



A Primer on Algorithmic and High-Frequency Trading

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Algorithmic Solutions – The Context

- Increasing Electronic Trading and post-crisis Regulatory pressure on “transparency” => changes in the microstructure of FI / FX markets towards an “Equities-like” structure => facilitating and highlighting the need for Algorithmic Strategies
- Increasing sophistication of Clients’ (Multi-Asset and High-Frequency) Trading Strategies => increased demand for Algorithmic Solutions for => Dynamic Pricing, Hedging and Real-time Risk Management.
- Globalizing (across Regions and Product areas) Algorithmic Development efforts => Synergy, Business Continuity, and Scalability of Quant, Data and IT infrastructure
- Increased demand for Client-Focussed Algorithmic Solutions => Algorithmic Spreading, Client Quality and Interactive Analytics

Overview

- Algorithmic Trading Strategies (ATS!)
 - Definition, Scope and Generic Structure

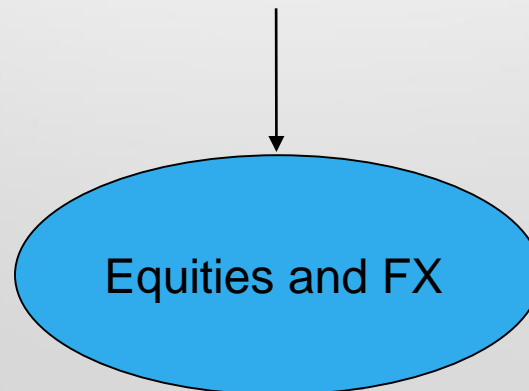
- Algorithmic Trading \leftrightarrow Market Microstructure

Regulatory Driven changes -> forcing the change in market microstructure -> trading and clearing infrastructure

- Client sophistication => demand for algorithmic products
- *Important – Endogenous change in Market Microstructure* because of usage of **Algorithms**
- **Impact on market liquidity**

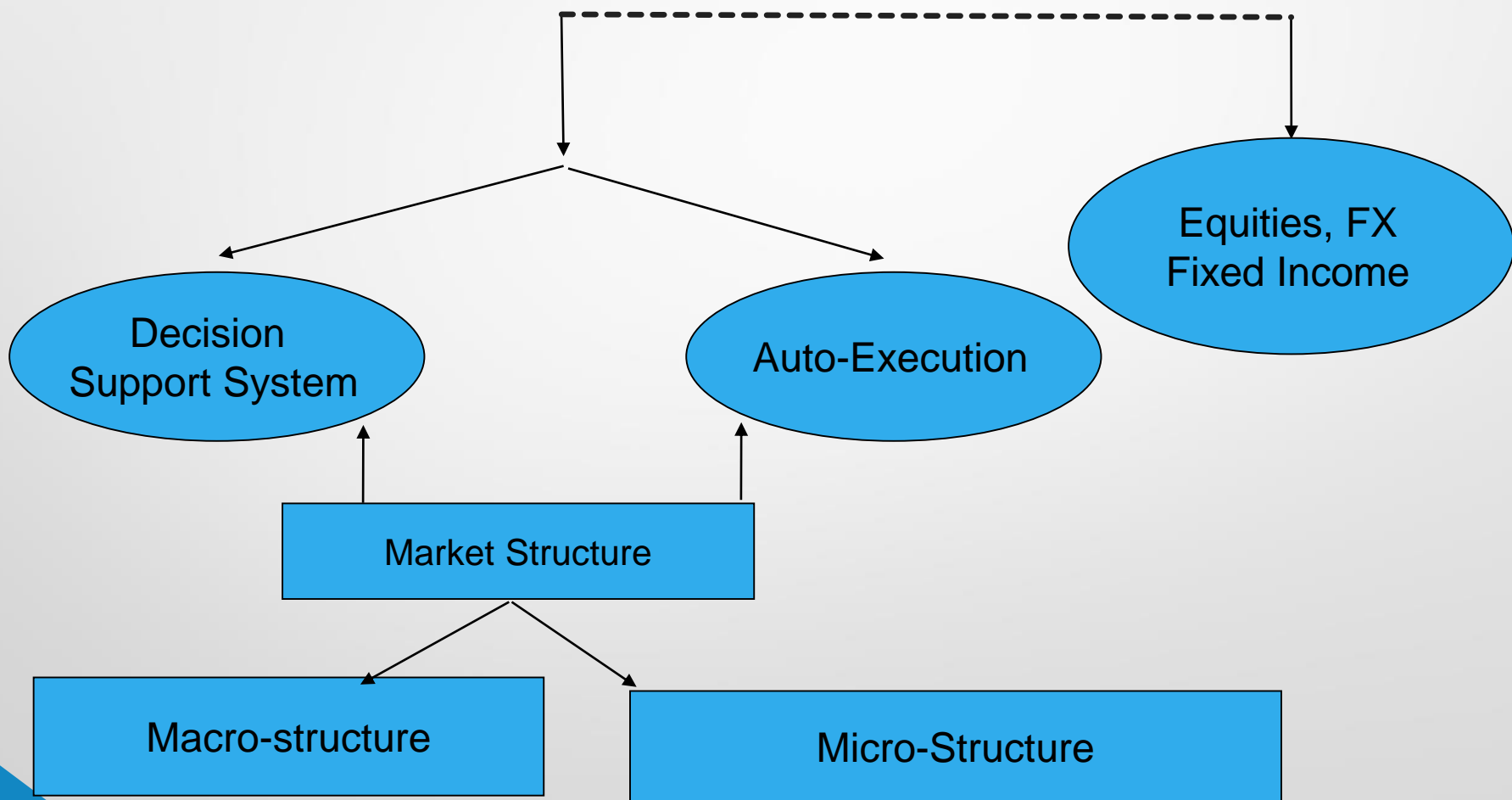
Algorithmic Trading Strategies – Definition

- Algorithmic trading is any type of computer-assisted mathematical / statistical model based trading activity which handles the timing, submission and management of trades and orders.
- Encompasses 'model-based trading', 'program trading', 'auto trading', 'black box trading' and 'high-frequency trading', across single or multiple pools of liquidity.

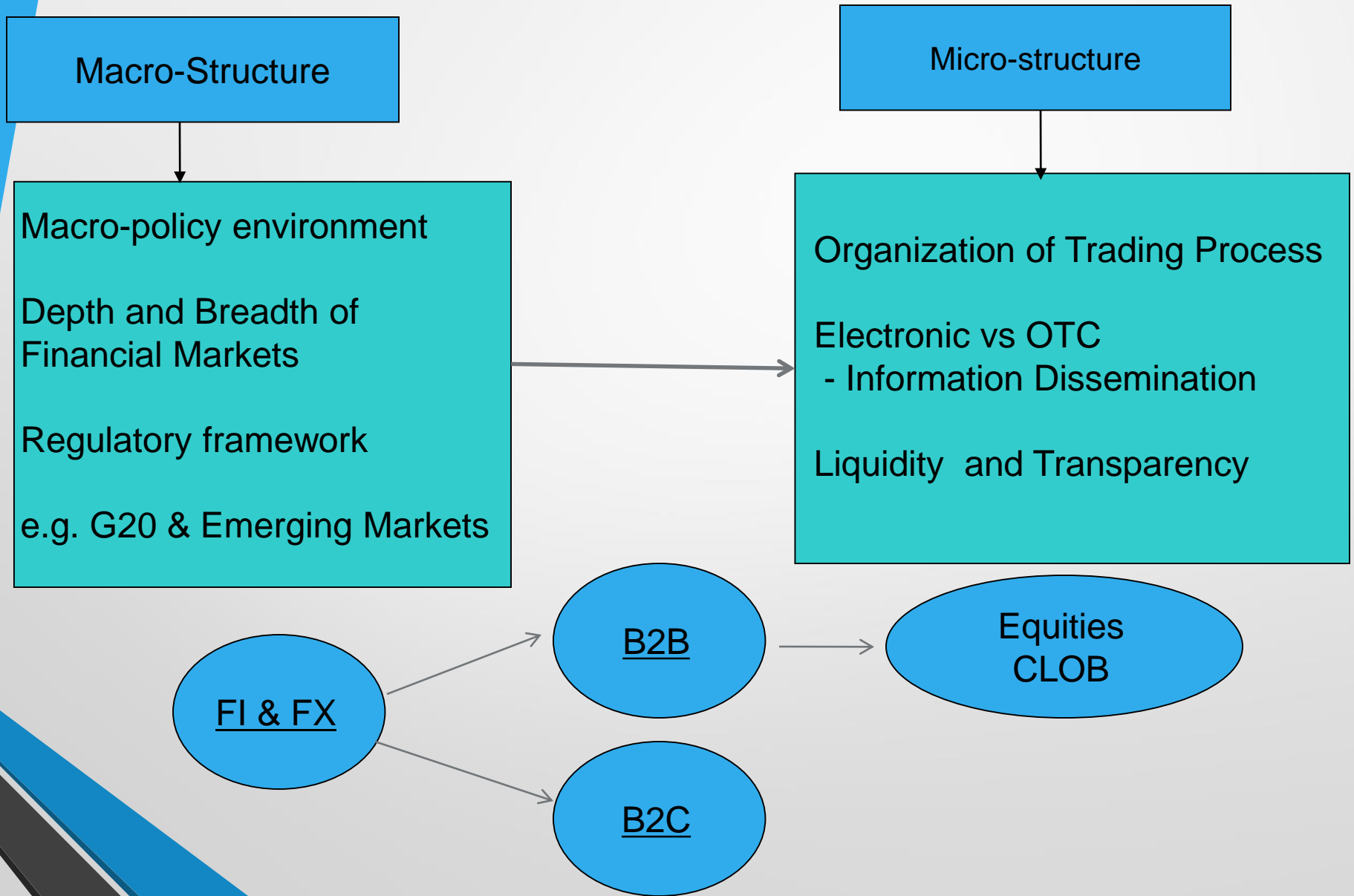


Algorithmic Trading Strategies – Definition (contd..)

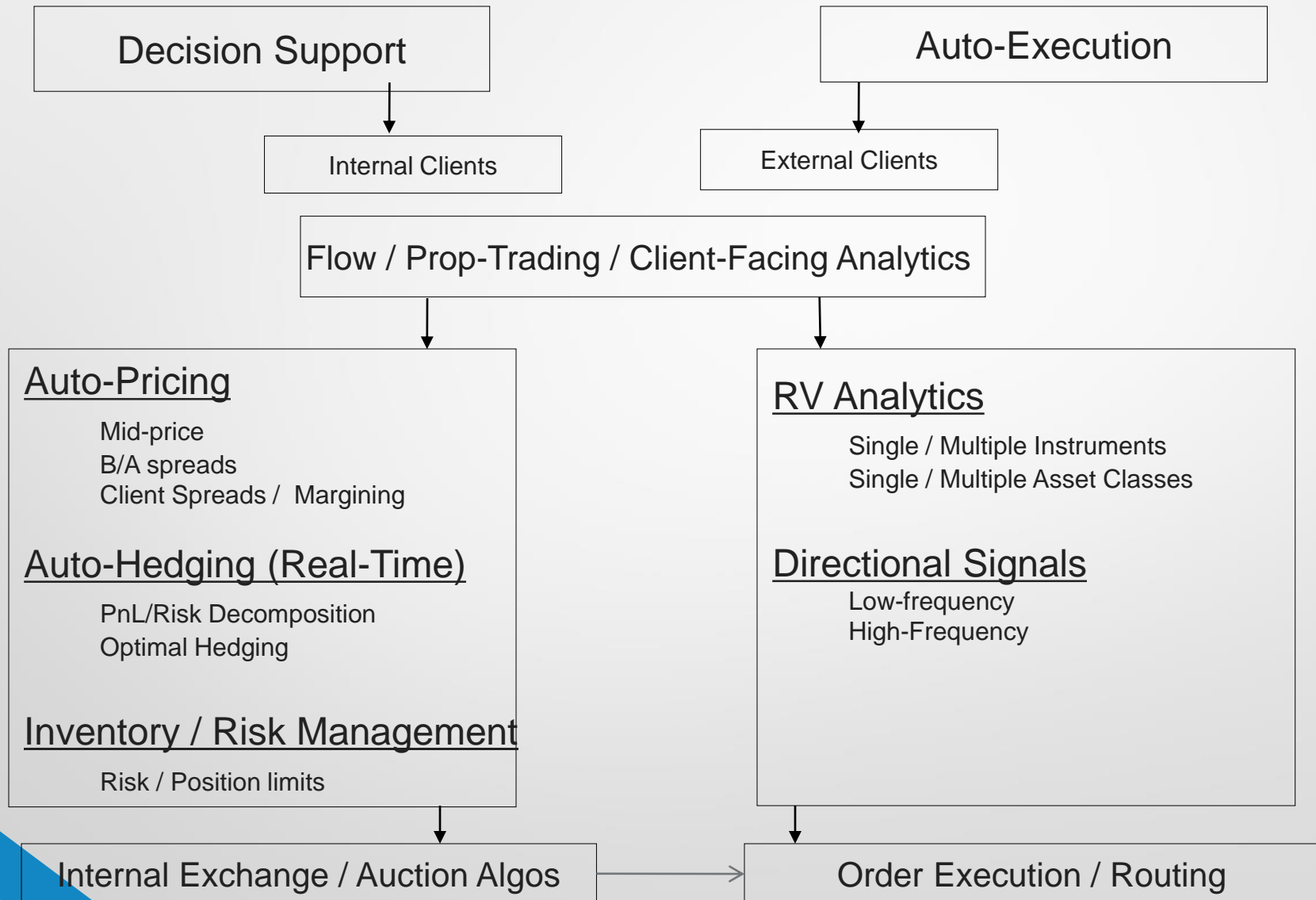
- More generally, Algorithmic Trading could be defined as any automated routine that processes incoming market data and provokes trading activity.



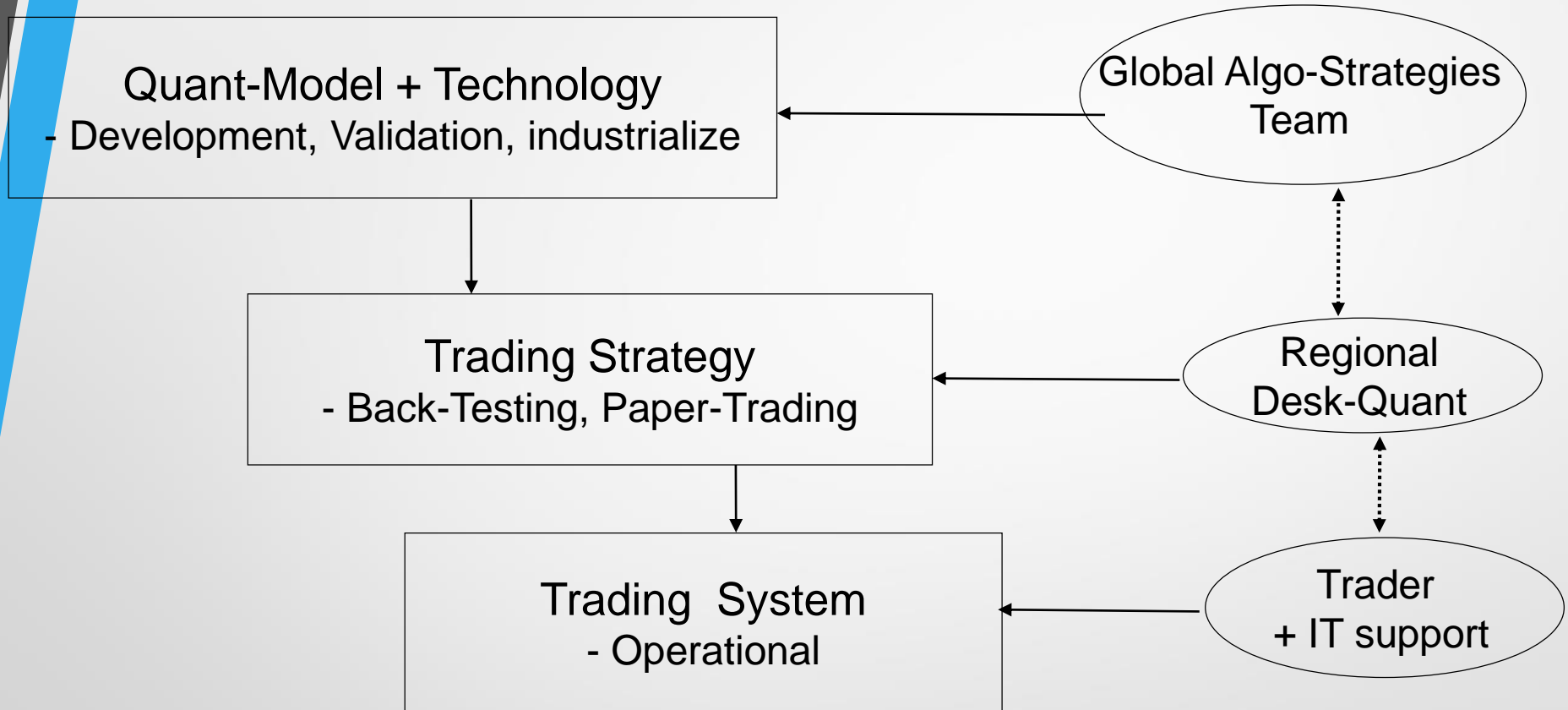
Market Structure and Algorithmic Trading




Algorithmic Strategies – Generic Scope



Generic Structure of ATS





Algorithmic Trading and Market Structure

Algorithmic Trading \leftrightarrow Market Microstructure

- Exogenous Changes in Market Structure => Algorithmic Trading
- Regulatory Driven changes -> forcing the change in market microstructure -> trading and clearing infrastructure
- Client sophistication => demand for algorithmic products
- New Markets – Emerging Market regulations

- Endogenous Changes in Market Structure <= Algorithmic Trading
- ***change in Market Microstructure*** because of usage of Algorithms
- **Impact on Market Liquidity**
- ***Excess Volatility***
- **Micro vs Macro markets**

- Role of Quants in Algorithmic Trading – can “wrong” models aggravate the consequences when used in HF environment - more relevant in macro markets which are relatively more model driven!

Intrinsic characteristics of Equity vs Bond Markets

- The differences in the intrinsic features embodied in equity and government securities markets have an effect on their tradability or on the trading behavior of market participants (market-makers and customers alike).
- The three intrinsic characteristics can be categorized as: the private information embodied in each type of security, the security's finite maturity, and the degree of homogeneity within each class of securities.

Intrinsic Characteristics

Private information

Maturity

Degree of Homogeneity in Hedging

Private Information

Payoff-relevant private information

- Although it is quite natural to assume an asymmetric information-trading environment for equity markets, this is not a natural assumption in the case for Government Bond markets.
- It is unclear to what extent there exists private information about the value of government bonds.
- Prices for Government Bonds are dependent on the term-structure of the underlying risk-free interest rates.
- Interest rates depend on macroeconomic factors about which investors will not have private information.

Government Bonds hold, zero payoff-relevant private information, while equity securities hold some positive amount of private information.

If private information is of little concern for market-makers in Government Bond markets, then what are the factors influencing their bid-ask spreads and in turn their provision of liquidity?

Liquidity in bond markets is closely linked to the market-maker's inventory risk management costs which are, in part, subsequently linked to variations in the market-maker's level of risk aversion and bond price volatility

Maturity

- **Stocks have an infinite maturity while government debt securities have a finite maturity**
 - A finite maturity structure for a security implies that investors have the option of liquidating their position in that security at a *known maturity date*, rather than liquidating their position sometime before that date via the (secondary) market. This implicit option is not available for equity investors who must always liquidate the stock in the market and in turn incur some market trading costs.
- **Differences in Holding Period**
 - The equity investors' holding period is conditional on the stock's expected return at any given time, which is in turn dependent on the stock's price and the agent's private information and expectations at that time
 - A government debt security provides the investor with the outside option of fixing her holding period to a known date. This optionality drives a wedge in the pool of available government security investors thus generating two types of investors:
 - Buy-and-Hold and Trading market participants.
- **The supply of the Government Securities available for trading - *the floating or effective supply* - is less than the total (outstanding) supply, which is not the case for equities**
 - Decreasing floating supply has a detrimental impact on the liquidity of the security both in terms of trading intensity and bid-ask spreads. The smaller number of securities in the hands of trading market participants tends to have a direct negative impact on the trading intensity of the security.

Degree of Homogeneity - Hedging

- One of the intrinsic properties of Government Bond inventories versus Equity inventories is that there is a far greater number of instruments available to hedge the bond inventories.
- For equity market-makers, avenues for hedging their inventory balances in a specific stock are, for all but the most actively traded, much more limited. Often the only inventory risk adjustment available to equity market-makers is to rebalance their inventory.
- The major difference is that equity market-makers cannot in general hedge their inventory by taking an opposite position in a similar stock nor can they find a near perfect hedge using a futures contract. These strategies are not available to equity market-makers because there are no instruments (another stock or a futures contract) which are sufficiently correlated to the stock's price.
- The greater homogeneity among Government Bonds in terms of yield dynamics, implies a greater ease of inventory price hedging for the Government Bond market-makers relative to their counterparts in equity markets.

Market Transparency

- One factor that differentiates multiple dealership GS markets from multiple dealership equity markets is the fact that dealership equity markets (such as the LSE and NASDAQ) are centralized, while multiple dealership GS markets are decentralized.
- The degree of information available to the public (both customer and dealers alike) on a consolidated basis differentiates between decentralized and centralized markets

Centralized Markets and transparency

- NASDAQ operates as an over-the-counter (OTC) market, it is nonetheless linked together electronically such that **price and trade** information can be viewed on a consolidated basis by any investor wishing to transact in this market.
 - Pre-trade information (bid and ask quotes across dealers)
 - Post-trade information (data on completed trades in the market)

Market Transparency

Decentralized markets and transparency

As opposed to single dealer markets, such as the NYSE, market-makers in multiple dealer markets must directly compete for their share of the order flow.

In a multiple dealer environment, market makers can share their inventories with the existing dealers rather than rebalancing their inventories by waiting for the arrival of customer orders.

Facets of decentralized multiple dealer markets (that cannot be adequately captured in specialist based markets).

1. Competition for customer order flow that exists between multiple dealers.
2. The existence of two parallel trading environments: *Dealer to Customer* and *Dealer to Dealer*.
3. The dealers have the choice of either trading bilaterally with each other or trading indirectly with each other anonymously via an inter-dealer broker (IDB) system, which resembles the auction agency trading structure found in many order driven exchanges.

Market-makers are much more likely to be the “informed agent” in Government Security dealership markets than their counterparts in equity dealership markets.

Order flow dynamics

Inter-dealer trading facilitates the dealer's inventory risk management process, allowing them to take on large inventory positions that they would otherwise be unwilling to take if they could only rebalance positions through the arrival of offsetting public orders.

- Specifically, dealers are more likely to engage in inter-dealer trading when their inventories are high or when they hold extreme, relative inventories.
- When customer to dealer trading intensity is low, risk averse dealers are not likely to witness a rebalancing order from the public sphere and will thus tend to rebalance in the inter-dealer market.

Use of inter dealer trading services is more in Government securities markets relative to other markets

- Market-makers receive orders that are, relative to their desired (risk adjusted) inventory level, on average larger as well as less frequent than their counterparts in the equity

Institutional investors form the majority of the customer base in Government Securities market while this is much less the case in equity dealership markets in which individual investors participate actively.



Thank You