

Price & Volume, Digging Deeper

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When securities change hands on a securities auction market, the volume of shares bought always matches the volume sold on executed orders. When the price rises, the upward movement reflects demand exceeds supply or that buyers are in control. Likewise, when the price falls it implies supply exceeds demand or that sellers are in control. Over time, these trends of supply and demand form accumulation and distribution patterns. What if there was a way to look deep inside price and volume trends to determine if current prices were supported by volume. This is the objective of the Volume Price Confirmation Indicator (VPCI), a methodology that measures the intrinsic relationship between price and volume.

The Volume Price Confirmation Indicator or VPCI exposes the relationship between the prevailing price trend and the volume, as either being in a state of confirmation or contradiction, thereby giving notice of possible impending price movements. This paper discusses the derivation and components of the VPCI, and explains how to use the VPCI as a trend validation tool. We also review comprehensive testing of the VPCI, and presents further applications using the indicator.

In exchange markets, price results from an agreement between buyers and sellers to exchange, despite their different appraisals of the exchanged item's value. One opinion may have legitimate fundamental grounds for evaluation; the other may be pure nonsense. However, to the market, both are equal. Price represents the convictions, emotions and volition of investors.¹ It is not a constant, but rather is changed and influenced over time by information, opinions and emotions.

Market volume represents the number of shares traded over a given time period. It is a measurement of the participation, enthusiasm, and interest in a given security. Volume can be thought of as the force that drives the market. Force or volume is defined as power exerted against support or resistance.² In physics, force is a vector quantity that tends to produce acceleration.³ The same is true of market volume. Volume substantiates, energizes, and empowers price. When volume increases, it confirms price direction; when volume decreases, it contradicts price direction. In theory, increases in volume generally precede significant price movements. This basic tenet of technical analysis, that volume precedes price, has been repeated as a mantra since the days of Charles Dow.⁴ Within these two independently derived variables, price and volume, exists an intrinsic relationship. When examined conjointly, price and volume give indications of supply and demand that neither could provide independently.

Deriving the components

The basic VPCI concept is derived by examining the difference between a volume-weighted moving price average (VWMAs) and the corresponding simple moving price average (SMA). These differences expose information about the inherent relationship between price and volume. Although, SMAs demonstrate a stock's changing price levels, they do not reflect the amount of investor participation. On the other hand, with VWMAs, price emphasis is adjusted proportionally to each day's volume, and then compared to the average volume over the range of study. The VWMA is calculated by weighting each time frame's closing price with the time frame's volume compared to the total volume during the range:

*volume-weighted average = $\sum \{ \text{closing price } (I) * [\text{volume } (I) / (\text{total range})] \}$ where I = given day's action.*

This is an example of how to calculate a two-day moving average, using both the SMA and VWMA for a security trading at \$10.00 a share with 100,000 shares changing hands on the first day, and at \$12.00 a share with 300,000 shares changing hands on the second day. The SMA calculation is Day One's price plus Day Two's price divided by the number of days, or $(10+12)/2$, which equals 11. The VWMA calculation would be Day One's price \$10 multiplied by Day One's volume which is expressed as a fraction of the total range: $(100,000/400,000 = 1/4)$ plus Day Two's price \$12 multiplied by Day Two's volume of the total range expressed

as a fraction ($300,000/400,000 = 3/4$), which equals 11.5 (2.5 Day One + 9 Day Two)⁵.

The VWMA measures investor's commitments expressed through price, weighted by each day's corresponding volume (participation), compared to the total volume (participation) over time. Thus, volume-weighted averages weight closing prices in exact proportion to the volume traded during each time period. Keeping in mind how VWMA's work, an investigation of the VPCI may begin.

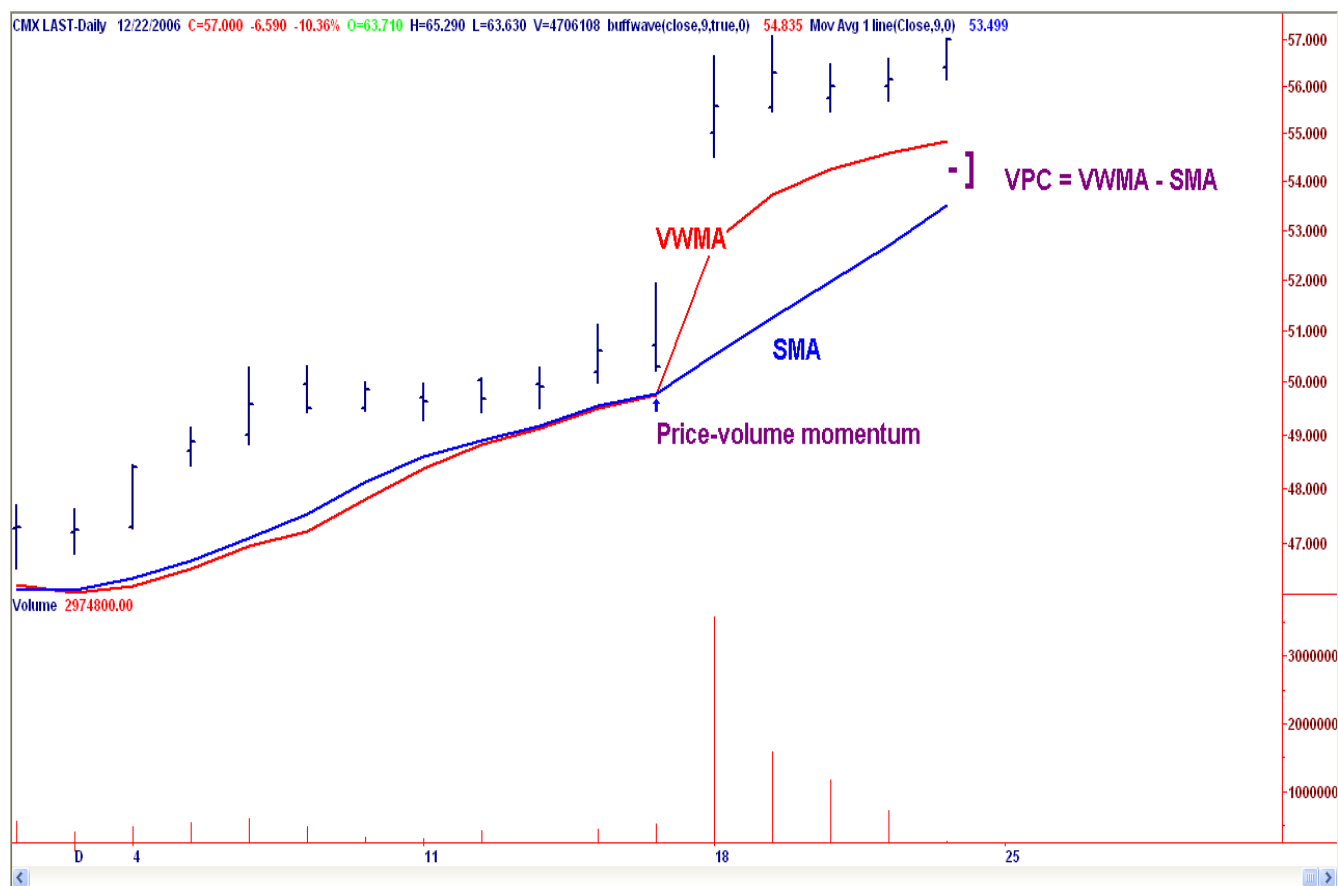
The VPCI involves three calculations:

- 1) volume-price confirmation/ contradiction (VPC+/-),
- 2) volume-price ratio (VPR), and
- 3) volume multiplier (VM).

VWMA volume-weighted moving average
VPC (+/-) volume/price confirmation/contradiction
VPR volume/price ratio
VM volume multiplier

The VPC is calculated by subtracting a long-term SMA from the same time frame's VWMA. In essence, this calculation is the otherwise unseen nexus between price and price proportionally weighted to volume. This difference, when positive, is the VPC+ (volume-price confirmation) and, when negative, the VPC- (volume-price contradiction). This computation is the intrinsic relationship between price and volume symmetrically distributed over time. The result is quite revealing. For example, a 50-day SMA might be \$48.5, whereas the 50-day VWMA may be \$50. The difference of 1.5 represents price-volume confirmation (VWMA - SMA). (see Chart 1) If the calculation were negative, then it would represent price-volume contradiction. This calculation alone provides purely unadorned information about the otherwise unseen relationship between price and volume.

Chart 1) $VPC = VWMA - SMA$



The next step is to calculate the volume price ratio (VPR). VPR accentuates the VPC+/- relative to the short-term price-volume relationship. The VPR is calculated by dividing the short-term VWMA by the short-term SMA. For example, assume the short-term time frame is 10 days, and the 10-day VWMA is \$68.75, while the 10-day SMA is \$55. The VPR would equal 68.75/55, or 1.25. This factor will be multiplied by the VPC (+/-) calculated in the first step. Volume price ratios greater than 1 increase the weight of the VPC+/- . Volume-price ratios below 1 decrease the weight of the VPC+/- .

The third and final step is to calculate the volume multiplier (VM). The VM's objective is to overweight the VPCI when volume is increasing and underweight the VPCI when volume is decreasing. This is done by dividing the short-term average volume by the long-term average volume. As an illustration, assume SMA's short-term average volume for 10 days is 1.5 million shares a day, and the long-term average volume for 50 days is 750,000 shares per day. The VM equals 2 (1,500,000/750,000). This calculation is then multiplied by the VPC+/- after it has been multiplied by the VPR. Now we have all the information necessary to calculate the VPCI. The VPC+ confirmation of +1.5 is multiplied by the VPR of 1.25, giving 1.875. Then 1.875 is multiplied by the VM of 2, giving a VPCI of 3.75. Although this number is indicative of an issue under very strong volume-price confirmation, this information best used with consideration of the price trend and relative to recent VPCI levels. Next, we discuss how to properly use the VPCI.

Table 1) Four quadrants of the price/volume relationship:

Price Expansion & Volume Expansion		Price Contraction & Volume Contraction	
Trend Up & Volume Rising Greed w/ Energy = Invigorated Greed <div style="text-align: center;"> Phase 1 Phase 2 Price 10 12 Volume 100 300 VWMA = .25 * 10 + .75 * 12 VPC = 11.5 (VWMA) – 11 (SMA) Price Trend +2 (Rising) -VS- VPC = +.5 (Rising) </div> Bullish <div style="text-align: right;"><i>Uptrend Confirmation</i></div>		Trend Down & Volume Falling Fear w/ Entropy = Apathy <div style="text-align: center;"> Phase 1 Phase 2 Price 12 10 Volume 300 100 VWMA = .75 * 12 + .25 * 10 VPC = 11.5 (VWMA) – 11 (SMA) Price Trend -2 (falling) -VS- VPC = +.5 (Rising) </div> Bullish <div style="text-align: right;"><i>Downtrend Contradiction</i></div>	
Trend Up & Volume Falling Greed w/ Entropy = Complacency <div style="text-align: center;"> Phase 1 Phase 2 Price 10 12 Volume 300 100 VWMA = .75 * 10 + .25 * 12 VPC = 10.5 (VWMA) – 11 (SMA) Price trend +2(Rising) -VS- VPC = -.5 (Falling) </div> Bearish <div style="text-align: right;"><i>Uptrend Contradiction</i></div>		Trend Down & Volume Rising Fear w/ Energy = Fear <div style="text-align: center;"> Phase 1 Phase 2 Price 12 10 Volume 100 300 VWMA = .25 * 12 + .75 * 10 VPC = 10.5 (VWMA) – 11 (SMA) Price -2 (Falling) -VS- VPC = -.5 (Falling) </div> Bearish <div style="text-align: right;"><i>Downtrend Confirmation</i></div>	
Price Expansion & Volume Contraction		Price Contraction & Volume Expansion	

Using the VPCI:

We have previously expressed price as the emotion, conviction and volition of investors. Logically, we could then also define a price trend as the emotion, conviction and volition of investors expressed over time. Generally, a buyer's underlying emotion or motivation is greed. Greed is the desire to obtain a profit. An uptrend could be viewed then as an accumulation of greed over time.

Many times, but not always, an investor who creates supply, a seller, is motivated by the fear of losing value in his investment. Likewise, a downtrend would then be the accumulation of fear over time. We also spoke of volume as the force that sustains price. Force implies energy. A rising volume trend would represent a buildup in energy or fuel. A decrease in volume would then represent the loss of fuel, nonworking energy or entropy.

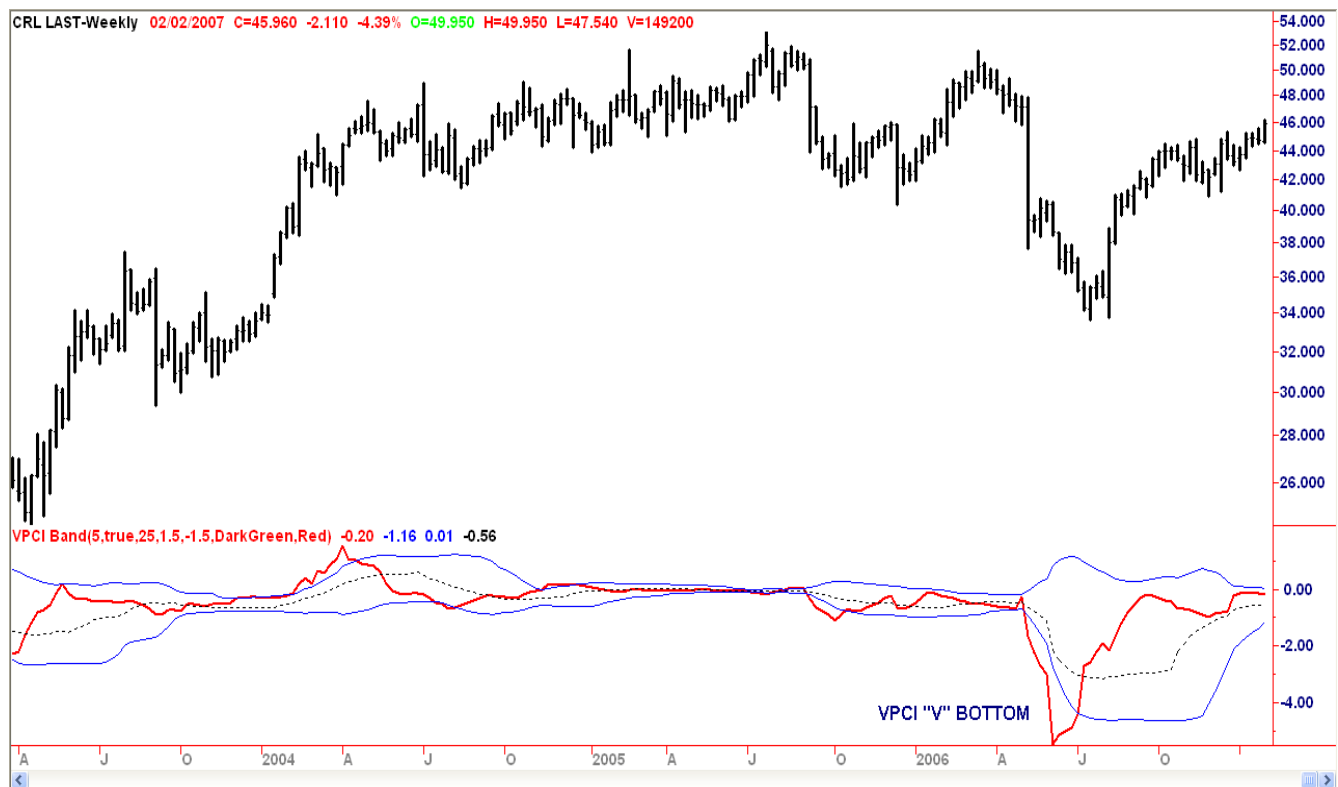
Greed or an uptrend needs fuel to build and sustain itself. Greed's growth cannot be sustained without energy. An investor will lose interest and move on to better opportunities. Whereas, an investor who is a seller, maybe bearish or fearful, but not necessarily. A seller could be motivated by greed and sell, allowing participation in a more lucrative investment. Or a seller could be motivated by greater emotions than greed, such as lust or personal responsibilities. In such cases, the investor will sell his investment to buy material pleasures or to satisfy his responsibilities. In this way greed (bulls) need fuel (volume) to expand but fear (bears) do not necessarily need volume to fall.

Confirming signals

Several VPCI signals may be employed in conjunction with price trends and price indicators. These include a VPCI greater than zero, which shows whether the relationship between price trends and volume confirms or contradicts the price trend.⁶ More importantly, a rising or falling VPCI, provides the trend direction of the VPCI, revealing the direction of confirmation or contradiction. And a smoothed volume-weighted average of VPCI called "VPCI smoothed" demonstrates how much the VPCI has changed from previous VPCI levels, and is used to indicate momentum. Bollinger Bands⁷ maybe also applied to the VPCI, exposing VPCI extremes.

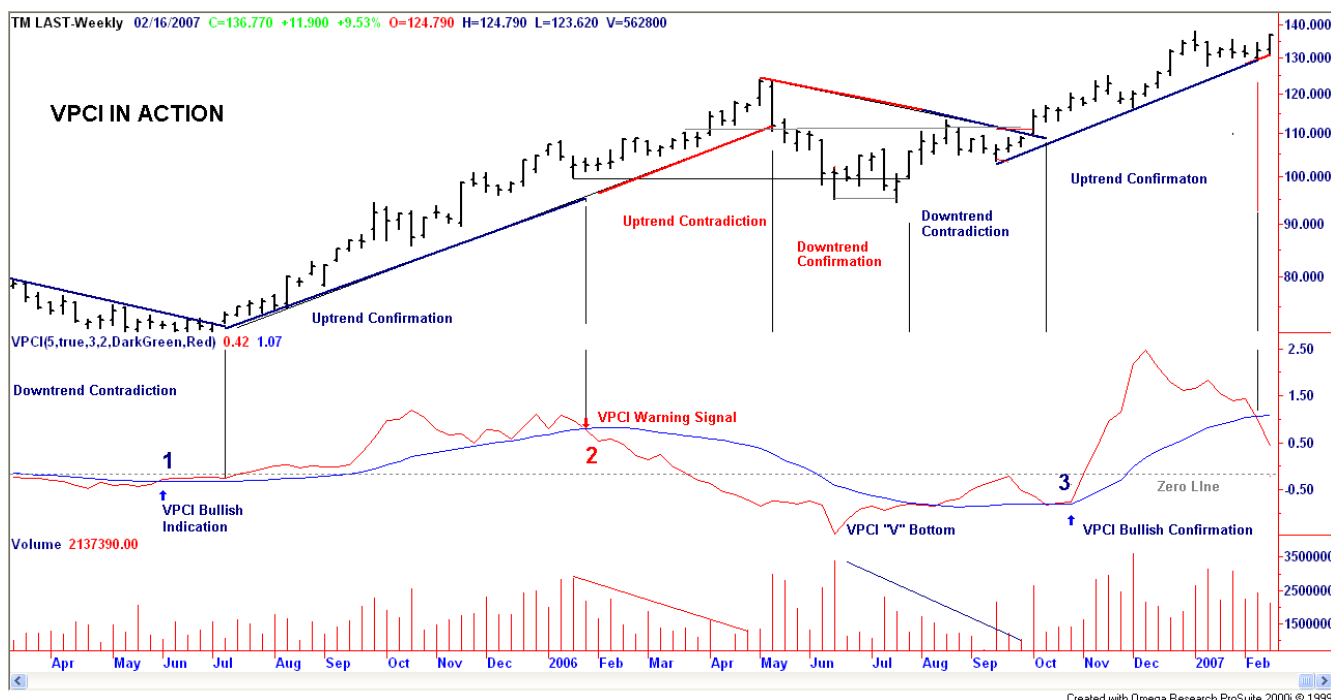
Fundamentally, the VPCI reveals the proportional imbalances between price trends and volume-adjusted price trends. An uptrend with increasing volume is a market characterized by greed supported by the fuel needed to grow. An uptrend without volume is complacent and reveals greed deprived of the fuel needed to sustain itself. Investors without the influx of other investors (volume) will eventually lose interest and the uptrend should eventually breakdown.

Chart 2. VPCI 'V' BOTTOM



A falling price trend reveals a market driven by fear. A falling price trend without volume reveals apathy, fear without increasing energy. Unlike greed, fear is self-sustaining, and may endure for long time periods without increasing fuel or energy. Adding energy to fear can be likened to adding fuel to a fire and is generally bearish until the VPCI reverses. In such cases, weak-minded investor's, overcome by fear, are becoming irrationally fearful until the selling climax reaches a state of maximum homogeneity. At this point, ownership held by weak investor's has been purged, producing a type of heat death capitulation. These occurrences may be visualized by the VPCI falling below the lower standard deviation⁸ of a Bollinger Band of the VPCI, and then rising above the lower band, and forming a “V” bottom.

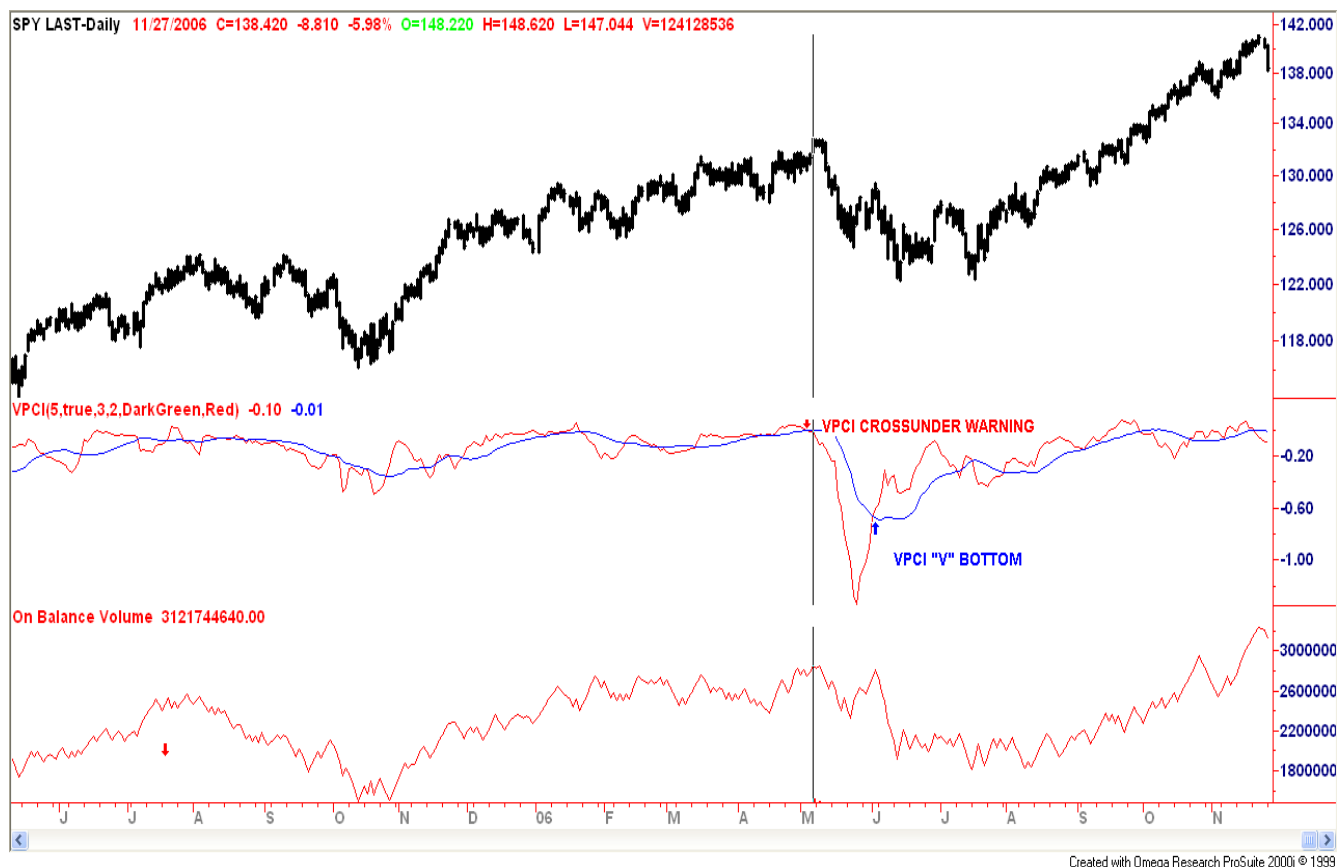
Chart 3: Putting it all together; an example of the VPCI in action



The objective of the VPCI is to assess the health of the current price trend. This information maybe useful in providing insights towards the forecasting of future price movements. Because volume movements often lead price movements, the VPCI may give indications before a price trend is evident. Thus, when a VPCI signal is given in an unclear price trend, it is best to wait until the trend becomes more apparent. As we begin a study of Chart 3, TM - Toyota Motor's stock price is steadily dropping in the spring of 2005. At Point 1 however, the VPCI (red line) breaks out above the VPCI smoothed (blue line) and then the zero line. TM immediately follows, reversing the previous downtrend. Between Points 1 and 2, TM's price and the VPCI rise together, confirming a bullish price trend. Later, the VPCI begins to fall during TM's uptrend, suggesting complacency. At Point 2 when TM is trading near \$100, the VPCI crosses underneath the VPCI smoothed line warning of a possible pause or an impending breakdown within the new uptrend. This is a classic example of a VPCI bearish contradiction signal, signifying an unhealthy uptrend. As TM breaks down in a confirmed downtrend during the summer of 2006, the VPCI makes an interesting “V” bottom, a pattern that often indicates the washing out of weaker shareholders. Notice the volume spike forming the center of the “V” formation. As TM attempts to level, the VPCI rises above the VPCI smoothed line confirming the earlier “V” bottom capitulation signal and thus moving TM into the bullish downtrend contradiction phase. At this point, TM has returned to \$100, the same price level as when the VPCI gave a warning signal given at point 2. Upon reaching point 3, TM clearly breaks through the downtrend and breaks above overhead resistance, while being accompanied by another VPCI bullish crossover, hence returning TM back to a healthy bullish confirmed uptrend. Finally by mid February of 2007, as TM's price approaches \$137, we see another VPCI warning signal suggesting another pullback maybe again looming for TM as the VPCI line falls below the VPCI smoothed line.

⁸ A measure of the dispersion of a set of data from its mean. The more spread apart the data is, the higher the deviation.

Chart 4. The VPCI predicted the last major market pullback in May 2006

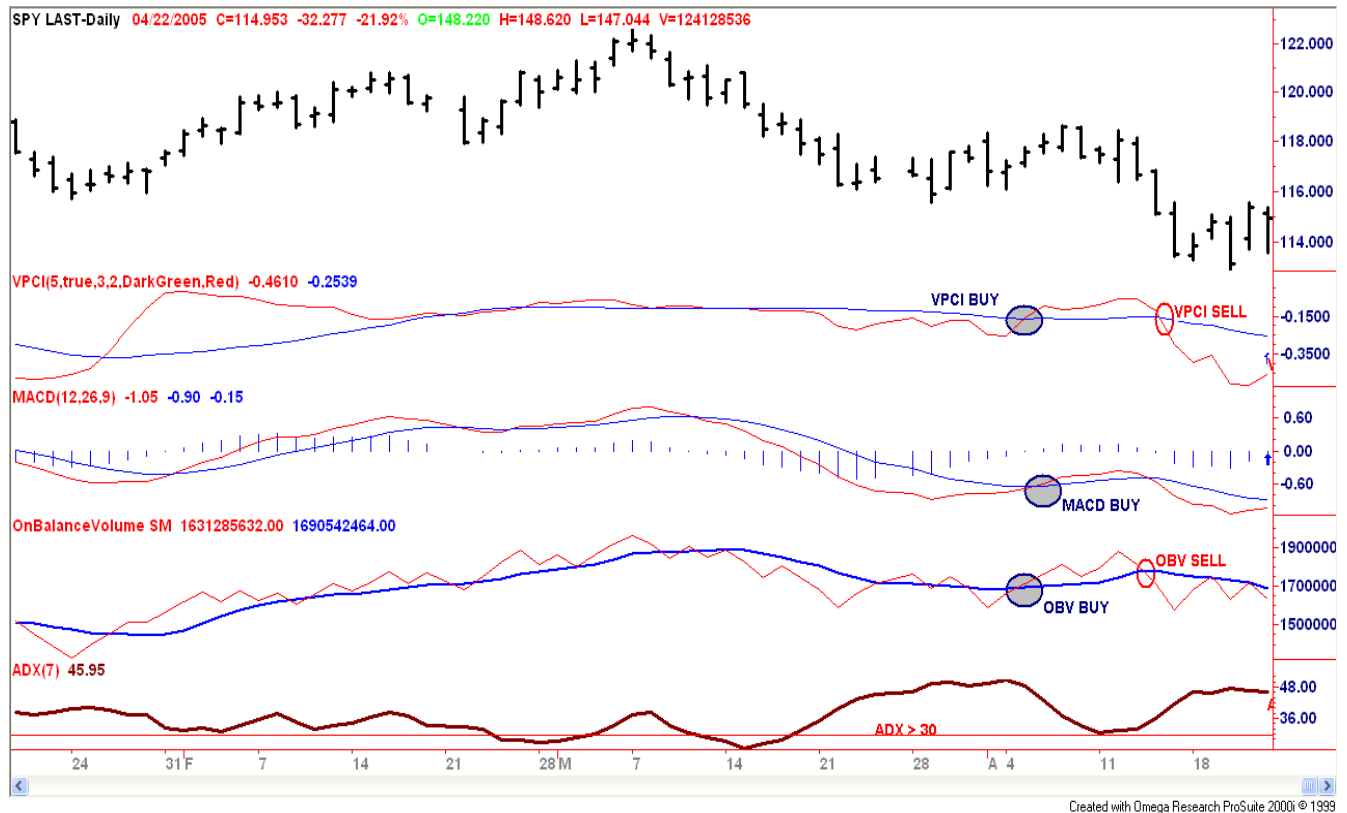


Comparing the VPCI to other Price Volume Indicators

There are many price-volume indicators one could use in comparison to the VPCI. However, the most acclaimed is Joe Granville's original on-balance volume (OBV) indicator.⁹ Recognizing volume as the force behind price, Granville, created OBV by assigning up days as positive volume (measured by an up close) and then subtracting volume on down days. OBV is price-directed volume, the accumulation of +/- volume flows based upon price direction. Granville's original objective with on-balance volume was to uncover hidden coils in an otherwise non-eventful, non-trending market.¹⁰ With his OBV indicator, Joe Granville, became a renowned market strategist. In so doing, he popularized OBV and the wisdom of using volume in securities analysis. Now, OBV is a standard application on charting software and there are many OBV practitioners. However, few are able to interpret the indicators indications as competently as Granville.

The VPCI differs from OBV in that it calculates the proportional imbalances between price trends and volume-weighted price trends. This exposes the influence volume has upon a price trend. Although both contain volume-derived data, they convey different information. In composition, the VPCI is not an accumulation of history like OBV but rather a snapshot of the influence of volume upon a price trend over a specified period of time. This enables the VPCI to give faster signals than accumulation indicators similar to an oscillator. In contrast to OBV, the VPCI's objective is not to uncover hidden coils in trendless markets, but to evaluate the health of existing trends.

Chart 5) VPCI / OBV comparison



Comparing the VPCI to OBV:

To illustrate the effectiveness and proper use of the VPCI, a test was conducted comparing the VPCI to OBV. The most general VPCI buy signal is when the VPCI crosses above the VPCI smoothed in an up-trending market. This indicates the VPCI is rising relative to previous VPCI levels. The traditional OBV does not have a lagging trigger like the VPCI smoothed, so I amended the OBV by adding an additional eight-period simple moving average of OBV. The net effect gives OBV a corresponding trigger to the VPCI smoothed. OBV crossovers of OBV smoothed would give indications of OBV rising relative to previous OBV levels. Remember, VPCI is designed to be used in a trending market, with a trending indicator. Thus we need two additional tools to complete this test. First, we'll need an indicator to verify whether or not we are in a trending market. A seven-period ADX (Average Directional Index by Welles Wilder) indicator fulfills this criterion by indicating an intense trend when ADX equals or is greater than 30.¹¹ Next, we will need a trend indicator to show the trend's direction. Gerald Appel's MACD (Moving Average Convergence Divergence) with the traditional (12, 26, 9) settings was used to provide buy entry signals for this test.¹² Finally, we will need a test subject which illustrates how these indicators work across a broad market. I can think of no better or popular vehicle for this experiment than the SPDR S&P 500; exchange traded fund. The testing period was conducted from inception (February, 1993) until the end of 2006. Standard specifications were used on both indicators (OBV – 28 day and VPCI 7/28 {7 day short-term trend & 7*4 day long-term trend}). Results were not optimized in any way. (Please note that the examples provided are for informational purposes only. This is in no way a solicitation or offer to the fore mentioned security.) In this system, long positions are taken only when the above conditions are met when accompanied by OBV crossovers in the first test, or by VPCI crossovers in the second test. Long positions are exited with crossunders of OBV smoothed in the first test or with VPCI crossunders in the second study. Although this test was created rather simplistically and traditionally for both observational and creditability purposes, the results are quite stunning.

Chart 6) SPY: On-Balance Volume Equity Curve

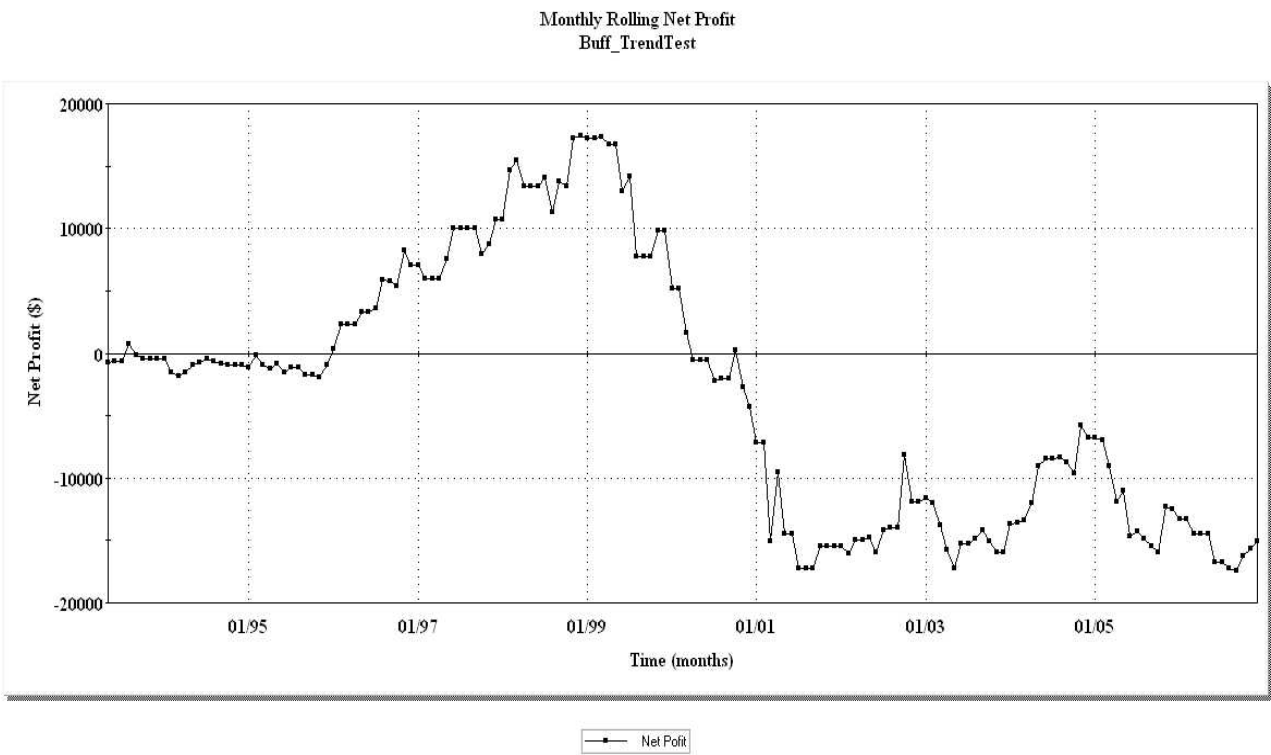
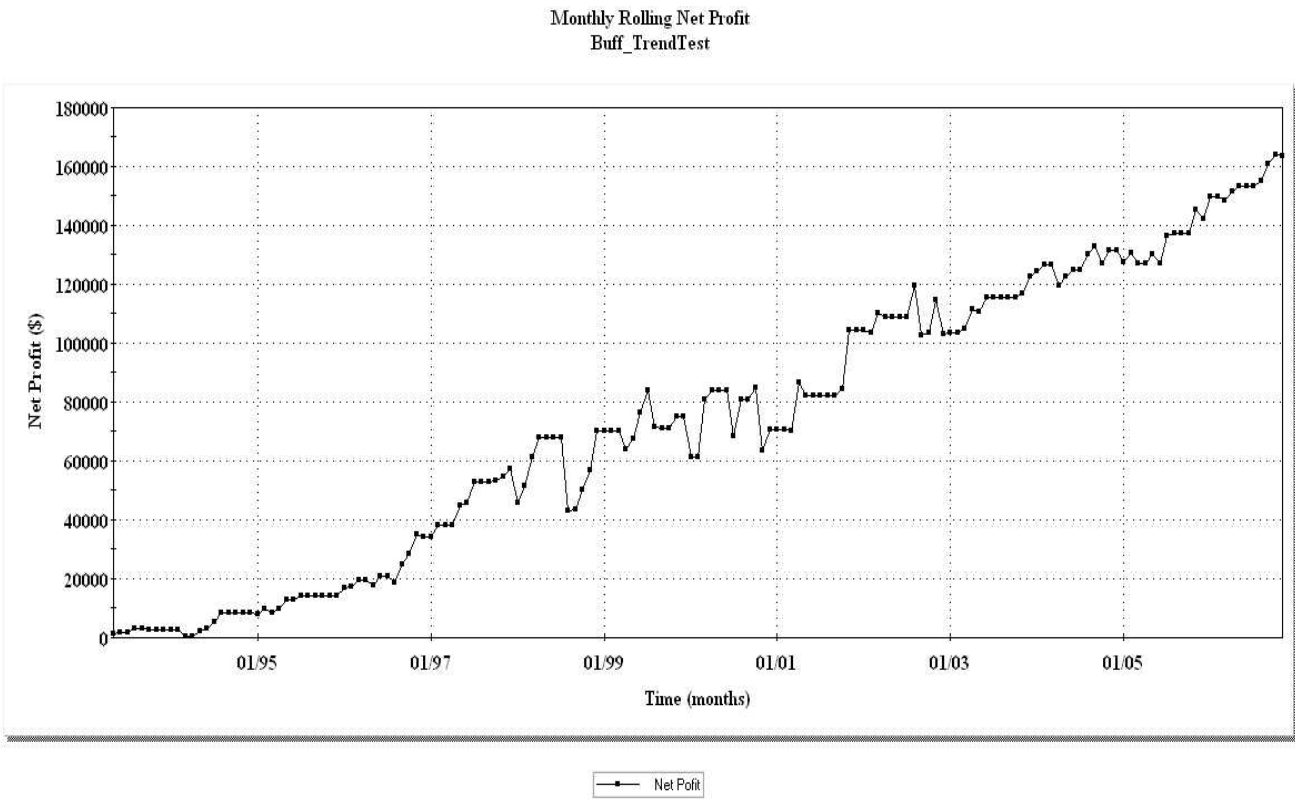


Chart 7) SPY: The VPCI Equity Curve



Excluding dividends or interest, OBV's annualized rate of return in the above system was -1.57%, whereas the VPCI's annualized return was 8.11%, an out-performance of over 9.5% annualized. The VPCI improved reliability, giving profitable signals over 65 percent of the time, compared to OBV at only 42.86 percent. Another consideration in evaluating performance is risk. The VPCI had less than half the risk as measured by volatility, 7.42 standard deviations compared to OBV with 17.4 standard deviations from the mean. It is not surprising, then that the VPCI had much better risk adjusted rates of return. The VPCI's Sharpe Ratio from inception was .70 and had a profit factor of 2.47, compared to OBV with a -0.09 Sharpe Ratio and a profit factor of less than 1. Admittedly, this testing environment is an uneven match. The VPCI uses information from volume-weighted prices to gauge the health of existing trends, whereas OBV accumulates volume flows as directed by price changes to uncover hidden coils. Thus the conditions setup in this system, a trending market with apparent price direction, is one in which the VPCI is designed to succeed. Although, OBV was not necessarily setup for failure either, this study does illustrate how less savvy practitioners often fail to use the indicators' information correctly or fail to coordinate the indicators properly.

Table 2: Comparing strategies' returns

Strategy*	Annual Return	Time invested	Std Dev	5yr Sharpe	% Profitable	Profit Factor
Buy Hold	9.94%	100.00%	17.75%	0.10	N/A	N/A
MACD	-3.88%	24.79%	13.03%	0.27	41.79%	0.97
VPCI	8.11%	35.63%	7.42%	0.74	65.15%	2.47
OBV	-1.57%	27.02%	17.40%	0.05	42.86%	1.00

*Dividends not included

What if an investor had just used the MACD buy and sell signals within this same system, without utilizing the VPCI information? In this example, this investor would have lost out on nearly 12% annualized return, the difference between the VPCI's positive 8.11% versus the MACD's negative -3.88% rate of return, while significantly increasing risk. What if this investor had just employed a buy-and-hold approach? Although this investor would have realized a slightly higher return, he/she would have been exposed to much greater risks. The VPCI strategy returned nearly 90% of the buy-and-hold strategy return while avoiding about 60% less risk as measured by standard deviation. Looking at risk-adjusted returns another way, the five year Sharpe Ratio for the SPDR 500 was only .1 compared to the VPCI system of .74. Additionally, the VPCI investor would have been invested only 35% of the time, allowing the investor the opportunity to invest in other investments. During the 65% of the time the investor was not invested, he/she would have only needed a 1.84% money-market yield to exceed the buy-and-hold strategy. Moreover, this investor would have experienced a much smoother performance, without such precipitous capital draw downs. The worst annualized VPCI return was only a measly -2.71% compared to the underlying investments worst year of -22.81%, more than 20% difference in the rate of return! If an investor had invested in a money-market instrument, while not invested in the SPDR S&P 500, this VPCI strategy would not have experienced a single down year.

Table 3) Annual returns by year

Strategy*	1993	1994	1995	1996	1997	1998	1999
Buy Hold	3.61	-2.21	34.95	20.1	31.44	27.04	19.11
MACD	0.31	5.42	0.88	12.63	14.72	-12.93	-30.6
VPCI	2.93	6.42	6.12	19.83	19.09	8.9	3.17
OBV	-1.03	-1.24	0	18.81	7.3	12.4	-12.43
Strategy*	2000	2001	2002	2003	2004	2005	2006
Buy Hold	-10.68	-12.87	-22.81	26.12	8.62	3.01	13.74
MACD	9.27	11.12	0.9	1.34	1.8	1.69	-11.32
VPCI	-2.71	21.28	-0.65	10.4	4.27	4.8	9.29
OBV	-26.55	-28.34	12.45	-12.79	33.32	-15.58	-8.33

*Annual rates of return w/out dividends

Other applications

Further testing not covered in this research report suggests the VPCI may be used broadly across most markets exhibiting clear and reliable price and volume data such as individual equities, exchange traded funds, and broad indices. The raw VPCI calculation may also be used as a multiplier or divider in conjunction with other indicators, such as moving averages, momentum indicators, or raw price and volume data. For example, if an investor has a trailing stop loss order set at the five-week moving average of the lows, one could divide the stop price by the VPCI calculation. This would lower the price stop when price and volume are in confirmation, increasing the probability of keeping an issue under accumulation. However, when price and volume are in contradiction, dividing the stop loss by the VPCI would raise the stop price, preserving more capital. Similarly, using VPCI as a multiplier to other price, volume, and momentum indicators may not only improve reliability but may also increase responsiveness as well.

Conclusion

The VPCI reconciles volume and price as determined by each of their proportional weights. This information may be used to deduce likelihood of a current price trend continuing or reversing. I believe this study clearly demonstrates that adding the VPCI indicator to a trend-following system resulted in consistently improved performance across all major areas measured by the study. It is my opinion that in the hands of a proficient investor, the Volume Price Confirmation Indicator is a capable tool providing information which may be useful in potentially accelerating profits, reducing risk and empowering the investor towards sound investment decisions.

Foot notes:

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