

The price-volume behavior of an equity: theoretical approach

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Dedicated to Ilkka Virtanen on the occasion of his 60th birthday

Abstract

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In spite of the fact that the technical analysis has been used for decades to analyse stocks and other commodities, the theoretical development in the area is very limited. The purpose of this article is to present the theoretical background for the price-volume behavior of a stock which is a well-known tool in technical analysis. The theoretical background stems from the supply and demand curves of the economics literature that are used to investigate how a particular market reacts to changes in supply or demand. By applying theory of supply and demand we build a theoretical background for important rules of technical analysis. Until now the justification of the rules has been purely empirical. Moreover, the theoretical background introduced helps to understand the dynamics of the equity market where the flow of information has an essential role. Since our analysis has only a few first steps for depicting the determination of equity prices by behavior of sellers and buyers, we hope that the article will encourage work in this important research area.

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1. Introduction

In spite of the fact that the technical analysis has been used for decades to analyse stocks and other commodities, the theoretical development in the area is very limited. Tools and methods in technical analysis are developed in practise and most of them are “ad hoc” in nature, lacking any theoretical justification. This is a serious drawback, since without

theoretical background we cannot know, for example, how a tool used to analyse stocks works as a stock market environment changes.

From the academic point of view the lack of theoretical background has been one of the key reasons why the academic research in the area is rather limited. Moreover, the research conducted is only able to answer the question whether some tool works in a specific market environment used in empirical analysis. Consequently, the results, without any theoretical justification, are basically valueless for the users of the technical analysis since the market conditions change all the time.

The situation, however, is changing in the academic research as the so-called behavior finance literature grows. In this area, the purpose is to investigate how and why different types of market participants are doing their trades in the market-place. This is important for the users of technical analysis since the methods used are based on market information, such as trading volumes, which is caused by the traders in the market place. I.e. trading behavior is behind the information used in technical analysis.

One example of this interesting research area is a study by Gervais, Kaniel, and Mingelgrin (2001) investigating whether the trading volume of a common stock can be used to predict stock returns. Based on the *visibility hypothesis* by Miller (1977) they argue that in future the stocks with higher (lower) than normal trading volume will have better (worse) returns than other stocks. The main point in the visibility hypothesis is not the trading volume itself, but instead the *visibility* observed in the trading volume. In other words, Miller (1977) states 'In theory, high volume does not indicate that the stock will rise and merely observing heavy trading volume should not cause anyone to buy. However, if the volume does attract attention and cause more people to look at a stock, some are likely to persuade themselves that the stock should be bought.' This indicates that as the visibility increases, especially for small firms, their stock prices increase. The empirical results by Gervais, Kaniel, Mingelgrin (2001) support the visibility theory.

The purpose of this article is to present the theoretical background for the price-volume behavior of a stock. This price-volume behavior is a well-known tool in technical analysis.

The theoretical background stems from the supply and demand curves of the economics literature which are used to investigate how a particular market reacts to changes in supply or demand.

2. Empirical criteria for the price-volume behavior of a stock

A common notion in handbooks of technical analysis (e.g. Elder 1993) is that increasing trading volume strengthens trend, i.e. increases the probability that the ongoing trend will continue. Conversely, falling trading volume signals that the current trend is going to reverse, i.e. the probability that a trend reversal is going to happen increases. More precisely we analyze four empirical price-volume rules generally used in the practice (see e.g. Young 2000). The rules are as follows:

1. Increasing volume on increasing price indicates possible price increase.
2. Increasing volume on decreasing price indicates possible price decline.
3. Decreasing volume on increasing price indicates possible price reversal or sideways movement.
4. Decreasing volume on decreasing price indicates possible price reversal or sideways movement.

These rules are frequently used in technical analysis. The rules are clear and consistent but they are difficult to use in practise. Much experience is needed to use them. This is partly because volume has rather a big random component. It can be seen in any graphic presentation, for example in Figure 1. We have drawn a grid and 20 days' moving average of volume for better visualization. Healthy uplegs and healthy downlegs should have increasing respective declining volume. According to Figure 1 a volume of Tietoenator from Helsinki Stock Exchange trend has been increasing until mid-November and then it has begun to decrease. After mid-November we have to follow prices very carefully. Uplegs should have increasing or big volume and downlegs should have decreasing or small volume. Not before last downleg in January can we see unhealthy development. It follows a downward breakout with increasing volume.

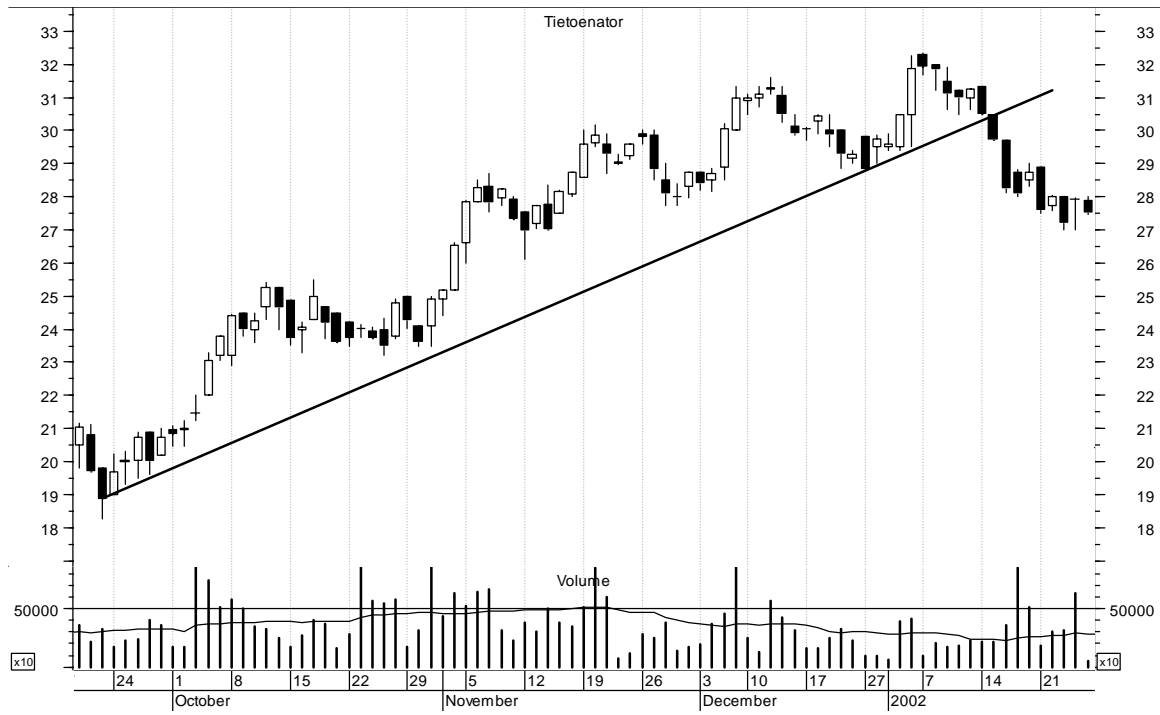


Figure 1. Tietoenator with increasing trend.

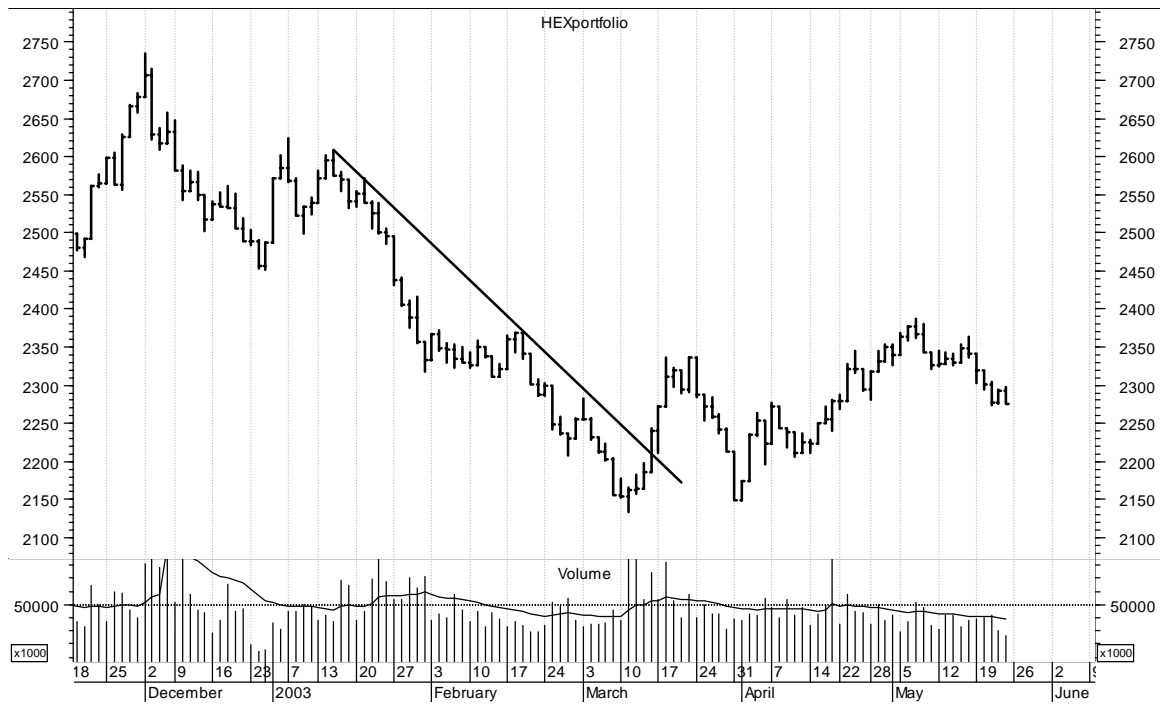


Figure 2. Hex portfolio index with a downtrend.

In Figure 2, the HEX portfolio index of Helsinki Stock Exchange has a volume trend that began to decrease from the beginning of February, signaling that the probability of a price trend reversal has grown. Trend breakout happens with increasing volume fairly soon after a volume trend has begun to increase.

These two examples are rather easy to interpret using four rules presented above and other knowledge about technical analysis. Usually a graph is much more difficult to interpret. In this article, the objective is to find a theoretical background for these four rules.

3. Supply and demand curves

In economics financial assets are considered as commodities. Supply and demand of an ordinary commodity is presented in Figure 3 (see any text-book in economic analysis, for example Varian 1999). The curve “Demand” represents the dependence of the demand on the price, *ceteris paribus* and the curve “Supply” presents the dependence of the supply on the price, *ceteris paribus*. Consequently, the interpretation of supply and demand curves is based on the idea that one curve moves and the other remains same, i.e. the equilibrium point moves to the right or to the left.

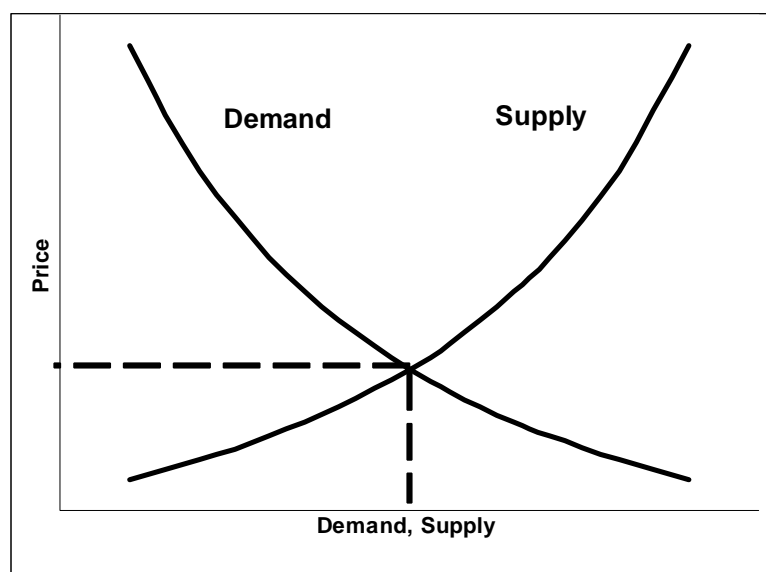


Figure 3. Typical demand-supply curves with an equilibrium point.

On asset markets, information arrives both during the trading day and overnight. As a consequence of this information arrival, the demand curve does not remain unchanged but changes. If the information is not very exceptional and the liquidity of the financial asset is high enough, the demand and the supply will be in equilibrium at the end of the trading day. Moreover, the daily changes will be approximately equal in size. If the supply is greater than the demand, the prices will fall from P_a to P_b as shown in Figure 4. If, on the other hand, the demand is greater than the supply, the prices rise from P_b to P_a . The problem is the fact that on financial markets supply and demand are not known in advance. There are always as many sales as purchases and consequently, the exchange trading volume does not help in clarifying, the supply-demand situation. A questionnaire survey could in principle be used to analyze the relation of demand and supply. In practice it is not a useful approach, however, and therefore, practical and theoretical considerations about price-volume behavior are needed.

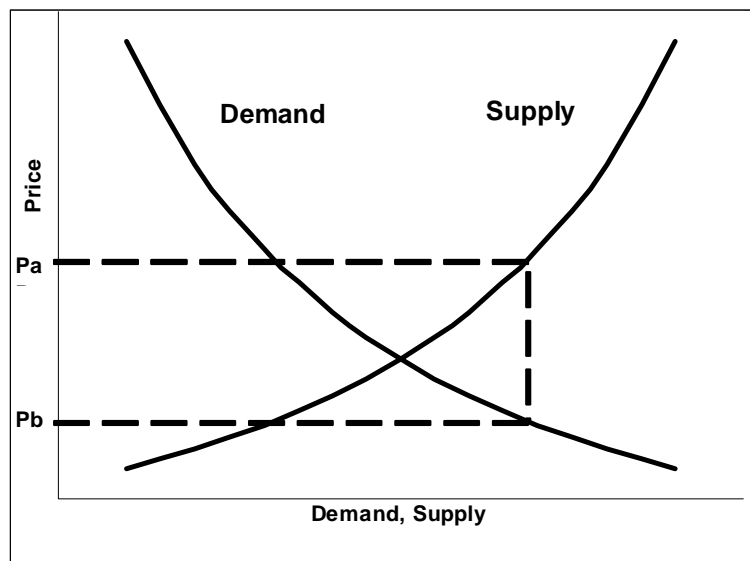


Figure 4. If supply is greater than demand the price falls (from P_a to P_b). If demand is greater than supply the price rises (from P_b to P_a).

4. Uptrend

Applying demand curves and supply curves to analyze the behavior of stock prices is problematic since along with the new information the curves may change. However, the

trend represents a certain form of stability. For this reason, the trend and its evolvement can be perhaps described and can be understood by analyzing the curves. It is assumed that no unexpected news regarding either the company or the macroeconomic environment is released. The stock becomes popular and new buyers appear in a steady flow. Demand leads to further demand and the trend continues as long as new buyers appear. Figure 5 illustrates the situation of the upward trend. As can be seen in the picture, the trading volume also increases. The trend in question is often called “a healthy trend” in technical analysis because the trend will with high probability continue. This corresponds to the first empirical criterion above. It is assumed that the supply curve remains the same. This will be a reasonable assumption provided that the time span is not too long, since in the case of a rising trend the buyers' behavior determines the price level. The demand curve changes quite regularly way while the supply curve stays the same. For the sake of simplicity the random component of the price as well as the cyclical component are ignored here and also in the future examinations. Figure 1 is a representative example of an empirical uptrend. To remove noise and cyclical variation in volume figures, the 20-day moving average is presented. The figure shows that the moving average increases from the turn of September-October, i.e. nearly from the beginning of the trend, to the end of November. This part represents the healthy part of the trend and indicates that the trend will continue.

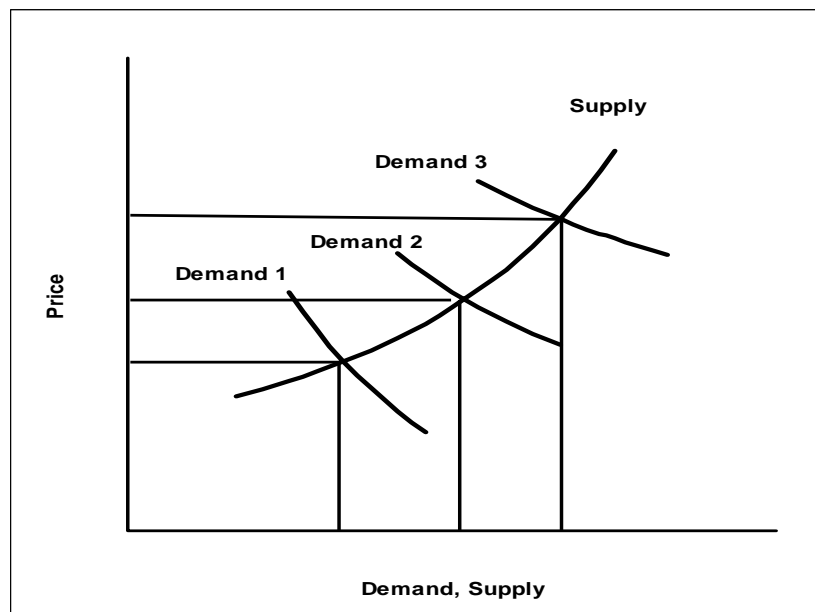


Figure 5. Healthy uptrend.

5. Downtrend

In the case of the downward trend the sellers are the ones who determine the trade price. When the market is decreasing, new sellers appear on the market in a steady flow. While nothing has essentially changed in companies, it is the attitude of the owners regarding the share which has changed. Figure 6 represents the case of a downward trend. The demand curve stays the same but the supply curve will change when the sellers' behavior determines the behavior of the financial asset prices. The figure again shows a stage of the healthy trend, the volume increases, in other words more sellers appear on the market. This corresponds to the second empirical criterion. Figure 2 shows the development of the HEX portfolio index as an example of a downward trend. It can be seen that the trend begins around the middle of January. At the same time, the trading volume increases and increases throughout January. This indicates that the trend is likely to continue. Figure 2 shows that the trend has still indeed lasted all through February.

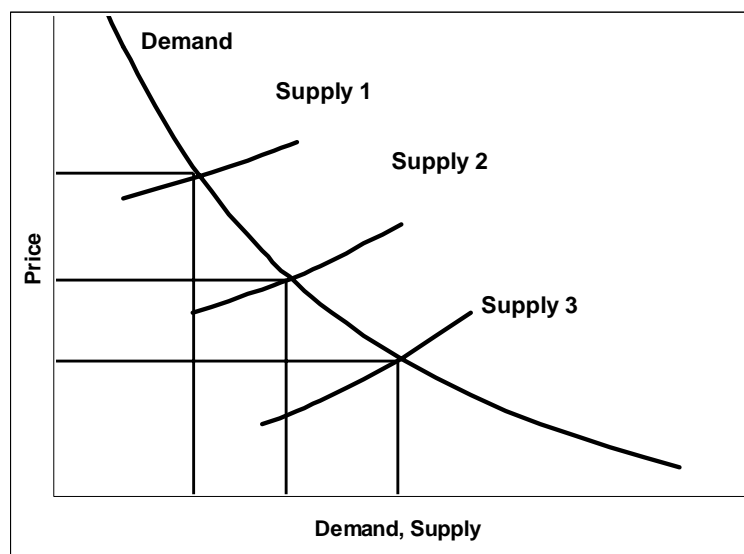


Figure 6. Healthy downtrend.

6. Ending of the uptrend

When a rising trend dominates, the new buyers flow evenly onto the market. It raises the price of a financial asset which in Figure 7 is seen as the transition of the demand curve.

At some stage of the upward trend, the share owners become aware of the rising trend of the stock. The share has become 'hot' or popular and the current shareholders become greedy and are not willing to sell at the price indicated by the current supply curve. This leads to the upward transition of the supply curve as presented in Figure 7. Soon the emergence of new buyers also will begin to decrease, which in the figure implies the smaller transition of the demand curve. From the figure it can be seen that the trading volume becomes smaller, which is in accordance with the third empirical criterion. When the investors start to extensively cash their stock positions, the stock price will begin to decrease. In our example (Figure 1) trading with Tietoenator becomes smaller from the middle of November to the middle of January, in which phase the trend line breaks.

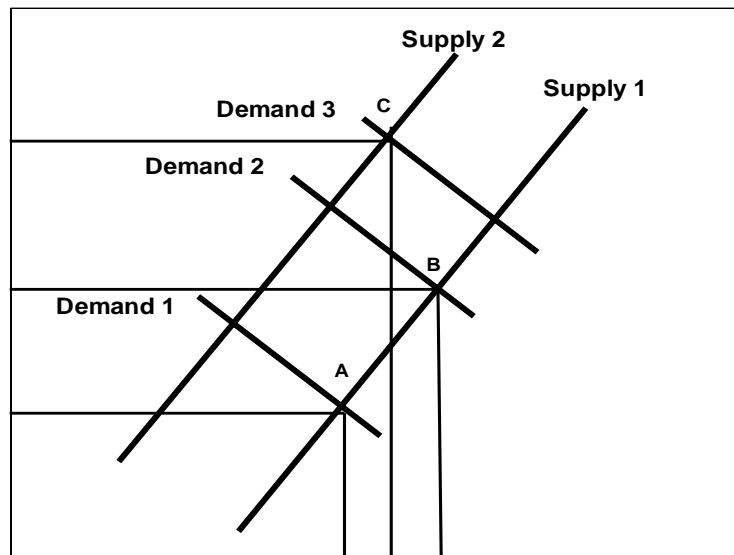


Figure 7. Ending of a uptrend.

7. Ending of the downtrend

The share will get a bad reputation after the downtrend has taken long enough and nobody will want to buy it. This leads to a decrease in the demand curve in Figure 8. Both price and volume decrease which is in accordance with the fourth empirical criterion. At some stage "wise money" considers the share underpriced and begins to buy it. At least the first stage of this phase is easily hidden by the pessimism on the market.

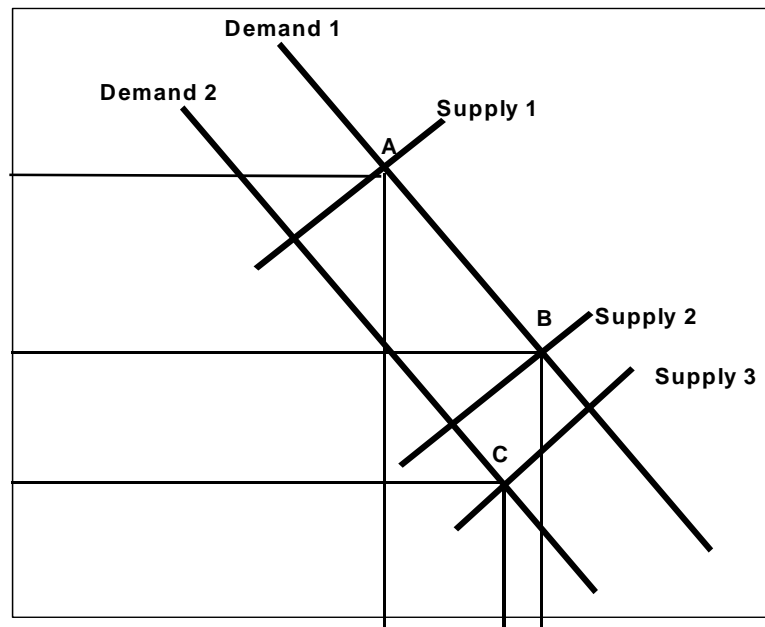


Figure 8. Ending of a downtrend.

8. Conclusions

This article has contributed the literature by presenting justification for four price-volume rules of technical analysis by using demand and supply curves from economics literature. In this way we have built a theoretical background for important rules of technical analysis. Until now the justification of the rules has been purely empirical. Moreover, the theoretical background presented helps to understand the dynamics of the equity market where the flow of information has an essential role. Since our analysis has only a few first steps for depicting the determination of equity prices by behavior of sellers and buyers, we hope that the article will encourage work in this important research area.

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