Chapter 3 - A Supply and Demand Model for Stocks
written for Economics 104 Financial Economics by Prof. Gary Evans
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There are few markets in the world that are more active or competitive than the market for stocks. Stock prices in every exchange in the world fluctuate actively at every moment throughout the trading day for any market that is open, and the prices of many popular stocks continue to move on a 24-hour cycle in the increasingly active electronic after-hours markets. Companies of larger and more popular stocks like Intel (INTC) generally trade around the clock, which implies that the price of Intel stock can, and does, change at any moment.

But what causes the price to change? Why does the share price of Intel rise and fall in value?

This chapter introduces an elementary Supply and Demand Model for stocks. The intent here is to give us an analytic perspective on why stocks rise and fall in value. This chapter does not so much discuss the multiple variables, like earnings and dividends, that affect stock prices. Those variables are mostly discussed in Chapter 4, although by necessity some variables are discussed in this chapter. Mostly, though, the intent here is to set up a model that explains the mechanics of the interaction between Supply and Demand.

Here is what I intend to cover:

1. The logical justification of Supply and Demand curves and what they represent.
2. Multiple examples of shocks to Supply and Demand curves and an explanation of why the cause stock or index prices to rise or fall.
3. Using the model to understand or explain general market conditions rather than the behavior of individual stocks.
4. An introduction to four-quadrant analysis

Setting Up the Model

To begin construction of the model, we have to remember that when you buy 100 shares (or so) of a stock like INTC, it is similar to buying a used car. You are certainly not buying the stock from the Intel Corporation (their actual legal name). That company benefitted from the sale of this stock on the day of the IPO, decades ago, when the stock was sold to the public for the first time. That is how Intel was initially capitalized. Since then, although shareholders, employees, executives, and other investors have all benefitted from the resale of Intel stock, the abstract corporation itself has received no additional benefit beyond the IPO, no matter where the share price has gone.

If you buy stock, you will be buying it from someone who earlier bought it like you are trying to do now, and when you sell it you may be selling it to someone who may be buying it for the first time.

It will also be useful to remember that once you buy stock, you can usually turn around and sell it back to the market at any time you want. You can hold the stock for 10 years, or you can sell it two minutes after you bought it, or if you have programmed a trading computer to buy and sell, that computer can literally execute a trade to sell a few nanoseconds after it executed a trade to buy.

Ultimately the price of any stock (and generally any financial asset traded by markets) will be determined by the ebb and flow of supply and demand for the stock in question. We can represent this market with an ordinary supply and demand model for shares of the stock, as though representing the supply and demand for gasoline, so long as we make a few qualifications.

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1 Companies can and frequently do have secondary public offerings and later public offerings for more shares of stock in the months or years following the IPO. This has the same effect of an IPO, adding more cash capital to the company itself.
Refer to Figure 1, which represents the supply and demand curves for INTC stock. To make the example, which is mostly hypothetical, a little more realistic, I have chosen an actual closing price ($22.08 per share) and daily volume (53.45 million shares) for June 2, 2011. Even at more than 53 million shares, trading volume on that day was less than the three-month daily average at that time, which was 67.20 million shares (shown with a red dotted line as a point of reference).

The blue Demand Curve shown in Figure 1 is meant to represent the intentions of thousands, possibly millions, of investors who are considering buying INTC at various prices. The Demand Curve has a negative slope because it is cumulative. Anyone willing to buy INTC at $24 per share would certainly also be willing to buy INTC at a lower price, like $21 per share. We will see in a couple of pages that a potential buyer interested in buying INTC at no more than $24 will typically enter an order to buy, called a bid, at the price of $24 or lower. That will be the typical bid. Therefore, the lower the price, the larger the number of trades that would be made at that price.

Given what was said above in the opening paragraphs, the green Supply Curve shown in Figure 1 is meant to represent the intentions of thousands of investors who already own INTC (because they bought it earlier, whether minutes ago or years ago) and will sell it at the right price. The Supply Curve obviously does not reflect any kind of offer generated by the Intel Corporation. Like the Demand Curve, the Supply Curve is cumulative and therefore has an upward slope. The higher the market price at any moment, the more shares will be offered for sale.

The supply and demand curves fluctuate all day long in response to news, earnings reports, or anything else that might affect investor sentiment (discussed in the Chapter 4) and the price moment by moment will reflect these fluctuations in supply and demand. In our example, the market pauses at the end of the normal trading day with

![Figure 1 – (Actual data) Hypothetical Supply and Demand Curves for INTC (Intel) Stock at end of trading day, June 2, 2011](image)
INTC priced at $22.08 per share and volume for the day as shown. Obviously volume is fluid and must be expressed as a flow over some period of time, such as daily or hourly.

**Example 1: Positive News Causes the Stock Price to Rise**

Individual stocks are of course very responsive to news. The new can be new information about the company itself, the industry in which the company competes, and even general economic news to the extent that it can affect a major segment of a market or markets overall.

**Figure 2** shows an example of how INTC might react to good news directly about the company, in this case an unexpected increase in earnings (profits). In a later chapter we will see that stocks in general react very strongly to rising earnings or greater prospects for rising earnings. The reason should be obvious - companies that are operating so well that their profits grow quarter after quarter will be rewarded with greater investor enthusiasm.

Publicly-listed companies report their earnings quarterly and usually analysts have generated some expectations about what earnings will be declared in the next quarterly report, typically stated as earnings per share. Let us say for the sake of example that INTC was generally expected to report earnings of around $0.60 per share per quarter (which is about where it would have been around the date of this example). Suppose then on the day of the earnings announcement, INTC surprises the market and announces earnings of $0.66 per share for the previous quarter. **Figure 2**, which is hypothetical and not based upon an actual example, show the effect that might be seen given this unexpected announcement.

First, the **Demand Curve** shifts out because the stock is suddenly more attractive to potential buyers because of the company's greater profitability. Second, the **Supply Curve** might shift back some, as shown, because some of those who currently hold the stock find it more attractive and might now be less inclined to sell it.

The net effect upon price of these two shifts is obvious - the price of INTC would rise, as is shown here rising from **$22.08** per share to **$24.61**.
The effect upon volume is not so clear. Because the Supply Curve is shifting backwards and the Demand Curve is shifting out, the final impact upon volume will depend upon the relative shifts of these two curves. In the example shown, Demand shifts out more than Supply shifts back so in that case the daily volume rises from 53.45 million shares to 56.21 million shares. With this kind of positive news for a popular stock, volume does tend to rise with the inevitable surge in price, which implies that the Demand Curve is much more strongly affected than the Supply Curve.

Generally, any kind of positive news about a stock has the potential to cause a reaction similar to the kind shown in this example.

Example 2: Negative News Causes the Stock Price to Fall

It should be obvious that negative news, even if indirect (primarily about some other company) has the potential to trigger off a supply and demand reaction that can cause the price of a stock to fall.

Figure 3 shows an example, also hypothetical, of the potential impact of a news release by a customer of INTC, which sells computer processors and chips to computer manufacturers like Dell. In this example, the major computer manufacturer announces an unexpected drop in revenues (sales) in their quarterly report, and attributes the drop to declining computer sales in general. As might be expected the stock price of the announcing company falls, but so potentially does the stock price of any other company, including components suppliers, that might be affected by declining computer sales. This reaction is sometimes called a sympathy move.

In the hypothetical example of the impact upon INTC shown in Figure 3, the Supply Curve shifts sharply outward - this announcement caught the individuals, mutual funds, and hedge fund owners of INTC by surprise, and many of them rush to unload their holdings. Demand also falls back because stocks from this industry in general are suddenly less attractive. The net effect is a clear decline in price, shown in the example as a move from $22.08 per share to $20.42 per share.

Again, the net impact upon volume would be ambiguous, although in this example volume rises. As was the case when we looked at the impact of good news, there tends to be a dominant curve shift, and when the news is bad it does tend to be on the Supply side, so volume will usually rise in a case like this.
Example 3 - Individual Stocks React to General Market News

Because we know that entire indexes rise and fall in reaction to general economic news, then obviously a single stock making up any index can respond to the same class of news, even though the company is not directly affected by the news.

Examples 1 and 2 above were hypothetical, so given that the original graph was based upon an actual historical day in INTC trading, what then actually happened to INTC in the trading days that followed June 2, 2011 (a Thursday).

Figure 4 shows where INTC actually stood on market close one week later, on June 9, 2011. The stock was trading a little lower, at $21.83, and volume for the day was exceptionally low, at 36.81 million shares, compared to 53.45 million shares the previous Thursday, and an average for those times of 67.20 million shares.

This slight decline in price and slump in volume was not due to a bad earnings report from INTC or unexpected announcements from competitors or customers, but reflected the generally poor atmosphere for stocks in the Summer of 2011 because of global economic problems. In Europe, a recurring debt crisis caused by the inability of some Eurozone governments like Greece and Ireland to roll over their debt hammered on the market throughout the summer. In the United States markets witnessed the inability of our two political parties to cooperate on a plan to curb our own budget deficits. These two negative influences ultimately drove retail (consumer) investors away from the stock market, which dragged stocks down in general and lowered trading volume for many.

Example 4 - MMI Reacts to a Surprise Buyout Announcement

The next example is an actual event that happened late in the summer of 2011 and shows what can happen to the price of a stock when it becomes the welcome target of a friendly buyout attempt.

The buyout target in this case was Motorola Mobility Holdings (MMI), the smartphone manufacturer who manufactured, for example, the Droid phones using the popular Google Android operating system. In January 2011 the original Motorola broke itself into two companies, this one and Motorola Solutions (MSI), which retained all of Motorola’s original business except smartphones and their intellectual property.

On Friday, August 12, 2011, MMI closed for the day at 24.27 and traded 3.8 million shares for the day. This initial equilibrium is shown in Figure 5.
No one knew that Larry Page, Google CEO, had been secretly negotiating with MMI executives to buy MMI in its entirety and effectively remove it from the market, for a cash value of $12.5 billion, an amount equal to $40 per share. Google wanted to expand their Android business in a way that could better synchronize hardware and software and wanted MMI's massive patent inventory.

When the announcement was made just prior to market open on Monday, August 15, the market reaction was explosive, and is shown in Figure 5. Supply was relatively unaffected because it was understood that the Google $40 offer to buy the stock would stand for a long time. But Demand of course shot out, pulling the final price up to near the offer price of $40 and exploding volume from Friday's 3.18 million shares to Monday's closing 14.4 million shares.

Why didn't the stock go all of the way to $40, since Google announced in a press release that they intended to pay that amount? An acquisition of this scope is complicated, expensive, and time-consuming and must overcome regulatory hurdles - in particular anti-trust opposition. Therefore the outcome is not guaranteed and there is some risk at this price, so the market price will often hover below the offer price until it is clear that the deal will be consummated.

As a note of interest, the acquiring company often sees a decline, at least for awhile, in the value of its stock when making an acquisition this large and controversial. After all, Google was offering to pay 60% more for the stock than the market was valuing it at the time of the announcement, and $12.5 billion cash is a lot of money. Not all Google investors will think that this is a wise market strategy (although to give Google some credit, that is how they acquired Android to start this all off), Consequently Google shares did sell off some, from a close of $563.77 on Friday on a volume of 3.154 million shares, to a lower close of $557.23 on Monday on a much higher volume of 7.145 million shares. In a Supply and Demand Model for GOOG, this would be reflected as strong moves outward by Supply and Demand, but more so by Supply than Demand.

Using the Model to Evaluate General Market Conditions Instead of Individual Stocks

The model that we have been using is easily converted to a useful model for evaluating entire markets, as represented by indexes like the S&P 500 or Dow Jones Industrial Average (DJIA). After all, these indexes are weighted composites of the individual stocks that make them up and the Supply Curves and Demand Curves will aggregate into composite Supply and Demand Curves that behave much like they do in the disaggregated model.
It is best to demonstrate this by a real example. Look at Figure 6, which shows a candlestick chart of the open, high, low, and close of the DJIA for market days August 1 to August 15, 2011, along with another chart showing the daily volume of the 30 stocks that make up the DJIA for the same period.

Figure 6 – Open, High, Low, and Close Candlesticks and Volume for the Dow Jones Industrial Average, August 1 to August 16, 2011

Candlestick charts are easy to read and used a lot to represent financial data. Any single candlestick has four pieces of information. Look at the candlestick for August 12 as an example. Because it is blue, that indicates that the market was up for the day (and red indicates a down day). The top of the wick represents the high of the day (11,402.83), the bottom of the wick represents the low (11,116.29), because this candlestick is blue the bottom of the candle represents the open (11,143.39) and the top of the candlestick represents the close (11,269.02).

This data period was chosen because it was unusual and very volatile and is a good example of the influence of political events upon stock prices.

In early August the Eurozone countries continued to have problems refinancing the government debt of member countries like Greece, Ireland, and Portugal, and the problem was beginning to spread to larger economies like Spain and Italy. Although European politicians like French President Nicolas Sarkozy and German Chancellor Angela Merkel often disagreed on the controversial steps to mitigate the crisis, throughout the summer the authorities of those governments and the International Monetary Fund offered one solution after another to stem
the crisis at the moment. And then a few days later it would be replaced by another. With each wave of bad news global bond and equity markets softened and then would stabilize when a solution came along. This repeating process had unnerved markets, including the U.S. stock market, for months.

Then problems shifted to the United States.

In 1917 a law was passed establishing a debt ceiling, effectively limiting the size U.S. Government budget deficits. The law, of course, has never met its intended goal because each time the ceiling is reached, the Congress raised the ceiling to a higher level. Usually this is done quietly but in some years partisan acrimony forces a confrontation, with a circus-like atmosphere of wild accusations about who is to blame for budget deficits along with multiple proposals, some outlandish, impractical and loaded with ideological baggage that produces spectacular political theater while potentially damaging the U.S. economy. Alas 2011, with the anemic recovery from the last recession already on the wane and at a time when political leadership was needed by both parties, the drama surfaced with a venom not seen in American politics since the Great Depression.2

Generally, Democrats did not want to meaningfully alter the huge entitlements programs like Medicare and Social Security and Republicans did not want to raise taxes, both of which were probably necessary to have any hope of bringing the federal budget into balance, or anywhere near balance. And there was absolutely no spirit of compromise.

Treasury Secretary William Geithner warned the markets that unless the debt ceiling was raised by August 2, then the U.S. could no longer borrow net new funds nor possibly roll over its short term debt, which would render the U.S. Treasury insolvent and possibly cause the first ever default on U.S. debt.

Meanwhile, in the background ratings firm Standard and Poor's was threatening to downgrade long-term U.S. Treasury debt from where it had always been since ratings began, AAA, to a lower AA+ rating. Generally Standard and Poor's saw no meaningful effort to reduce the scale of the budget deficit to historically tolerable standards.

On the weekend of July 30 and 31, the Congress and the President, not wanting to be responsible for triggering off yet another stock market crash, finally reached a compromise and managed to get the debt ceiling raised (from $14.3 trillion to $14.7 trillion) on the day of August 2 deadline, technically averting a debt default. But the compromise was empty - a new 12-member committee (six Democrats and six Republicans and six from the House and six from the Senate) called the Joint Select Committee and Deficit Reduction were given the task of recommending legislation for debt reduction that would appeal to a majority of both parties.

Generally, markets met this political development with a wall of skepticism and, as can be seen in Figure 6, stocks fell through the week from August 1 to August 5.

Far more important, Standard and Poor's was unimpressed with the compromise, and late on Friday, August 5, they downgraded U.S. Treasury long-term debt from AAA to AA+.3

The first trading day after that downgrade was Monday, August 8, 2011, the day that we are reviewing here by example.

First look at the candlestick in Figure 6 for Monday, August 8, 2011, then look at Figure 7, which is meant to represent what happened during that day given the news context described above.

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2 For a discussion of the historical debt ceiling and some of the problems caused by this rule in the past, see Gary Evans, *Red Ink - The Budget, Deficit, and Debt of the U.S. Government*, pp. 17-18.

3 The summary provided above doesn't do justice to the complex reasons provided by Standard and Poor's for downgrading long-term U.S. Treasury debt. To read their own explanation in their own words, see Standard and Poor's Research Update, United States of America Long-Term Rating Lowered to 'AA+' On Political Risks and Rising Debt Burden, Outlook Negative, August 5, 2011.
The red candlestick shows that it was a very bad day for the *Dow*, recording a drop of 634.76, about 5.5%. It wasn't a record by any means, but any movement in the *Dow* of more than 300 points is going to be a notable day.

Note also that there is no upper wick on the candlestick, which implies that the *Dow* opened at its high for the day and fell relentlessly thereafter, closing very close to the low for the day, as made evident by the tiny wick on the bottom of the candlestick.

The is one more interesting phenomenon to observe - daily volume for the day was quite low, at 2.615 billion shares, about half of what it had been the previous Friday and well below the daily average for the previous year, 3.952 billion shares.

As Figure 7 indicates, this price/volume combination implied by the Supply and Demand graph is informative. It clearly indicates that the large August 8 sell-off was *not* due to a seller's panic, which would have been indicated by a large increase in volume in addition to the sharp drop-off in price.

In contrast, the terrible market decline that began in early October, 2007 and lasted until March 2009, which saw the *S&P 500* lose well more than 50% of its value, was accompanied by a very substantial rise in volume, which did indicate a panic sell-off. Figure 8 shows the peak and trough of this terrible cycle as measured by the *S&P 500* (remember that in other comparisons were using the *DJIA* - here...
we are using the broader index), and **Figure 9** shows the huge increase in share volume (for the 500 stocks that make up that index) during that period, showing both daily data and data smoothed by a 110-day moving average.

More typical of a supply-surge selloff would be the day represented by **Figure 10**, September 29, 2008, when the **S&P 500** fell 106.85 points, an amount equal to a staggering 8.8% of the index value (the **Dow** fell 777 points on the same day). On that day, again a Monday (and maybe there is a lesson in these Monday examples) volume swelled to 7.305 billion shares from 5.284 billion shares the previous Friday, in a year when daily volume averaged 5.018 billion shares for the stocks in the **S&P 500**. As a note of information, this particular collapse was also a product of partisan rancor in Washington, this time during the final months of the Bush administration. The House of Representatives failed to pass a $700 billion financial rescue package (eventually to pass and to be known at **TARP 1** for you political history buffs). And it wasn't the only news of the day. Rumors were circulating through the markets that several European banks needed government bailouts. Not too much should be made of this. Some of the highest volume days of 2008 saw little change in the index. For example, on October 10, 2010, a Friday, a volume record for the **S&P 500** was set at an astonishing 11.456 billion shares, but on that day the **S&P 500** index only fell 10.7 points.
899.22 (although on the following Monday it rose 104.13 points, a record). Obviously October 10 would be represented by Supply and Demand curves both shifting out about the same amount, raising volume substantially but leaving the index value largely unchained. Obviously this was a wild day with no clear consensus among traders, with as many optimists (bulls) as pessimists (bears).

Looking back at Figure 8 tells us that at that point the bears were right - the market as measured by the S&P 500 index had another 25% to fall.

**Supply and Demand Four-Quadrant Analysis**

These examples above suggest that looking at patterns of price movement and volume for any individual stock or for the market as a whole represented by an index might prove useful. The circumstances that produce a rising price on rising volume, such as the impact upon MMI stock of the Google acquisition effort shown in Figure 5 are of an entirely different nature than those the produce rising prices on falling volume, such as the decline in the DJIA shown in Figure 7.

**Figure 11 – Four-quadrant analysis, discussing likely scenario interpretations given the interactions between Supply and Demand the impact upon the Price and Volume pairing.**

<table>
<thead>
<tr>
<th>Quadrant II</th>
<th>Price change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price or index increase on falling volume, which implies relatively stable Demand while Supply recedes. Turnover is declining and investors are holding their portfolios. Probably a quiet news period.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Quadrant III</th>
<th>Price change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price or index drop on falling volume, which implies relatively stable Supply as Demand atrophies. This is a quiet, discouraged market, with distracted investors, relatively little news.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Quadrant I</th>
<th>Volume change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price or index surge on rising volume, which implies a strong surge in Demand relative to Supply. Very news-sensitive. Heavy momentum phases and speculative surges will be in this quadrant.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Quadrant IV</th>
<th>Volume change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price or index drop on rising volume, which implies a strong surge in Supply relative to Demand. Likely to be news-sensitive. This could represent panic sales or large portfolio shifts. Very dangerous.</td>
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</tbody>
</table>

**Figure 11** introduces four-quadrant analysis, which introduces scenario interpretations for the interaction between Supply and Demand and the impact upon the price and volume pair that are the result of that interaction.
For example, read the entry in Quadrant I of Figure 11. Quadrant I, whether reflecting an index or an individual stock, represents the market circumstance where the Demand curve shifts out strongly, producing a rise in both price and volume. The attempted Google purchase of MMI as shown in Figure 5, represents a Quadrant I event.

Quadrant IV, on the other hand, represents a price decline on rising volume, which implies a large surge in Supply at a time of relatively stable Demand. If substantial and sustained, the phenomenon might represent panic selling in a very bearish market.

The term Volume change referred to on the abscissa of Figure 11 is a relative term and will depend in part upon the market context where the analysis is being used. If referring to an index like the S&P 500 for example, Volume change might refer to average volume for a number of days compared to an annual volume average for the same index, such as the kind of volume comparison that was done in Figure 9. The period discussed in Figure 9, from October 9, 2007 to March 9, 2009, was a Quadrant IV episode, a sharply declining market over a number of months of rising volume, when comparing the 100-day moving average to the longer-term average.

In reference to a single stock on the other hand, Volume change will either refer to an increase in volume today relative to yesterday or a high volume today relative to a recent average daily volume.

Although quadrant analysis is limited in what it offers, here are a few generalizations that can be made about these four trading patterns.

**Quadrant I** - With both rising prices and rising volume, this represents the ultimate bull market, the environment that makes most retail investors happy. If sustained, this kind of price activity is potentially very profitable for even the smallest traders. This type of behavior, if sustained over time, is at the root of market momentum and sometimes even momentum ramps and runaway markets (which will be discussed in the next chapter), especially if the price being represented is a major index. When this is a short-run phenomenon, especially in reference to a single stock over one or two days of trading, the shock that moves this market into Quadrant I might be a significant news event. Although this is obviously a lucrative environment it can be dangerous if one dallies too long in a long position. Extremes in Quadrant I warrant diligent attention.

**Quadrant II** represents the happy prospect (usually) of rising prices, but in a quiet market with declining volume. For volume to be declining, Demand would have to be relatively stable while Supply is contracting. Remembering that Supply represents the potential selling activity of investors who already own the securities in question, this might represent a quiet period when investors are content with their existing portfolios, perhaps in part because they are earning dividends. Momentum markets and speculative bubbles - dangerous markets in general - are far less likely to be developing when markets are generally in this quadrant or near to ordinate axis (stable volume). This environment is typically less risky than Quadrant I, but also tends to be rather short-lived. Markets really don't tend to have sustained rallies in the face of declining volume.

**Quadrant III** also usually represents a quiet lackluster market. Potential sellers are relatively inactive, so Supply is stable, but Demand slowly decays for whatever reason, pulling down prices. If this is an individual stock the lack of interest is often because the company is doing nothing notable in earnings, or is not growing, and generally is attracting very little news interest. Poorly managed companies will often see their stocks in Quadrant III because the investing public is just losing interest.
This is a very serious affliction for smaller companies because they have trouble generating news attention anyway, but can also afflict even the largest and most recognizable names like Microsoft and Cisco if the companies appear to be stagnant in their technology or market development.

When referring to indexes on the other hand, Quadrant III behavior can be seen during troubling times when markets are very much in the news. Figure 7, which showed the S&P 500 falling sharply on a day of very low volume after the downgrade of U.S. Treasury long-term debt is one such example. Sometimes the demand atrophy can be attributed to the temporary absence of high-volume institutional traders, including algo traders, who disappear from the markets (essentially disappear from the bid queues), even if only for a few hours, during times of extreme uncertainty or duress.4

Finally, Quadrant IV represents the dreaded crashing market. Those who have stocks want to sell them, and although there is demand, buyers are bargain hunters, willing to buy only at prices that are depressed relative to recent prices. This is how bubbles and other momentum markets end, rising volume and falling prices. This perfectly represents the terrible bear market that was discussed above in Figure 8 and Figure 9. When prices begin to stabilize after one of these bear episodes, it will usually be accompanied by gradually declining volume.

**Final Words**

This chapter was meant to offer an elementary introduction to thinking about stock market performance in modeling terms. The usefulness of these models are of course limited. They tend to be a bit more useful for explaining what has already happened rather than what might happen next, and we are usually a lot more interested in the latter than the former.

Likewise the model has little to say about market **volatility**, the tendency of these prices oscillate back and forth, sometimes savagely, between gains and losses.

But the model is valid to some degree, because these are truly competitive markets and in such markets prices do reflect the ebb and flow, even when volatile and erratic, of supply and demand, or competition between players on the buying side and the selling side.

As stated in the introduction to this chapter, little was said about the variables (like corporate earnings) that affect supply and demand. We will return to that subject in Chapter 4, after we take a diversion to discuss how stocks are bought and sold.

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4 This institutional market behavior is a little advanced for this level of material and will have to go unexplained beyond what is said here. The lectures based upon this and later readings will elaborate on the role played by the algo traders in volatile markets. The expression "algo" is an abbreviation for algorithmic trading, which is ultra-high speed automated computerized trading with little or no human intervention. Algo trading patterns do affect volume hugely on some days. This material is advanced and is discussed more in Economic 136. For students who know what the term means, a "flash crash" is an extreme Quadrant III event caused by algo trading on a day of panic.