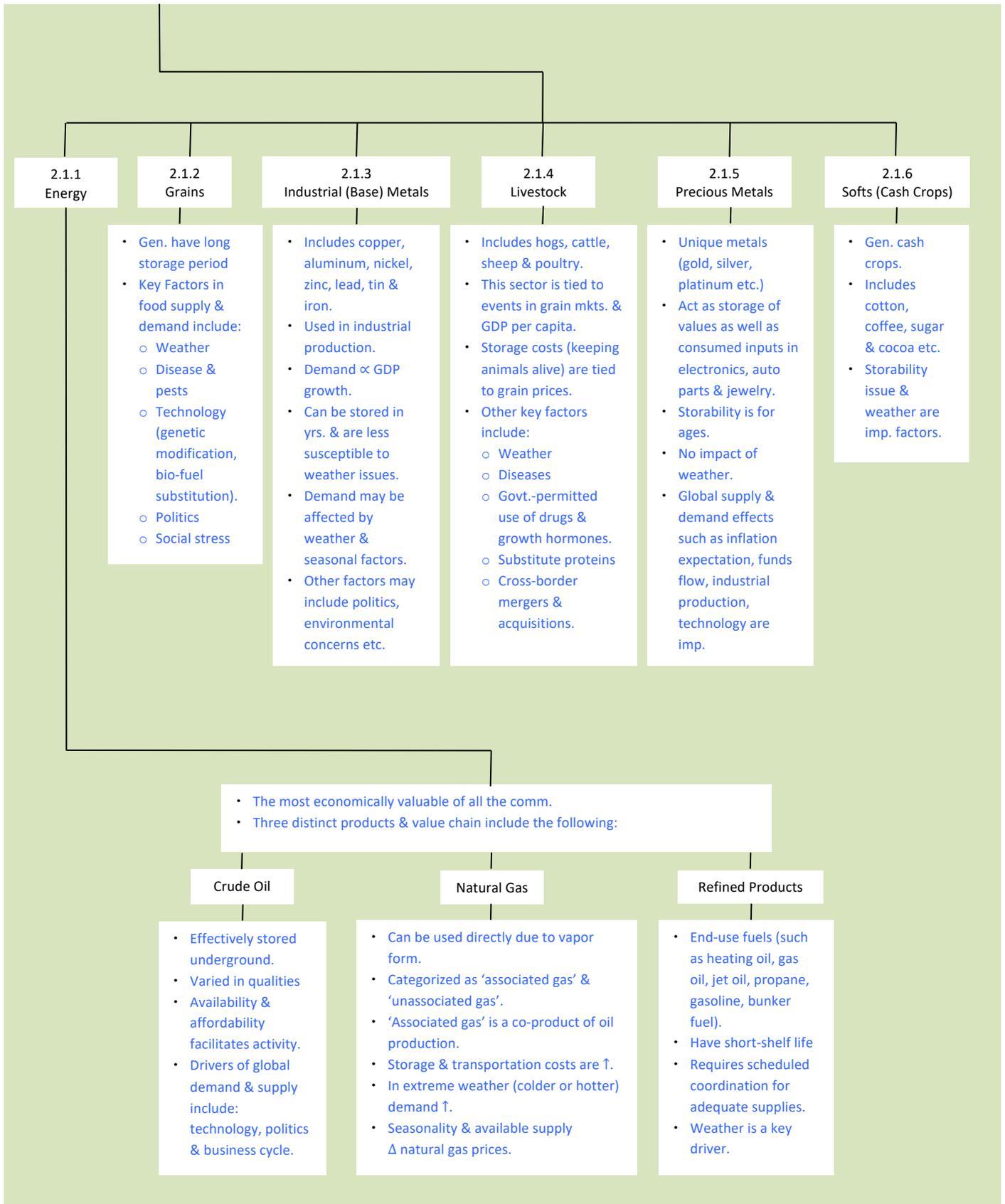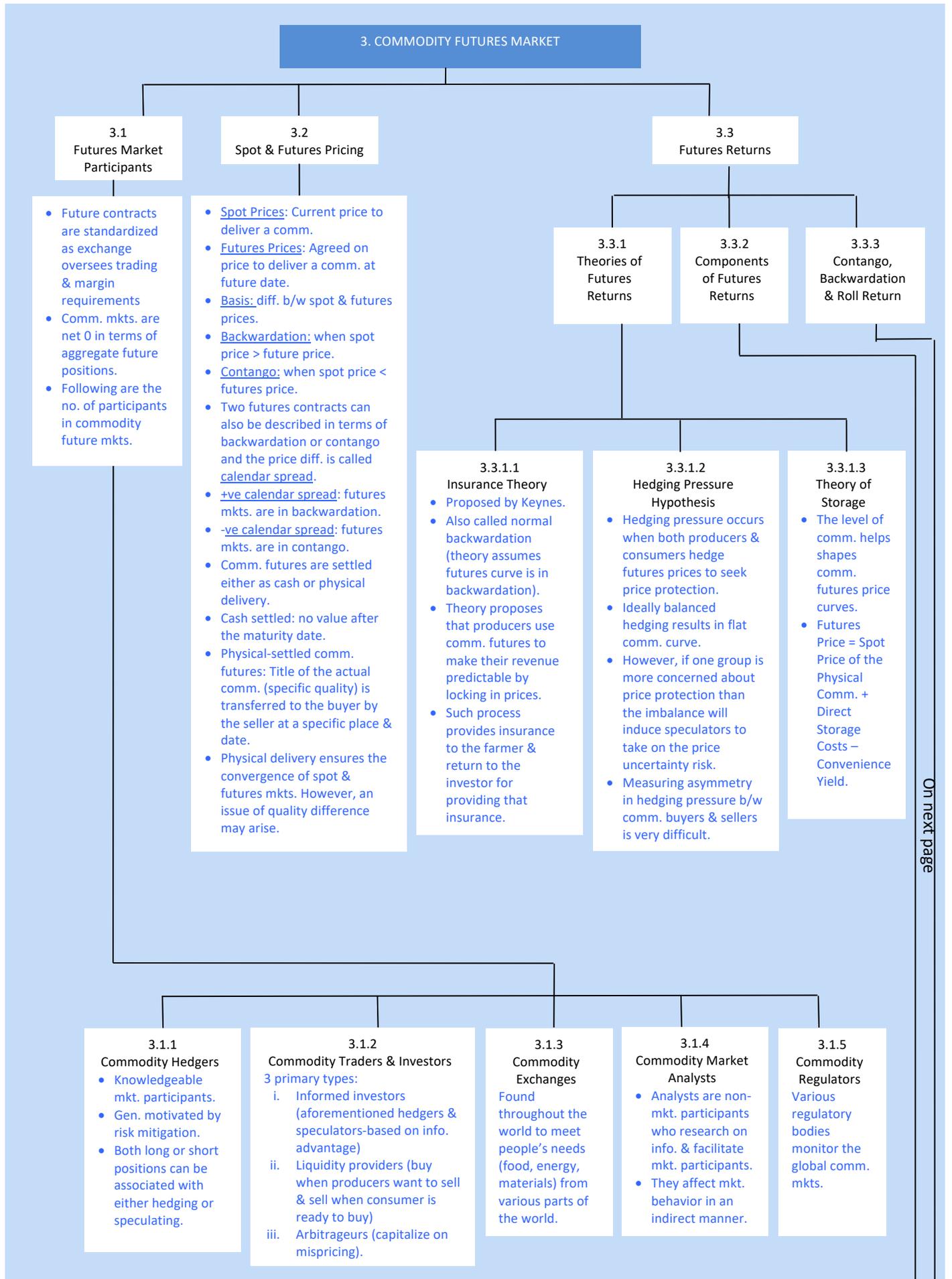
Mkt. = Market
Gen. = Generally
Imp. = important
Comm. = commodities
Pmts. = payments

1. INTRODUCTION

- Comm. trade in physical (spot) mkts. and in futures & forwards mkts.
- Key considerations include: Relation b/w spot & future prices & components of future returns.
- Comm. have shown historically low avg. return correlation with stocks & bonds.

2. COMMODITIES OVERVIEW

- Comm. are inherently different from other asset classes.
- Value depends on their use as consumables or as inputs to the production of goods/services.
- Offer distinct set of risk exposures to investors.

2. 1 Commodity Sectors

- Segmenting comm. into various sectors.
- Features that affect supply & demand of each comm. sector include:
  o Comm. storage
  o Frequency/ timing of consumption.
  o Spoilage
  o Insurance
  o Ease of transportation
  o Weather
  o Geo-political & geo-economic events

Various Sectors of Commodities

on next page

2. 2 Lifecycle of Commodities

Key lifecycle types include:
- Straight-through consumption with natural gas
- Input-output production lifecycle with crude oil & gasoline, heating oils or other products.
- Seasonal planting production with grains.
- Year-round production with coffee

Energy

Steps for Energy Complex
1. Extraction (50-100 days)
2. Transportation (1-10 days)
3. Storage (days- few months)
4. Trading (N/A)
5. Refining (3-5 days)
6. Transportation & trading (5-20 days)

Industrial / Precious Metals

- Flexible life cycle
- Large economies of scale involved
- Supply &

Livestock

- Fluctuations in animal availability.
- Maturity timings ↑ with size e.g.
  o Poultry →few weeks
  o Hog →few months
  o Cattle →few yrs

Grains

Steps for grain production
1) Planting
2) Growth
3) Pod/Ear/Head Formation
4) Harvest

Softs

- Include coffee, cocoa, cotton & sugar.
- Coffee is harvested somewhere all around the yr.

2.3 Valuation of Commodities

- Comm. are gen. physical assets.
- Most common way to invest in comm.is via derivatives.
- Valuation of comm. is based on a forecast of future prices based on factors such as supply & demand, timings, & storage costs etc.
- Comm. do not generate future cash flows.
- Some businesses use comm. futures to hedge their price risk & uncertainty about future comm. prices.

2.1.1 Energy

2.1.2 Grains

- Gen. have long storage period
- Key Factors in food supply & demand include:
  - Weather
  - Disease & pests
  - Technology (genetic modification, bio-fuel substitution).
  - Politics
  - Social stress

2.1.3 Industrial (Base) Metals

- Includes copper, aluminum, nickel, zinc, lead, tin & iron.
- Used in industrial production.
- Demand ∝ GDP growth.
- Can be stored in yrs. & are less susceptible to weather issues.
- Demand may be affected by weather & seasonal factors.
- Other factors may include politics, environmental concerns etc.

2.1.4 Livestock

- Includes hogs, cattle, sheep & poultry.
- This sector is tied to events in grain mkts. & GDP per capita.
- Storage costs (keeping animals alive) are tied to grain prices.
- Other key factors include:
  - Weather
  - Diseases
  - Govt.-permitted use of drugs & growth hormones.
  - Substitute proteins
  - Cross-border mergers & acquisitions.

2.1.5 Precious Metals

- Unique metals (gold, silver, platinum etc.)
- Act as storage of values as well as consumed inputs in electronics, auto parts & jewelry.
- Storability is for ages.
- No impact of weather.
- Global supply & demand effects such as inflation expectation, funds flow, industrial production, technology are imp.

2.1.6 Softs (Cash Crops)

- Gen. cash crops.
- Includes cotton, coffee, sugar & cocoa etc.
- Storability issue & weather are imp. factors.

- The most economically valuable of all the comm.
- Three distinct products & value chain include the following:

Crude Oil

- Effectively stored underground.
- Varied in qualities
- Availability & affordability facilitates activity.
- Drivers of global demand & supply include: technology, politics & business cycle.

Natural Gas

- Can be used directly due to vapor form.
- Categorized as 'associated gas' & 'unassociated gas'.
- 'Associated gas' is a co-product of oil production.
- Storage & transportation costs are ↑.
- In extreme weather (colder or hotter) demand ↑.
- Seasonality & available supply Δ natural gas prices.

Refined Products

- End-use fuels (such as heating oil, gas oil, jet oil, propane, gasoline, bunker fuel).
- Have short-shelf life
- Requires scheduled coordination for adequate supplies.
- Weather is a key driver.

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3. COMMODITY FUTURES MARKET

3.1 Futures Market Participants

- Future contracts are standardized as exchange oversees trading & margin requirements
- Comm. mkts. are net 0 in terms of aggregate future positions.
- Following are the no. of participants in commodity future mkts.

3.2 Spot & Futures Pricing

- Spot Prices: Current price to deliver a comm.
- Futures Prices: Agreed on price to deliver a comm. at future date.
- Basis: diff. b/w spot & futures prices.
- Backwardation: when spot price > future price.
- Contango: when spot price < futures price.
- Two futures contracts can also be described in terms of backwardation or contango and the price diff. is called calendar spread.
- +ve calendar spread: futures mkts. are in backwardation.
- -ve calendar spread: futures mkts. are in contango.
- Comm. futures are settled either as cash or physical delivery.
- Cash settled: no value after the maturity date.
- Physical-settled comm. futures: Title of the actual comm. (specific quality) is transferred to the buyer by the seller at a specific place & date.
- Physical delivery ensures the convergence of spot & futures mkts. However, an issue of quality difference may arise.

3.3 Futures Returns

3.3.1 Theories of Futures Returns

3.3.2 Components of Futures Returns

3.3.3 Contango, Backwardation & Roll Return

3.3.1.1 Insurance Theory
- Proposed by Keynes.
- Also called normal backwardation (theory assumes futures curve is in backwardation).
- Theory proposes that producers use comm. futures to make their revenue predictable by locking in prices.
- Such process provides insurance to the farmer & return to the investor for providing that insurance.

3.3.1.2 Hedging Pressure Hypothesis
- Hedging pressure occurs when both producers & consumers hedge futures prices to seek price protection.
- Ideally balanced hedging results in flat comm. curve.
- However, if one group is more concerned about price protection than the imbalance will induce speculators to take on the price uncertainty risk.
- Measuring asymmetry in hedging pressure b/w comm. buyers & sellers is very difficult.

3.3.1.3 Theory of Storage
- The level of comm. helps shapes comm. futures price curves.
- Futures Price = Spot Price of the Physical Comm. + Direct Storage Costs – Convenience Yield.

3.1.1 Commodity Hedgers
- Knowledgeable mkt. participants.
- Gen. motivated by risk mitigation.
- Both long or short positions can be associated with either hedging or speculating.

3.1.2 Commodity Traders & Investors
3 primary types:
i. Informed investors (aforementioned hedgers & speculators-based on info. advantage)
ii. Liquidity providers (buy when producers want to sell & sell when consumer is ready to buy)
iii. Arbitrageurs (capitalize on mispricing).

3.1.3 Commodity Exchanges
Found throughout the world to meet people's needs (food, energy, materials) from various parts of the world.

3.1.4 Commodity Market Analysts
- Analysts are non-mkt. participants who research on info. & facilitate mkt. participants.
- They affect mkt. behavior in an indirect manner.

3.1.5 Commodity Regulators
Various regulatory bodies monitor the global comm. mkts.

3.3.2
Components of Futures Returns

3 components of total return
  i.   Price return
  ii.   Roll Return
  iii. Collateral Return

- Price Return = $\frac{(\text{current price} - \text{previous price})}{\text{Previous price}}$
- Roll Return = [(Near-term futures contract closing price – Farther-term futures contract closing price)/Near-term futures contract closing price] × % of the position in the futures contract being rolled.
- Roll return is sector dependent.
- Collateral Return is the yield (e.g. interest rate) for bonds or cash sued to maintain investor's future position.
- On indexed investments cash is equal to the notional value of futures and total return also includes rebalance return (return from rebalancing the component weights of the index) in addition to above three returns.

3.3.3
Contango, Backwardation & the Roll Return

- Contango & backwardation and the resulting roll return reflect underlying supply and demand expectations and are accounting mechanism for commodity term structure.
- Industrial metals, agriculture, livestock, precious metals & softs has statistically strong –ve mean roll returns e.g. gold's perpetual storage as an alternative to currency.
- Only Energy have statistical possibility of +ve mean roll return as energy is consumed in real time basis.

4. COMMODITY SWAPS

- A legal contract involving exchange of pmts over multiple periods of specified reference price/index of comm.

- Provides risk management, risk transfer and degree of customization.
- Many types of swaps available because they are not standardized e.g.
  o Excess return swap-pmts. are made or received by either party based on a return calculated by Δ in the level of index relative to the benchmark or fixed level.
  o Total return swap-one party receives pmt. based on the Δ in the level of the index multiplied by the notional amount of the swap.
  o Basis swap-periodic-pmts. are exchanged based on the values of two related comm. reference prices that are not perfectly related.
  o Variance swaps-two parties agree to periodically exchange pmts. based on the proportional diff. b/w agreed or proposed variance in the comm. price levels & some fixed variance amount established at the outset of the contract.
  o Volatility commodity swaps-very similar to variance swaps with the exception that the direction & amount of pmts. are determined relative to the observed vs. expected volatility for a reference price comm.

Swap Market Participant Structure
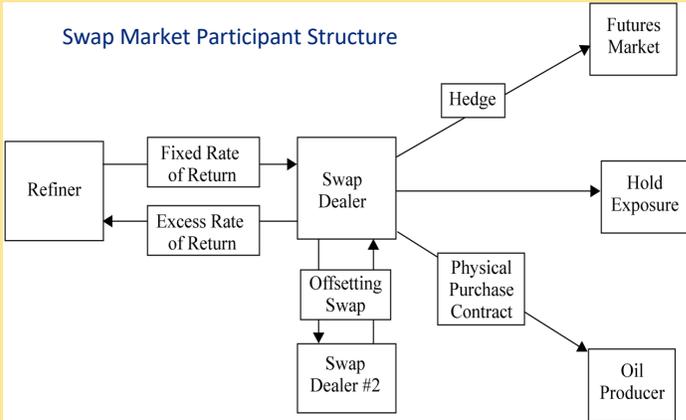
Reference: CFA Institute Level II Volume 6, Reading 37, Exhibit 15.
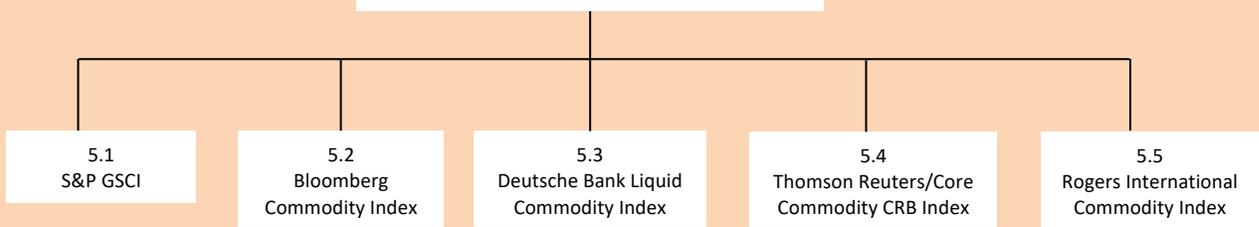
5. COMMODITY INDEXES

Three primary roles in comm. investments:
  i.   As a benchmark to evaluate broader moves in comm. pricing.
  ii.   As an indicator to examine relation b/w comm. prices & other macroeconomic variables.
  iii. Act as basis to monitor Δ that can affect contract value.

Key characteristics that differentiate indexes from each other are as follows.
- Breadth of coverage
- Relative weightings assigned and how the weights are determined.
- Rolling methodology (how contracts will roll over).
- Methodology & frequency for rebalancing the weights of the individual comm., sectors & contracts in the index.
- Governance of indexes.

Five Commercially Imp. Commodity Indexes are:

5.1 S&P GSCI	5.2 Bloomberg Commodity Index	5.3 Deutsche Bank Liquid Commodity Index	5.4 Thomson Reuters/Core Commodity CRB Index	5.5 Rogers International Commodity Index

5.6 Re-balancing Frequency

- Rebalancing is imp. if mkt is frequently mean reverting & for indexes that rebalance more frequently.
- In a trending mkt. frequent rebalancing can lead to underperformance.

5.7 Commodity Index Summary

- There is no dominant index on a particular methodology.
- Comm. indexes (like equity indexes) act in parallel even when when their returns frequently differ dramatically over time.