Chapter 2 - Types of Stock Orders and Order Routing
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This chapter concerns how you might submit an order to buy or sell a stock, how that order is listed, and when an why you would use market orders or limit orders. There is a section on short sales, and the chapter ends with a detailed discussion the new role of exchanges in order routing, and the controversial topic of large orders and the Dark Markets that accommodate those large orders.

Here is what I intend to cover:

1. Best Bid and Best Ask (Level I) and how these get disseminated.
2. Level II and other Depth of Market (DOM) quotations.
3. Using market order and limit orders
4. Short Sales
5. The role of the stock exchanges
6. The role of market makers
7. Large order processing and Dark Markets (Dark Pools)

1. Best Bid, Best Ask, and Market and Limit Orders

We know from Chapter 1 that you can easily use an online broker to buy some stock, but how do you go about doing that? We know that the stock price changes moment by moment but what price is the current price? What price should you pay for your 100 shares of stock and how do you let the market know that you are interested? The first three sections of this chapter answer those questions, and the best place start is to explain Level I quotations and Best Bid and Best Ask.

If you are not already familiar with these topics you have to be patient. You can't really understand Best Bid and Best Ask completely until you understand limit order queuing and Depth of Market quotations, but they can't be explained until after our first attempt at explaining Best Bid and Best Ask. So we have a bit of a chicken and egg problem - where do we start? But by the time we have completed section 3, you will understand it all.

Let us start by supposing that you want to buy 100 shares of Intel (INTC). Your first act would probably be to see at what price INTC is currently trading. You would go to your online brokerage site and would eventually encounter a screen that includes a segment that would look a lot like Figure 1 shown below.

![Figure 1 – Segment of an Ameritrade Trading Screen Showing Best Bid and Best Ask for Intel (INTC)](image)

Although the prices are labeled only Bid and Ask, it is understood that the prices shown are Best Bid and Best Ask. Generally, these are the best prices available from all quotations and all markets. This kind of quotation, showing only Best Bid and Best Ask is called a Level I quotation.

If you instruct your broker to buy your 100 shares of stock at the best possible price, you will normally pay the Ask (the higher of the two prices). If you instruct your broker the sell 100 shares at the best possible price, you will be

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1 The reader should go to one of the two financial sites used in this class (yahoo or google), get a current quote for INTC and find Best Bid and Best Ask. What is truly meant by "best" has to be qualified some, but we will do that later.
paid the *Bid* price. For heavily traded stocks like *INTC*, the *Bid* and *Ask* are typically only a penny apart, as shown here. But for less popular stocks, like *Nathan's Famous (NATH)* the spread between *Bid* and *Ask* can be much wider, five cents or even more.

An order that instructs a broker to buy or sell stock at the best possible price is called a *market order*. Figure 2 shows two *trade tickets* from online broker *TD Ameritrade*, one for a market order and the other for a *limit order*. The top trade ticket instructs *TD Ameritrade* to use a *market order* to buy *INTC* - the instruction, circled in red, is found in the *Order Type* dropdown box. In effect, you are telling *TD Ameritrade* to buy for $18.38 per share (which is what *Best Ask* was at the moment the *trade ticket* was triggered).

The bottom *trade ticket* in Figure 2 shows another ordering option - trying to buy 100 shares of *INTC* with a *limit order*. A limit order allows you to specify a specific price at which you want to make a trade. The limit order shown in Figure 2 on the bottom trading ticket, circled in green, instructs *TD Ameritrade* to submit an order to buy 100 shares of *INTC* at a price of $18.26 or better (lower). You can submit any price you want, typically at or below current *Best Ask*, although you can submit a limit order a little above *Best Ask*.

The *market order* would be executed immediately upon submission, but the limit order, if below *Best Ask*, would not, and might not be executed at all. If during the trading day, as the price of *INTC* goes up and down, if and only if *Best Ask* drops down to or below your limit price, then your *limit order* to buy 100 shares will be executed.

So how long would this limit order stay active? That is determined by the instructions to you have chosen in the *Time-in-Force* dropdown box. The *Day* instruction (called a *day order*) shown in Figure 2 with the market order, instructs the broker to leave the order in effect only during normal stock market hours, which begin at 9:30 AM and end at 4:00 PM.
New York time every Monday through Friday except holidays. If a limit order is submitted as a day order if it has not been executed by 4:00 PM, then it disappears from the books.

The Day+ext Time-in-Force selection leaves the limit order active throughout the day and in the after-hours market that is now available after 4:00 PM New York time until the market opening the next day. Other options include GTC, which means "Good until ('til) Cancelled," which will keep the order open until you explicitly cancel it in a dedicated transaction, and GTW, which means "Good through the Week" and so forth.

Limit orders if not executed can be cancelled at any time.

2. Level II and other DOM Quotations

Clearly a limit order is an order than can stand for some period of time but also must be automatically executed if and when the market moves to the price specified by the limit order. This is automatically (by computers) resolved by moving the limit order to its proper location in a special pricing queue. The display of this pricing queue to traders is called Depth of Market for securities in general (this queuing technique is commonly used in most securities markets, including commodities and FOREX) and is typically referred to as Level II (as opposed to Level I, where only Best Bid and Best Ask are shown, as discussed above) for stocks.

Figure 3 shows a stylized Level II screen for technology giant Cisco (CSCO). This is a display of the limit order queue that existed for CSCO at that moment.

On the right under the ASK column (sometimes called OFFER) are the limit orders to sell arranged from the lowest price at the top (hence the "best" from the standpoint of someone who wants to buy) rising as you move down the column.

On the left under the BID column are the limit orders to buy arranged from the highest price at the top (hence the "best") declining as you move down the column.

We can conclude from this that the Level I quotes generally available on all financial websites for free, which shows only Best Bid and Best Ask are simply the top of the Level II queues, shown in yellow.

The MPID column shows the Market Participant ID (identification) symbol for the exchange or market maker who has submitted this quote to the queue. In the sample shown, BATS, ARCX, NSDQ, and CINN are exchanges and NITE and UBSS are market makers (explained later in this chapter).

Typically the Level II quotation shows only the Best Bid and Best Ask from each MPID listed. For example, at BATS the highest limit order to buy is at 15.25 (Best Bid for all markets) and the highest limit order to sell is at 15.31 (not Best Ask for all markets, but Best Ask for BATS). BATS may also have a limit order to buy at 15.20, but it is not listed.

The Vol column shows the number of shares in hundreds at that limit order price submitted by the identified market participant, and it may, and typically does, represent more than one order. The market participant, like NITE (market maker Knight Capital) representing 3,200 shares on the BID side at 15.24 (meaning they want to buy at this price), may have consolidated limit orders from many traders at this price and may be trying to buy some shares for their own account at this price. This multiple orders at the same limit price are time stamped as they are entered and the oldest orders are executed first.

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2 And most are. According to The Wall Street Journal, only about 1% of all limit orders are ever executed.
So to answer the question of where limit orders go, if you were to submit a limit order to buy 300 shares of CSCO at 15.20, that order would be routed by your broker to one of the exchanges or large traders represented in the MPID column. Suppose it was routed to NSDQ. Then it would typically show up on the BID side below the NITE 15.24 entry and above the ARCX 15.18 entry (and you shouldn't read any further unless you absolutely understand why this is true). During normal market hours Best Bid will always be below Best Ask in these queues. Why? These are automated markets so if these two prices are the same, someone out there wants to buy the stock at the same price someone wants to sell it, so it doesn't go into the queue - instead the order is transacted!

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Given that market orders to buy are executed at Best Ask and market orders to sell are executed at Best Buy, which means they are picked off of the top of the appropriate queue, a market order to sell 200 shares of CSCO will immediately be executed at 15.25. Because BATS (a stock exchange) was offering 400 shares at this price, those limit orders with the oldest time stamp summing to 200 shares would be sold and the BATS bid at 15.25 would remain Best Bid, but for only 200 shares.

When is a limit order executed? When it makes it to the top of its respective queue because the market has moved to that price. In other words, our limit order to buy will be executed if, only if, and when the orders in the BID queue above it have cleared and our order at our price has risen to the top and become Best Bid, and then only if someone is either willing to sell it at that price through a market order (automatically) or with a limit order to sell at your price. Obviously it is possible for your order to sit at the top of the queue without being executed - it happens all the time for less liquid stocks especially.

Ideally there is only one Best Bid and one Best Ask out there for all markets. But market and limit orders can be routed by many brokers through many market makers and other major transactors to any one of multiple exchanges in the United States. So how does a single Level II queue and, more important, how does a single Best Bid and Best Ask price emerge from this?

Since 1978 an organization called the Securities Industry Automation Corporation (SIAC) has executed a protocol called the Consolidated Quote Plan resulting in the Consolidated Quotation System (CQS). As part of this service CQS identified the “National Best Bid and Offer (NBBO)” (highest bid and lowest ask), which was disseminated by SIAC to subscribing market participants (including your broker) through the CQS Multicast Line.

In 2012, the SEC and market participants began to change the NBBO designation to Protected Best Bid and Offer (PBBO) to take into account the growing importance of stock quotes from markets that are not included in the CQS protocol, such as the dark markets that are discussed later in this chapter, whose quotes are not publicly displayed. Although currently the media still refers to the public quotes as NBBO quotes, they should now be referred to as PBBO quotes.

Again, this PBBO quote, the Level I quote, is what you see on an online trading site when you ask for a quote. Normally this system insures that no matter what exchange or ECN your broker trades through, you will get best bid or best ask on market orders to sell or buy.

Figure 4 shows an actual Java TDAmeritrade Level II trading display for Ford (F) and a NASDAQ Total View for Intel (INTC) taken on September 1, 2010. Whereas the Level II screen shows only the best bid and ask limit orders for each individual exchange, the NASDAQ Total View screen shows the entire depth of market for all limit order within the NASDAQ exchange.

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3 The order will appear on Level II only if it is the "best" price submitted by that MPID.
5 This profoundly complicated issue is important, which is why it is here, but a complete explanation of the distinction being made here isn't possible until dark markets are explained, later in the chapter. For the sake of distinction though, no matter what the media says, all Level I and Level II public quotes that you see as a trader are PBBO quotes.
Whereas Level I access is available on all brokerage sites and even many financial news sites at no cost, this isn't necessarily true for Level II. Brokerage sites often require the trader to either have a minimum balance in the account or to execute a minimum number of trades. Otherwise they must pay a fee to view Level II.

**Figure 4 – Actual TD Ameritrade Level II Display for Ford (F) and NASDAQ Total View Display for Intel (INTC), September 1, 2010**

Note that on the upper left of the TD Ameritrade Level II screen for Ford there are two green buttons, one with a B and the other with an S, in case you want to buy or sell Ford, perhaps based upon what have seen on this display. If you select one of these, the Trade Ticket appears (like the one in Figure 2) with some of the order information already pre-filled.

### 3. Using Market and Limit Orders

The static view shown in Figure 4 does not begin to capture the functioning of the Level II interface, which is very dynamic. An active stock like Intel might average a thousand shares a second on a very busy day, which implies that this screen becomes very active and Best Bids and Asks may not last very long - maybe less than a second or only a couple of seconds. It is for that reason that on active days for active stocks, you should always use a limit order to place an order. If you use a market order, you might be very surprised at the price you paid for a stock.

Probably the most volatile market you would ever see is on the first day of trading for an active and popular IPO. Since no one is sure of what the price should be limits orders just start flying and the queue can swing through dollar differences in Best Bid and Best Ask in just a few seconds. For that reason brokerages do not allow traders to even use market orders on the first day of an IPO - you are required to use a limit order. I remember trading in the first few minutes of trade for the wildly volatile Las Vegas Sands (LVS, pronounced "Elvis" of course) on December 13, 2004. Facing a hectic market, I placed my limit order to buy more than 50 cents above the top of the Ask queue to insure that I got the order, and I did as a result, and later sold for a nice profit.

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If you are currently a student in Economics 104 then either right now or at the end of this article you should find the assignment associated with this module of the class to go to the screencast.com video labeled Understanding Level II Quotations to see an active Level II screen.
I, in fact, always advise my students to use Level II quotes when trading, even if you must pay a little extra for access to Level II, and to always use limit orders rather than market orders for initiating the trade, even in the quietest market for the calmest stock. It is just a good habit to get into because there are times of high volatility where one must submit limit orders.

Also, of course, you may want to use a limit order because either you have a target price in mind for buying or selling a stock or you simply think that you can make a trade at a better price than the current price.

Finally limit orders eliminate the necessity of watching the market at every moment once you are in a position. If, for example, you bought INTC for 16.12 and hope to sell it at 18.42, you don't need to sit and watch it until it hits that price. Just submit a GTC limit order for 18.42 and forget about it.

For example, look at Figure 5, a finance.yahoo graph showing Intel's market activity during a busy trading week between Monday, August 30 and Friday, September 3, 2010 (this was a strong rising week for the stock market).

First, notice the overnight discontinuities (where there is a clear breach in the spread between a price and the next quoted price in the series) in the stock price every day, such as between the market close at the end of Wednesday at 17.65, and the open on Thursday, at 17.97! This is very common for actively traded stocks like Intel, especially in volatile markets.

Suppose, to use the example above, you had bought Intel for 16.12, which you could have done with a limit order in July 2009. Intel had been lackluster for the entire summer of 2010 so you are looking for an exit possibility. On Tuesday, August 31 you are discouraged - Intel slumps to within a dollar of your purchase price from nearly a year before. But on Wednesday, September 1st, during a strong rally for the market, Intel shoots up above 18. Rather than jump in with a market order you decide to try to get a better price and submit a GTC limit order to sell for 18.42. Wednesday you miss and on Thursday you miss, but on Friday you see another discontinuity at well above 18.42 and your order executes at that price or above. either because it executed during after-hours trade or at the open of the normal market on Friday.

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7 After-hours trading is relatively new in stocks and although it is generally available to even small traders, it isn't yet very liquid and really hasn't caught on. For most stocks the market just dies at 4:00 PM. It is possible, however, to execute a trade after hours, and as time goes on the distinction between after-hours trade and trade during traditional hours will disappear. This will become increasingly
Also look carefully at Friday's trade. Had you been in California where the market opens at 6:30 AM you might still have been in bed when your limit order executed. Had you relied upon watching the market and using market orders, the opportunity would have vanished if you are a late riser. By the time you roll out of the sack Intel might have been trading at 18.30 That's why you always use limit orders.

Given this example, it should be noted that the heaviest market activity and often the greatest price volatility nearly always takes place in the first fifteen and last fifteen or so minutes of the trading day. Look at the volume spikes for Intel at the bottom of the graph in Figure 5.

4. Short Sales

Normally when you trade a stock, or anything else for that matter, if you don't already own it, then you first buy it and later sell it, hoping in the interim that the price will rise.

But what if you think that the price of the stock or the market in general is going to go down. Is there any way to directly trade based on that belief?

Of course there is. These market are highly innovative. If you think that the price of a stock is going to go down you can sell it short, and if you do, that is called a short sale.

In a short sale, you reverse the order of a transaction: (1) you sell the stock first and (2) you buy it back later.

Figure 6 shows a hypothetical example. August 2011 was a difficult month for the stock market and bank stocks including Bank of America (BAC) were poor performers. Generally there was some question about whether global banks had adequate reserves to absorb continuing loan losses, including those that might arise if a large European government like Greece or Italy were to default on their public (much of that debt was owned by banks). There was also some concern that mortgage loans in the U.S. were again beginning to perform poorly. Bank stocks, including BAC began a sell-off that continued through that month.

Now suppose an investor wanted to take advantage of this situation. It would be done through a short sale. With a limit order the investor could first sell in early August at a price like $9.49, as marked in Figure 6, then wait. As can be seen BAC dropped below $6.50 but suppose the investor decides to wait a little longer. BAC had a small rally after August 20 and let's suppose the worried investor puts in a limit order to buy at $7.51 which in this case will have the effect of closing out the exposure to BAC instead of initiating it. Now because the investor bought BAC for $7.51 and sold BAC for $9.49, even though not in that order, she made a profit of $1.98 per share.

So how is this possible to sell something that you do not own?

true as traders attempt to trade more global stocks directly in overseas markets. Normal hours in the United States are not the same as normal hours in Japan or Europe.

This isn't the only way to do this. In a later chapter you will learn about options, which also allow the investor to indirectly short stocks.

As it turned out, on August 25, 2011, billionaire investor Warren Buffett surprised the markets by announcing that he was going to invest $5 billion in BAC, but at the time of the investment some investors saw this as evidence of how serious the problem was rather than any sort of salvation for BAC and the stock did not rally in response to the investment.
First, your broker has to give you permission to make short sales in the first place and then if that is allowed, the broker must then be in a position to lend you the stock in-kind and promising to repay it in-kind later. In other words, you are not borrowing some amount of money, you instead are borrowing 1,000 (or so) shares of BAC and are promising to pay the loan back with 1,000 shares of BAC. So you borrow, then sell, then buy, then repay. For the loan you will pay interest based upon the nominal value of the stock you have borrowed (for example, given that 1,000 shares of BAC had a nominal value of $7,510, you would pay interest at an annualized rate of, say, 8% of that amount over the duration of the period of time that you were holding the short).

Typically the broker is acting as an intermediary, lending you stock lent by someone else and then passing on some of the interest to the ultimate lender. The latter may be a mutual fund, hedge fund, or large investor planning to hold a long position in the stock indefinitely. Knowing that the stock will be returned (and realizing that this is merely a reversible bookkeeping entry) the large fund, already long in the stock anyway, is willing to earn a little extra by lending the stock to a short trader.10

Figure 7 shows an example of what the trade ticket or transaction screen would look like for a short sale. The top two radio buttons allow for a standard transaction (buy or sell long) but if selling short, the trader initiating the trade would select the Sell short button. Then later to exit the transaction the investor would select the Buy to cover (which means buy to complete the transaction) and the short position is complete.

I used an interesting example here from years ago. This transaction shown in Figure 7 is a limit order to sell short 300 shares of CFC at the price of $5.92. This would have been a brilliant order if executed. CFC was Countrywide Financial, a bank that was destroyed in the mortgage meltdown of 2008 and its assets absorbed by Bank of America. Essentially this stock went to zero.

When researching a stock, even if intending to take a traditional long position, it is sometimes worthwhile to review any available data about shorts on the stock. These data are normally available for most stocks in the financial variables section of the online research sites like finance.yahoo.com. There are two key variables that should be considered. Ford (F), a heavily shorted stock, is used for a typical example.11

The short ratio equals the number of shares sold short divided by the average daily trading volume. For Ford on August 15, 2011, average daily volume for the previous 90 days had been 72 million shares and shares short equaled 146 million shares, so the short ratio was almost exactly 2.0, a rather high amount. BAC in comparison had a short ratio of only 0.50. On the other hand, INTC had a higher short ratio of 2.6. The short ratio is also called the days short because this ratio is clearly the number of days on average that it would take to clear off all short sales if all volume was dedicated to shorts going long.

Finally, shorts as a percent of float is the percentage of all shares outstanding that are shorted. In the case of Ford 3.41 billion shares were outstanding, so shorts as a percent of float equaled 3.8%.

10 In recent years it was revealed that many brokers were allowing traders to trade short without arranging for a loan of the stock in kind, which is called a naked short and is of dubious legality. At the time of this writing, it was not clear whether this practice had been discontinued.
11 From the Key Statistics section for Ford from finance.yahoo.com.
These numbers are useful only when compared to competing companies or values in the past.

If the short ratio is unusually high this is worth knowing for two reasons: (1) it reflects clearly that someone out there is pessimistic about this stock and it might be interesting to know why, and (2) on the other hand, shorts must eventually be covered, so a high short ratio suggests that there is a floor of latent demand - at some point short sellers will have to buy to cover their positions.

A high prevalence of shorts at times will introduce the phenomenon called a short squeeze, which happens when a heavily-shorted stock starts to rise in value, forcing the short sellers to buy to cover their positions, further accelerating the price increase. Clearly, an abundance of short trading can make markets more volatile.

**5. The Role of the Stock Exchanges**

So far we have made it clear that to buy or sell stock you must open an account at a broker. Also it is clear from the discussion of Level II listings that the orders are routed to some kind of exchange where in effect buyers and sellers are matched up, the trade consummated, and the information disbursed so the rest of us know that it happened.

**Figure 8 - Order routing** shows the typical channel taken by your order. Once the broker receives it, it can be sent directly to any one of a number of exchanges, where once consummated the transaction is sent to a quotation service where it shows up with almost no latency on everyone's computer screen, even if for only a tiny second, and then sent off to a clearing house to insure everyone is paid and all securities transferred.

Sometimes the order is instead routed to a specialized securities firm, typically a market maker (described below) who actually pays for the order routing so that they can match internal orders or generally perform their market maker function. As such, the transaction may be consummated without ever involving an exchange.

The role of any stock exchange, historically or currently, is to match a seller with a buyer at a price that is agreed to (directly or indirectly) by both. The stock exchange is also responsible for executing and clearing the order.

Back in the good old days when I bought a few shares of Ford from my broker Marvin Arnold, the terms listing agencies and stock exchanges were synonymous. If a stock was listed on the New York Stock Exchange it was also typically traded on the New York Stock Exchange, which then was a physical exchange located at 1 Wall Street in New York (it's still there, but most trades are now executed electronically away from the floor of the exchange). NYSE-listed stocks could also be traded on one of the many small regional physical exchanges, like the Pacific Coast Stock Exchange in San Francisco (shown in **Figure 9**) and Los Angeles. These regional exchanges have either disappeared altogether or trade securities other than stocks (like options or commodities).

So my order for Ford would likely have been routed from my broker in Fresno to either the New York Stock Exchange or the Pacific Coast Stock Exchange.
At the time there was a competing exchange, the American Stock Exchange, or AMEX, also located in New York. The AMEX had lower listing standards than the NYSE. Over the years though the AMEX could not compete and in 2008 the exchange and its listings were absorbed by NYSE Euronext.

The NASDAQ market came online in 1971 and it differed from the NYSE in that it was the world's first electronic stock market without a physical market place. The AQ in NASDAQ stood for "automated quotation" (system). This system, which worked like a very primitive version of the internet, powered by huge, expensive and primitive computers (by today's standards) located in Trumbull, Connecticut, sent out order information to brokers nationally about prices that traders, like me, were willing to trade for smaller stocks that were not listed on the NYSE or the AMEX.

As NASDAQ matured then stocks that were listed on NASDAQ were traded on NASDAQ.

So up until 2005, as explained above, the majority of stock orders were executed by the New York Stock Exchange, still largely a non-automated physical exchange where floor traders and specialists standing in trading booths using a physical system called open-outcry (see Figure 10 for an archival photo of the open-outcry system) or through the automated NASDAQ, along with a small trickle that ended up at AMEX or a regional exchange.

But two forces began to change the comfortable and established exchange arrangement which resulted in the radical difference that we see in the multiple and competing exchanges that we see today.

First, trade execution technology began to change in favor of full automation. Automated exchanges were beginning to gain acceptance if overseas markets like Singapore, and specialized fully electronic automated order trading and clearing networks collectively called Electronic Communications Networks (ECNs) began to appear. The oldest was called Instinet, which had been established in 1960 as an exchange specializing in listing bid and ask quotes for large block trades (typically in excess of 10,000 shares). Instinet was quick to automate. Two other clearing networks called Archipelago and The Island began to attract a lot of attention. Although at inception they weren't legally defined as exchanges by the Securities and Exchange Commission (SEC), traders, especially professionals, rather quickly noticed that these new ECNs offered very low-latency trading at potentially a fraction of the cost of human-based trading systems like the NYSE's open-outcry. When the trade efficiencies of the ECNs became obvious, the older systems were doomed.

The second force for change was a 2005 SEC mandate called The SEC Regulation National Market System, or as referred to by the media in shorthand, Reg NMS. This sweeping mandate effectively allowed the ECNs to become exchanges so long as a detailed set of criteria were matched. Among other things, a special Rule 611 required that any new exchange follow the NBBO (now PBBO) protocol that insured all bids and asks are consolidated to produce Best Bid and Best Ask and to insure that no matter what the exchange used by a customer, that market orders trade at the "best possible price." This was no small task. The automated electronic systems of the old exchanges and these new exchanges had to be consolidated sufficiently to comply with the Consolidated Quotation System (CQS) that produces the all-important Level I and Level II quotations discussed in section 2 of this chapter. These public quotations are referred to in Reg NMS as "protected quotes", an obscure distinction that will become important in the next section, hence the term Protected Best Bid and Ask (PBBO).
The result of Reg NMS? Currently in the United States there are sixteen securities exchanges approved by the Securities and Exchange Commission that now compete for order flow, including combinations of the old New York Stock Exchange (NYSE), NASDAQ, BATS, and Direct Edge. It didn't take long for the established exchanges to see the writing on the wall. NASDAQ purchased Instinet (INET) and the NYSE purchased Archipelago (which became the symbols ARCA and ARCX on the Level II screens).

Both exchanges also went on a global merger and acquisition binge. The NYSE merged with Euronext in 2007, which in turn had consisted of the Paris, Amsterdam and Brussels exchanges and later acquired the Portuguese exchange. NASDAQ acquired directly or indirectly 10 former overseas stock exchanges and the blended super-exchange became NASDAQ OMX.

In the next wave of this, it appears that some of the original ECNs are merging among themselves. On August 26, 2013, BATS and Direct Edge merged to form BATS Global Markets, headquartered in Kansas City, MO, which further demonstrates that in this day of computer automation, you don't have to be located in a large money center top run a global exchange empire.

And although the NYSE tried for awhile to preserve open-outcry, eventually all human-based exchange protocols disappeared except for some specializing in large block trades. Of the sixteen listed exchanges, not all trade stocks (some trade options only) and some are specialized divisions of the same company, like the EDGA Exchange and the EDGX Exchange (both trading divisions of Direct Edge).

So even though Ford (F) is still a stock listed by the NYSE, these days an order to TD Ameritrade to buy or sell F is not necessarily routed to the NYSE. Likewise, if you look at a Level II listing, which, remember, is a listing of limit orders at different exchanges, you will see a large number of exchanges being represented, all of them somehow queuing their orders properly into Level I and Level II.

6. The Role of Market Makers and High-Speed Traders

In between the brokers and the exchanges are a dedicated and important set of traders called Market Makers. Although the role of Market Makers has diminished with the growth of the number of exchanges and the emergence of high-speed and algo traders (explained later), they are a very traditional (established long ago) and very important part of the market structure. Their primary traditional job is to “make the market,” which specifically means to supply liquidity to the markets at all times and when no one else will, which by example means that they are willing to supply both bids and asks for selected stocks. In a few words, they are expected to fill in bids and asks on the Level II queue when no one else will.

12 For the full list, which seemingly changes by the day, see the SEC list of exchanges at http://www.sec.gov/divisions/marketreg/mrexchanges.shtml. Take a glance at the BATS or EDGA websites.
Before discussing why and how they do this, it might be useful to see who they are. **Figure 11 - NASDAQ Market Makers for NASDAQ Stocks, Summer 2013** shows the top ten market participants for NASDAQ stocks.\(^\text{13}\) As can be seen, many of them are banks or subsidiaries of banks.

Traditionally the kinds of specialized trading houses of the kind that are highlighted in **Figure 11** agree to participate actively in the markets for only certain stocks, although that list may be very long. In the past, if a company had been hired to be one of the underwriters of the **IPO** (effectively, a financial sponsor that helps finance and promote the **IPO** while assuring compliance with exchange and SEC regulations) then that company is obliged to be one of the market makers for the stock after it is listed.

Market makers are necessary for the less popular stocks (you don't really need a market maker for **Intel**) to insure that there is liquidity - established limit orders offering bids and asks to satisfy market orders, especially those coming from small traders. Market makers do this by trading for their own account while often at the same time trading on behalf of clients. If trading for their own account, that means that they are willing to either buy or sell the stock in question at the listed bid or ask. This implies of course that the market maker maintains a large and fluctuating inventory of the stock in question.

If you go back to **Figure 4** and look at either the **Level II** queue or **Total View** queue you will see market maker **UBS Securities (UBSS)** represented on both sides of the bid and ask queue. What we don't know is whether the bids and asks shown are for customers or for **UBSS's** own account. They could be either.

To get a better idea of the role of the market marker, review **Figure 12 - UBSS and other market makers providing liquidity to NATH on both sides of the queue**. This shows a frozen **Level II** screen from **Nathans Famous** from 2010. As we have already seen, unlike **INTC, NATH** is a fairly illiquid stock, sometimes with just a few hundred shares traded in a single day. This low liquidity is fairly typical for a small-cap stock. The most obvious effect of the lack of liquidity is the sizable spread between **Best Bid** and **Best Ask** compared to a liquid stock like **INTC**, which is typically a penny. This spread might be worse were it not for the market makers, You can see that **UBSS** has both a bid and an ask represented, as do some of the other market makers like **SUSQ (Susquehanna International Group)**, **HDSN (Hudson Securities)**, and

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\(^{13}\) Source: NASDAQ OMX [http://www.nasdaqtrader.com/trader.aspx?ID=topliquidity](http://www.nasdaqtrader.com/trader.aspx?ID=topliquidity) There are separate lists for NYSE and NYSE Arca securities. A "market participant" isn't necessarily a market maker, but most are,
**NITE (Knight Capital).** We can't be sure that the 1,000 share bid at 15.01 and the 1,754 ask at 15.60 is for **UBSS**'s own account but probably most of it is.

![Figure 12 – UBSS and other market makers providing liquidity to NATH on both sides of the queue](image)

It is important to understand that during times of crisis - especially during declining markets - the market maker is supposed to stay in the queue, *even when everyone else is withdrawing*, to make sure that *market orders* will find a buyer or seller. In a collapsing market the ask side of the queue should remain robust (this should require no explanation) but the bid side can vanish (everyone wants to sell, no one wants to buy). The market maker is expected to provide bids - even if low bids - effectively offering to absorb inventory even in a declining market.

Although market making requires huge financial resources, it is normally a very lucrative business. An inspection of **Figure 12** should show why. Although **UBSS** has both a bid and an ask, it is plain to see that the ask is $0.59 higher than the bid! Also look at the relative quotes of **HDSN** and **NITE**. An inspection of any **Level II** or **Total View** queue will show that for any market maker there is always a positive spread between bid and ask, for the market as a whole and for any market maker in the market. Given that the market maker adjusts inventory all day, adding to inventory from the bid side and depleting from the ask side, over time he makes money from the spread, even if the spread is only a penny.

Market makers also process trades for brokers or their own clients and manage client portfolios so fees are also a source of profit.

It is possible for a market maker to lose money. If a market maker goes into a sharply declining market with large inventory, then value will be lost as the value of the inventory declines with the falling price, and of course a market maker listing a bid may have to buy at that price, only to eventually see the stock price plunge below it. Market makers, though, generally profit in stable or rising markets.

This potential for profit from the spread between bid and ask has created a huge opportunity for a particular class of *high-speed algo (algorithmic) trading*. These kinds of trades are undertaken by these market makers (essentially all of them are all now algo traders - they have to be to remain competitive) but also specialty trading firms, sometimes called *quant traders* (traders using automated algorithmic techniques) who are not market markers and, more important, do not have the legal requirement to always make markets. The automated algo trading technique is called *spread arbitrage*.

**Spread arbitrage** takes advantage of the spread between bid and ask which is the origin of market makers profits. But **algo trading** takes it a step further. Fully automated computer programs seek spreads between bids and asks for a plethora

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14 NSDQ, arcx, batx, and cboe are all exchanges. The distinction between exchanges and market makers and the roles they play are blurring.

15 This is our first introduction to algo trading, which is a very complicated and advanced topic. This phenomenon will be discussed here and there in these chapters and more so in the lectures (in Economics 104), but this is a topic for a more advanced class, like Economics 136 *Financial Markets and Modeling - Futures, Options and other Derivatives* and so will receive only mention in passing here.
of stocks and if they see opportunity the program, with no human intervention, will trigger limit orders, typically on both sides, inside the existing spread, effectively making both limit orders Best Bid and Best Ask, even if for a very short period of time. Now if there is heavy order flow for market orders, or if the firm is paying for market order routing, then if market orders come in on both sides while you are at the top of the queue, then you both buy and sell approximately (not necessarily exactly) the same amount of stock at a positive spread.

Go back to Figure 12 and look at the spread between Best Bid and Best Ask on NATH. An automated program wanting to take advantage of this spread might simultaneously establish a limit order to buy 100 shares at 15.51 and a limited order to sell 100 shares at 15.55. Both would be established as Best in the PBBO structure so any market order that comes in for 100 shares would be yours. In this example, 100 shares are too few and liquidity in NATH is too low to make any real money, which actually explains why the spread is so wide - no algo traders are playing NATH! It also explains why the spread is so narrow for stocks like INTC - algo trading computers are at every second trying to play the spread.

These kinds of high speed trades, with no human involvement, are dizzying in their aggression and speed. These computer-generated limit orders can be generated and cancelled in seconds, causing order flows in and out of DOM queues that are staggering in their speed and scope. Why? Once we place our bid at 15.51 and ask at 15.55, what is to prevent another computer one second later placing 15.52 and 15.54? So we withdraw our limit order. Then someone executes and we start all over again. All in two seconds!!

Market makers are all now algo traders but many algo traders are not market makers, and this has caused a problem in recent years. Algo traders doing spread arbitrage are like market makers represented on both sides of the bid/ask queue and they are providing liquidity and marking markets just like the formal market makers, and maybe on a much larger scale. But the algo traders who are not market makers are not required to stay in position when things get tough, and they don’t! This capacity for algo traders to flee bad markets has more than once caused what is called a flash crash - a sudden acute but temporary severe market crash (or at least a crash in many stocks or ETPs) caused by the computers of algo traders abandoning the bid queue in a panic! Basically the bid side of Level II goes blank and prices plunge, all in a few seconds.

This phenomenon is described in detail in Chapter 6, so we return to it there. Suffice to say here that the all-important market-making mechanism that is supposed to provide liquidity to the markets has been glitchy in recent years, and as we will see in later chapters, it does impose a possible threat to the small retail investor.

7. Large Block Orders, Dark Markets and Dark Pools

As if this large and changing structure of exchanges doesn't complicate the picture enough, the neophyte stock trader may be disturbed to know that you are also competing with dark pools for attention when making your little stock purchase.

And that requires some background explanation.

In effect there is a second stock market out there that follows different rules and procedures but overlaps considerably with the stock market that has already been described. It is called the dark market. It is not a separate market entirely from what has been described. If you were to buy or sell 100 shares of Ford, there is a reasonably good chance that you would buy from or sell to a dark market without ever knowing it.17

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16 This example is important to keep in mind when weighing the heavy popular criticism of algo traders, which has been in the news a lot. Through their competition, they do keep spreads narrow for the more heavily traded stocks, and that is good for retail investors.

17 That you wouldn't know it is no big deal. Although prices and limit order queues for the stock market are transparent to a degree that is amazing - the NBBO/PBBO protocol has been remarkably successful over all of these decades - as a trader you will never
The dark market is a separate set of exchange rules and conventions that are mostly for large-block trades. The dark market allows the trader to list market and limit orders (especially the latter) with no exposure. The listing is in a dark pool, which effectively is a queuing of limit orders (and similar orders, some described below) that are not publicly available and do not appear in the Level II queue or anything equivalent. Effectively they are secret limit orders known only to a few.

Further, unlike ordinary stock trades, which are reported instantly through the Consolidated Quote Plan protocol discussed earlier in the chapter, stocks trades from dark pools are not reported until long after the transaction, so generally the public does not know about the trade right after it happens. In a few words, dark pools are exempt from the rules that guarantee the "protected quotes" that were defined in the previous section of this chapter.

This should clarify something for the patient reader. It was remarked earlier that the tradition National Best Bid and Offer (NBBO) designation was swapped gradually in 2012 for the more accurate Protected Best Bid and Offer (PBBO) designation. This is why - the PBBO refers specifically to the traditional "protected" transparent stock price quotation system that most retail investors recognize (and perhaps many believe is the only system in operation because it is the only one they have ever seen).

As one might guess, there are many critics of the dark markets and the special privileges they impart. After all, if everyone has a right to see your limit order and everyone will know the results of any trade you made, why should large traders be allowed to escape this transparency?

But dark markets are indeed necessary for large traders. They are meant to hide attempts to make trades that will have market impact because of their size. Additionally, the market impact would come at the expense of the party trying to make the trade.

This is best explained by example. Suppose you are an active trader who seeks to buy 1,000 of retail giant JC Penny Company (JCP). You are a savvy trader who puts in GTC limit orders at an attractive price, sometimes well below market, then you just hope for the best. You do a little background research on JCP and see that the company has 220 million shares outstanding. The stock has been active, selling about 15 million shares per day. You also notice that the stock is heavily shorted at 60 million shares, about 40% of the float. The stock has been doing poorly and the share price has been drifting down and is currently trading around $15, but you feel that the company is likely to hire new management who may turn the company around and restore the stock price. You also know that the shorts must be covered at some point. But you know that this is a risk and you want to shop for a good price.

Suppose you then discover that a large institution like a mutual fund wants to sell 40 million shares outright! They want out and effectively want to make a transaction equal to nearly three days trading volume. How would they do this? Put in a market order to sell 5 million shares at a time and wipe out the entire ask side of the Level II structure each time they did it? Perhaps put in a limit order to sell at 15.01 for 3 million shares and have it sit there and make it obvious to everyone that some massive trade was underway?

If you saw either happen or just knew in general that a sell-side avalanche was about to hit the market, you might be inclined to put in a limit order to buy - but now with this new information, only at $13.50, or even $12.80.

That's why the seller will want to keep his intentions secret - if he does not, then his mere bidding activity, because of its sheer scale, will have a market impact - meaning it will directly affect the price of the stock, and it will do so in a way that harms the seller. The dark markets allow these large-scale block trades to essentially be secret transactions.

know the counterparty to any trade you make. If you make a bid that is accepted the stock is gone in a few seconds and all records are updated. Who ended up with it? You will never know.
Large-block transactions are common, explaining as much as 50% of the volume, sometimes more, on any given day. Most of them are undertaken by large institutional traders like mutual funds (explained in Chapter 5) who own huge inventories of stock and must trade them in blocks of thousands of shares at a time.

In past times multiple means, some still employed, were developed to try to move large-block trades through the markets without them being recognized. For example, specialty trading houses would (and still do) break up large blocks into smaller blocks (say 200,000 shares into blocks of varying size but averaging 5,000) and try to move them separately out with well-placed limit orders in the effort to avoid attention. Such a technique can be effective but is not automated (entirely) and involves multiple transactions, so can be expensive and slow.

Other exchanges, whether dark pools or not, use a semi-automated procedure called an Intermarket Sweep Order (ISO) to accommodate large block transactions. An ISO is very interesting and revealing, but too complicated to explain here, so will be explained in greater detail in the lecture (for Economics 104 students).

Other dedicated ECNs will simply accept only large-block orders and when possible will use discretionary traders who try to match them, which will work if large traders are trying to sell large blocks while others are trying to buy them (for example, if one trader has a single limit order to buy 15,000 shares at 15.20 and another has a limit order to sell 22,000 shares at 15.30. A trader can bring them together. The original Instinet, the early-stage large-block ECN that was eventually bought by NASDAQ primarily performed this function. Instinet was a semi-automated dedicated trading exchange that accepted and queued large-block limit orders only.

Generally a dark pool is a modern Instinet, a dedicated exchange that accepts large orders, does not publish the limit orders through the NBBO protocol (so the limit orders do not appear in Level II or Level I or any other public depth-of-market queue), and does not report consummated transactions until long after they have happened. In fact, Reg NMS 605 requires dark pools to only report their trades monthly.18

There is yet another aspect to dark markets that complicates the order routing and price seeking process and which also effectively circumvents the PBBO protocol. Individual exchanges, large ECNs that are technically not exchanges, and even large brokers are allowed under certain circumstances to do cross trades, where buy and sell orders, whether limit order or market orders, are matched internally and executed without the order being released to PBBO. This is supposed to be done only when the exchange or broker can effectively guarantee that the price paid and received was at least as good as the price that would have been obtained had the bid or ask been listed in the traditional PBBO protocol. Since 2012 NYSE Euronext has been experimenting with such a dark market program called the Retail Liquidity Program which is supposed to be structured such that the retail investor is promised a price that is guaranteed to be slightly better than a price that would be obtained through the PBBO channel.19

Earlier Figure 8 - Order routing did not show the possibility of a retail order being routed specifically to a dark pool, although it did allow for the possibility of the order being tracked to a market maker who might process it internally, possibly in a dark market. It has become apparent in recent years that some order processors or exchanges (likes BATS Global, which advertises that they do this) may temporarily route a retail order through a dark pool to sample prices to see if they can beat or at least match the PBBO price. There is really no reason for a large order processor in a dark pool to avoid the small retail market if order flow will chip away at a large established position. One way to sell a million shares of INTC is to slowly sell a large block100 shares at a time if that will help move the block. In this case the dark pool would actually improve the retail environment for small investors.

18 "Shining a light on Dark Pools," The Economist, Aug 18, 2011.
19 For a description of this program and recent results of its effectiveness, read the various documents about the NYSE Euronext Retail Liquidity Program at https://usequities.nyx.com/markets/rlp.
As one might guess, the existence of *dark markets* and *dark pools* and any other protocol that hides prices and trades from immediate public scrutiny is controversial. Your teacher does not yet see any clear evidence that *dark pools* are harmful to the interests of small retail traders (of course a single large scandal could reverse this sentiment!) and hidden trading intentions really are necessary for the execution of large block trades undertaken by mutual funds. In fact, given that a considerable amount of retirement wealth is tied up in these very mutual funds, requiring *PBBO* transparency on all mutual fund trades might work *against* the interests of retail investors.

In fact, this discussion might encourage the small retail trader to consider that you might have a slight advantage in making your trades. Nothing you do has market impact so you can slip in and out of the market unobserved. In fact the retail trader might have an advantage of you develop some means to detect the occasional market impact of large traders.

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