

optiverΔ



# ALGORITHMIC TRADING INTRODUCTION



# WHAT THIS TALK IS ABOUT

## PART 1

Basics of financial markets and algorithmic trading

## PART 2

Discuss the challenge

## PART 3

Demo Optibook (our virtual exchange)



# PART 1: MARKETS & ALGORITHMIC TRADING

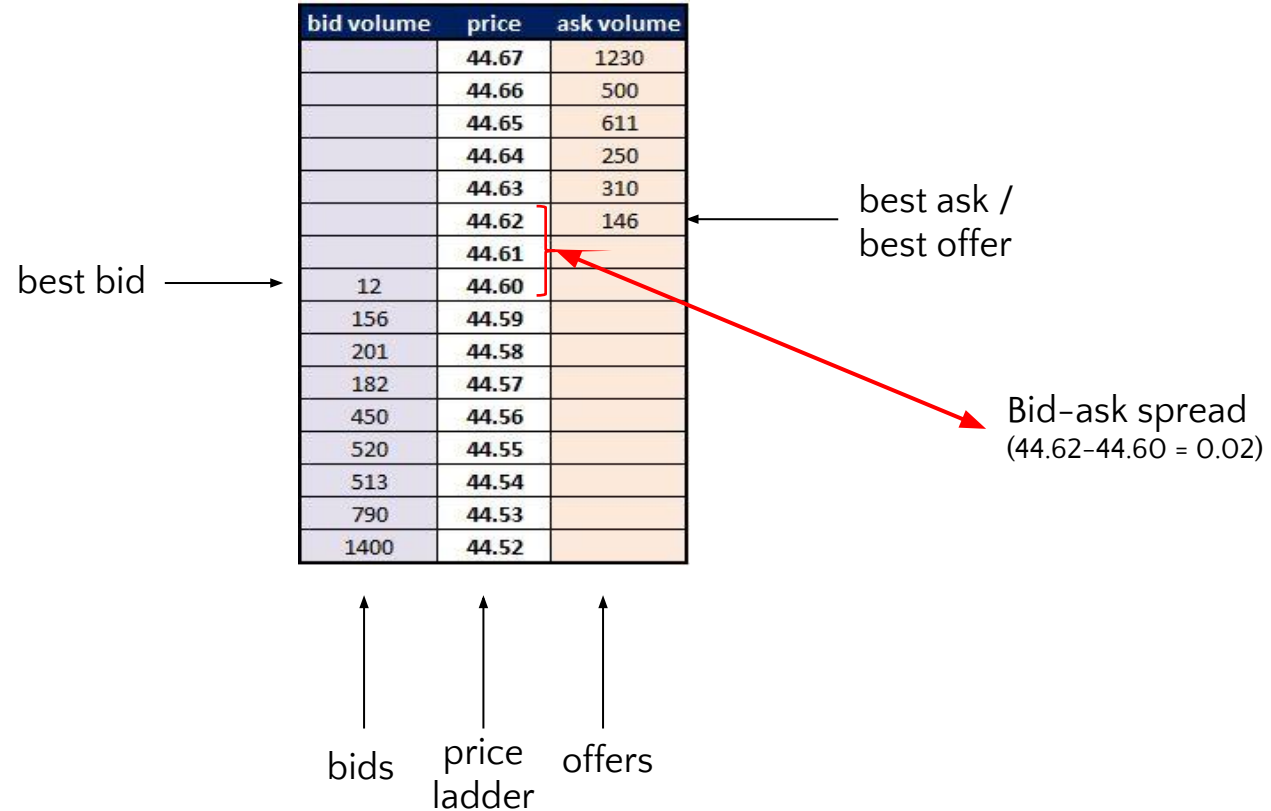
# FINANCIAL INSTRUMENTS

Any object that is traded on an exchange, e.g.:

- a stock
- a future
- an option
- an ETF
- a bond
- more...

Today we are only trading stocks.

# ORDER BOOKS



# LIQUIDITY

liquid

bid volume	price	ask volume
	<b>44.67</b>	8539
	<b>44.66</b>	10551
	<b>44.65</b>	3677
	<b>44.64</b>	6800
	<b>44.63</b>	9061
	<b>44.62</b>	6693
	<b>44.61</b>	6573
2049	<b>44.60</b>	
5176	<b>44.59</b>	
1080	<b>44.58</b>	
5000	<b>44.57</b>	
16776	<b>44.56</b>	
2000	<b>44.55</b>	
15349	<b>44.54</b>	
7800	<b>44.53</b>	
11327	<b>44.52</b>	

illiquid

bid volume	price	ask volume
	<b>44.67</b>	745
	<b>44.66</b>	496
	<b>44.65</b>	
	<b>44.64</b>	400
	<b>44.63</b>	14
	<b>44.62</b>	
	<b>44.61</b>	
	<b>44.60</b>	
	<b>44.59</b>	
	<b>44.58</b>	
	<b>44.57</b>	
	<b>44.56</b>	
202	<b>44.55</b>	
	<b>44.54</b>	
421	<b>44.53</b>	
846	<b>44.52</b>	

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- Volume
- Bid-ask spread

illiquid

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# MARKET MAKING

## PRIMARY ROLE

Provide Liquidity

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## HOW?

- Quote best bid and best ask
- Capture spread as profit

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quote here →	2049	44.60	← quote here
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	2000	44.55	
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→ Bid-ask spread becomes profit for a market-maker

# ORDER TYPES

Define how your order is executed on exchanges



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## OPTIBOOK ORDER TYPES

- Limit Order
- Immediate or Cancel

## ORDER TYPES ON EXCHANGES

- Market Order
- Quote
- Fill or Kill
- Stop (Limit) Order
- Iceberg Order

# ORDER TYPES

Sending a buy order for 20 lots:

- Limit order ("passive")
- Immediate or cancel, or IOC order ("active")

Limit order @ 151

bid #	price	ask #
	155	54
	154	60
	153	53
	152	37
2	151	
	150	
1	149	
13	148	
24	147	
47	146	
64	145	
56	144	

Start situation

bid #	price	ask #
	155	54
	154	60
	153	53
	152	37
	151	15
	150	3
1	149	
13	148	
24	147	
47	146	
64	145	
56	144	

IOC order @ 151

bid #	price	ask #
	155	54
	154	60
	153	53
	152	37
	151	
	150	
1	149	
13	148	
24	147	
47	146	
64	145	
56	144	

## PART 2: THE CHALLENGE

# EMERGING MARKETS PROBLEM

A stock pair in different countries:

One stock is trading on two different exchanges, in two different countries (i.e. in two different order books). The stock in one country is already well established and liquid. The stock in the other country is new, and not very liquid.

Since both order books in both countries concern the same stock, the value of the stocks should be the same. A difference in their price triggers a trading opportunity. Note: All stocks are traded in the same currency.



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Stock ABC on exchange 1		
bid volume	price	ask volume
	44.63	1000
	44.62	1000
	44.61	1000
1000	44.60	
1000	44.59	
1000	44.58	

Stock ABC on exchange 2		
bid volume	price	ask volume
	44.63	200
100	44.62	
300	44.61	
500	44.60	
600	44.59	
700	44.58	



# HEDGING

Your trading strategy should reduce market risk as much as possible. In order to do that you must hedge your trades.

Hedging is nothing more than making sure that you are not exposed to risks that you don't want to be exposed to.

In this case, you don't want to run the risks of the individual stock prices changing. Suppose our position is as follows:

Google\_US: +5

Google\_EU: -5

What happens if both stocks increase by 1%?

What happens if both stocks decrease by 2%?

Make sure to hedge your trades, such that you always own Google\_EU versus Google\_US in the same ratio.

# SHORT SELLING

In Optibook, you can sell something you do not have - you can have a negative position.

This is more complicated in real life, but in Optibook we kept it simple.

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What trade would we do here?

Stock ABC on exchange 1		
bid volume	price	ask volume
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	44.62	1000
	44.61	1000
1000	44.60	
1000	44.59	
1000	44.58	

Stock ABC on exchange 2		
bid volume	price	ask volume
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500	44.60	
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700	44.58	

# EMERGING MARKETS PROBLEM

Buy 100 shares for 44.61 on **exchange 1**

Sell 100 shares for 44.62 on **exchange 2**

Profit:  $100 \times 44.62 - 100 \times 44.61 = 1.00$

Net Position: **+100** on **exchange 1**, **-100** on **exchange 2**

Note: Here, the shares on **exchange 1** do not cancel out with the shares on **exchange 2**, so what do you do now?

Stock ABC on exchange 1		
bid volume	price	ask volume
	44.63	1000
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	44.61	1000
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## THE CHALLENGE: TRADING TWO STOCK PAIRS

On Optibook you will find two stock pairs, with each stock traded in a different country. The first company "TECH\_INC" will have successfully expanded to this new country, where it will be very liquid. On Optibook, there will be one stock listed in the original country, and one stock listed in the new country.

The other company called "SMALL\_CHIPS" has only recently set foot in the new country, and is still starting out there. It will be less liquid. On Optibook, there will also be one stock listed in the original country, and one stock listed in the new country there.

It is your job to build a successful trading strategy to provide liquidity to SMALL\_CHIPS. Try to make profit for yourself, and in doing so, you will make it more attractive for investors to invest in that company as more volume appears in the book and spreads get tighter. Of course, you can also trade TECH\_INC and try to do the same there, but it will be harder.



# THE CHALLENGE: TRADING TWO STOCK PAIRS

There are two concret parts:

## PART 1

Trade the "SMALL\_CHIPS" pair by making use of the temporary price discrepancies as explained before, while accounting for the fixed exchange rate.

## PART 2

Find a way to quote the "SMALL\_CHIPS" pair in a profitable manner, i.e. provide liquidity! Insert limit orders for both bids and asks. Try to find a way to make the bid-ask spread as tight as the "TECH\_INC" pair.

IMPORTANT: Come to us for credentials!

Challenge description and more details: <https://hackzurich.optibook.net>

## THE CHALLENGE: JUDGING CRITERIA & PRIZES

On Friday/Saturday you can freely develop your algorithm on Optibook. Don't be afraid to make a mistake, your results don't count yet. We will also reset all PnLs at least once per day. Take this time to develop and test your algorithm!

On Sunday before 9am you are required to hand in your code and a couple of paragraphs on the HackZurich platform.

At the same time we will reset the Optibook and run a 20 minute competition! Be prepared at 9am on Sunday to run your algorithm! You need to start the algorithm yourself at 9am. Keep an eye on the Discord channel for updates.

In order to judge the participants we will take into account the PnL of the competition, the trading approach taken and the Python code:

- How much risk are you taking?
- How novel is your strategy?
- Structure of your code

NOTE: PnL is not everything, and we do not solely judge on PnL!



## THE CHALLENGE: PRIZES

One winning team only.

Prize: iPhone 13 per team member

**OPTIBOOK**

