Supply and Demand from a Physicist's Viewpoint

EC4024 Lecture 6

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Today

1. Recap
2. Limit Order Markets
   - Definitions
3. Examples

Last Time

- Principles of Supply & Demand

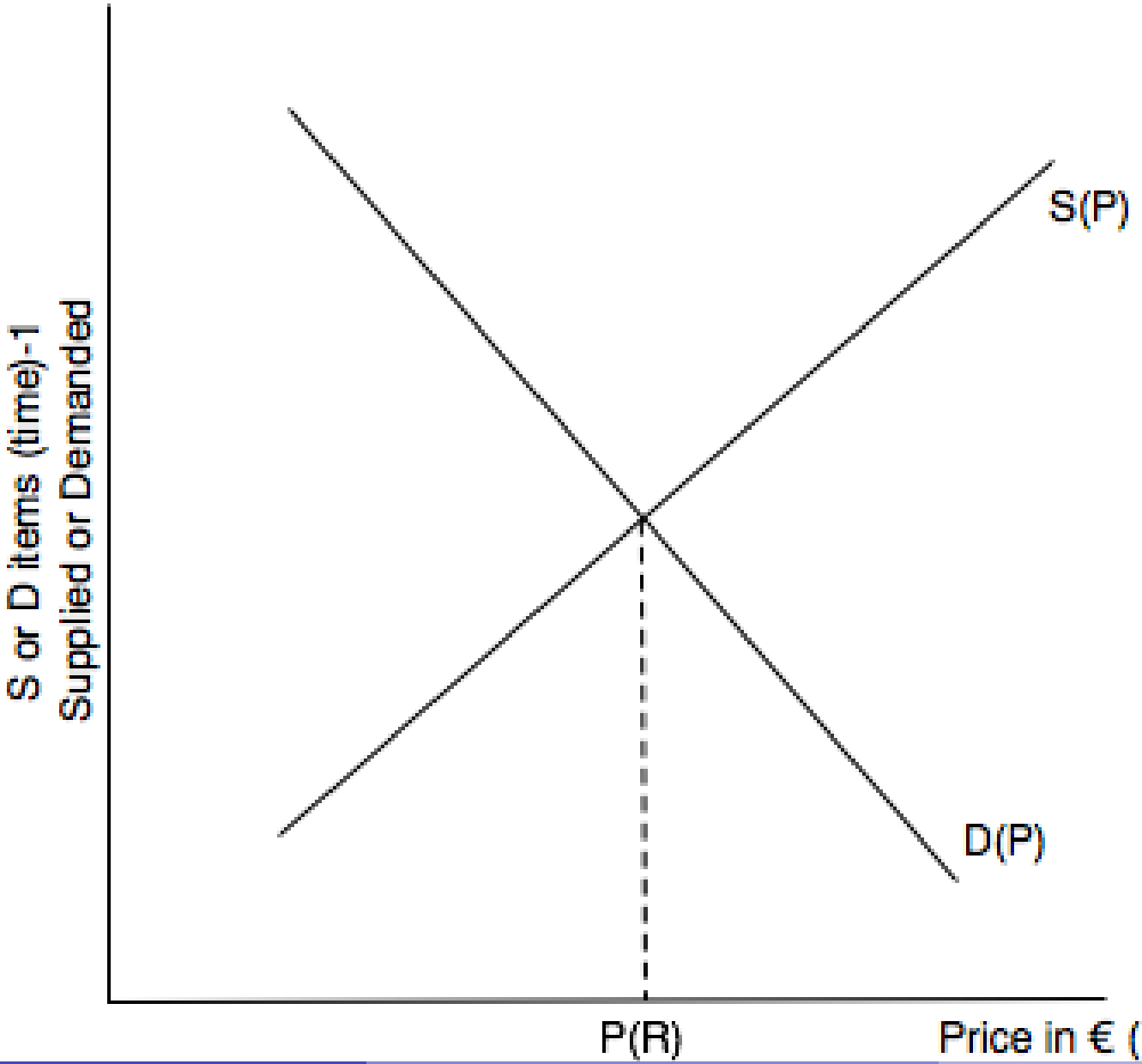
Last Time

- Principles of Supply & Demand
- Mrs. Ryan Buys that Dress

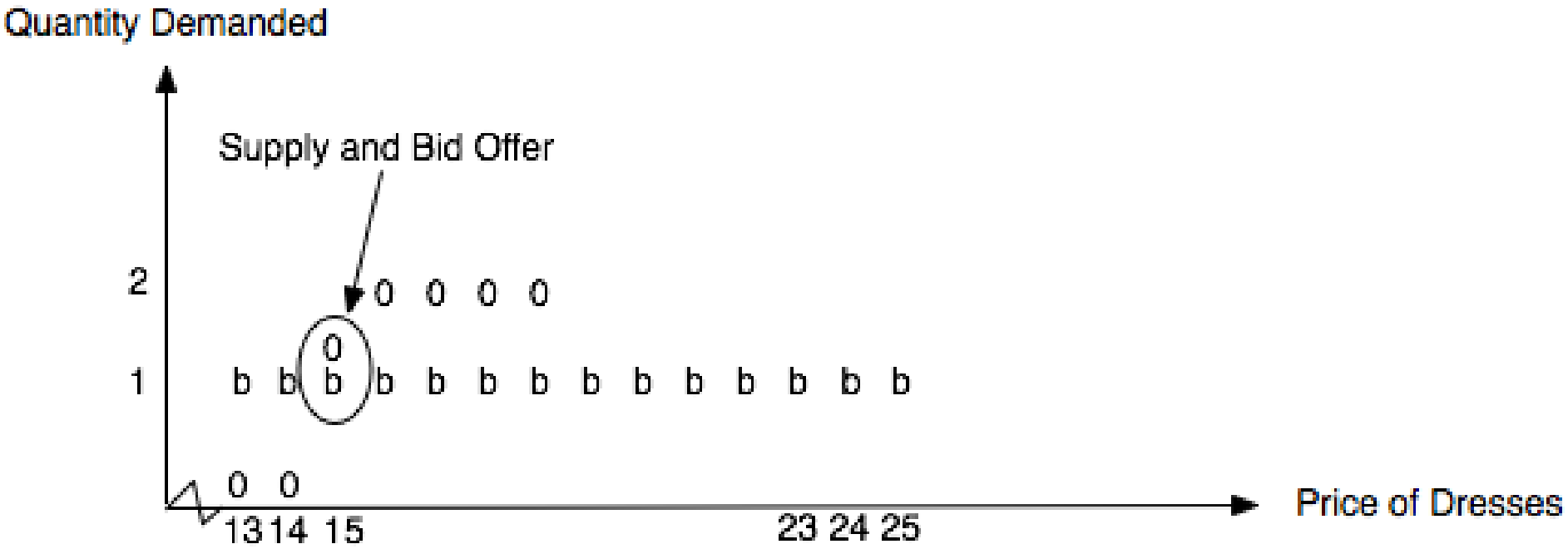
Last Time

- Principles of Supply & Demand
- Mrs. Ryan Buys that Dress
- **No** Lecture Next Monday

Supply and Demand, Redone



Supply and Demand for that Dress



One More Thing to Remember
Arbitrage

Definition (Arbitrage)

An arbitrage is a set of transactions such that

1. It requires non positive initial investment;
2. Yields non-negative payoffs (1);

Example (Citibank)

Citibank's 3 month lending rate is 3.825%. Fleet is selling 3 month CD's at 4%.

Example (IBM)

IBM trades at \$100 in NYC, 60 euros in Dublin. The current USD/EUR rate is \$1.50/€1

Definition (Limit Order)

A limit order is an instruction to trade a specific quantity of an asset at a specified price, or a better price. The order is an ex-ante pre-commitment (t, j, x, p) made on a date t to trade up to a given amount x of an asset j at a pre-specified limit price p. The order is in force until filled or cancelled, so unfilled orders accumulate in an limit order book. (2).

Order Books

Definition (Limit Order Book)

The limit order book is characterised by a discrete set of prices at which traders may submit orders.

Example

Example (Limit Orders in motion.)

A limit order to buy 100 shares can be filled at \$47.50 or below. A limit order to sell at \$50.25 can be filled at \$50.25 and above. The existence of the limit order is independent of having anyone to actually trade to fulfil the order. As time passes, one might not be able to fill the order. There several advantages to limit order markets. The first is the ability to obtain a better price. The second is the discrete nature of each trade: a limit order to buy simply means you specify how much of something you want, and and how much you are willing to pay for it, and vice versa for the supplier. Both demand and supply are discrete functions of price. Any combination of these orders in a specific time and place gives rise to a limit order only interrupted market where the orders are matched up for execution ((3, Chapter 2) is the classic exposition of LOOM).

More Examples

Price	$D(p)$	Priority	LO(Buy)	LO(Sell)	Priority	$S(p)$
> 46	0	-	-	1	-	5
$p = 46$	0	-	0	1	5	5
$p = 45$	1	1	1	1	4	4
$p = 44$	2	2	1	1^*	3	3
$p = 43$	3	3	1	1	2	2
$p = 42$	4	4	1	1	1	1
$p = 41$	5	5	1	-	-	0
< 41	5	-	0	-	-	0

More Examples

Price	$D(p)$	Priority	LO(Buy)	LO(Sell)	Priority	$S(p)$
> 46	0	-	-	1	-	5
$p = 46$	0	-	0	1	5	5
$p = 45$	1	1	1	1	4	4
$p = 44$	4	2,3,4	3=1,1,1	1*	3	3
$p = 43$	5	5	1	1	2	2
$p = 42$	6	6	1	1	1	1
$p = 41$	7	7	1	-	-	0
< 41	7	7	0	-	-	0

References

[1] J.-P. Bouchard, M. Mezard, and M. Potters. Statistical properties of stock order books: Empirical results and models. *Quantitative Finance*, 2(1):251–256, 2002.

[2] A. Kyle. Informed speculation with imperfect competition. *Review of Economic Studies*, 56(1):317, 355 1989.

[3] M.F.M. Osborne. *The Stock Market and Finance from a Physicist's Viewpoint*. Crossgagr Press, 1977.