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Is Overreaction an Explanation for the Value Effect? A Study Using Implied Volatility from Option Prices

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Abstract

Many empirical studies document the value effect. One explanation is that investors overreact to growth aspects for growth stocks. We apply Stein's (1989) method to investigate whether the degree of overreaction differs between value and growth stocks using the implied volatility from option prices. A finding of overreaction for either value stocks or growth stocks would lend support to overreaction as an explanation for the value effect. Empirical results here indicate a stronger degree of overreaction for growth stocks.

Is Overreaction an Explanation for the Value Effect? A Study Using Implied Volatility from Option Prices

I. Introduction

Many empirical studies indicate that value stocks outperform growth stocks in the long term, either measured by total return or risk-adjusted return (e.g., Fama and French. (1992, 1996); Lakonishok, Shleifer, and Vishny, (1994); Bauman and Miller, (1997)). The explanations for the value stock effect however are not clear. Efficient market arguments (e.g., Fama and French, (1992)) suggest that small firms with low price-to-book ratio may be riskier and as a result command higher risk premium. On the other hand, the rationale behind value investing is that investors overreact to lack of growth opportunities for value stocks and/or they overreact to growth prospects for growth stocks (e.g., Graham (1962)); consequently value stocks may be under-priced while growth stocks over-priced. The issue has important implications for individual investors as well as institutional ones. For instance, Morningstar classifies mutual funds' investment styles into value or growth and small or large oriented. This study attempts to shed light on the overreaction explanation for the price-to-book effect by using the methodology first proposed by Stein (1989).

Stein (1989) analyzes the term structure of options' implied volatility to infer the degree of investor overreaction. Intuitively, if stock prices have a tendency to return to their long-term mean, long-term investors revise their expectations for future volatility to a smaller extent than their short-term counterparts. The expectation for future volatility can be inferred from option prices, commonly referred to as implied volatility. Therefore, implied volatility is the current consensus of anticipated future volatility by market participants and it reflects the market sentiment for the underlying security. Stein's (1989) empirical results using S&P 100 index options show that implied volatility for long-term options moves almost in lockstep with short-term options, thereby suggesting overreactions. However, Diz and Finucane (1993) and Heynen, Kemna, and Vorst (1994) show that the degree of overreaction is sensitive to statistical specifications and assumptions about the underlying stock return generating process.

This paper applies Stein's (1989) method to investigate whether the degree of overreaction differs between value and growth stocks. To the authors' knowledge, there is no similar research on this issue. One study that is somewhat related is the one by La Porta, Lakonishok, Shleifer, and Vishny (1997). They examine stock price reactions to earnings announcements and conclude that a significant portion (roughly one third of the first two years) of the return difference between value and growth stocks is explained by systematically more positive earnings surprises for value stocks. Bauman and Miller (1997) document similar findings. However, none of these studies directly infer investors' expectations.

A finding of overreaction for either value stocks or growth stocks could lend support to overreaction as an explanation for the value stock effect. Absence of overreaction could be interpreted as evidence that investors in various types of stocks are not fundamentally different, which is plausible considering that institutional investors hold a large portion of shares and are fairly diversified. The focus here is whether the degree of overreaction differs between value and growth stocks. Unless measurement problems are more severe for a particular group of stocks, these problems as indicated by Diz and Finucane (1993) and Heynen, Kemna, and Vorst (1994) would have little effect on the results here. Moreover, this study estimates implied volatility for individual stocks, as opposed to previous studies that use index options. The use of individual stocks allows for a richer set of testing. This paper assumes bull and bear markets separately as the implied volatility changes may vary across up and down markets.

II. Relevant Literature

II. 1 Value Stock Effect

Fama and French, (1992, 1996), Lakonishok, Shleifer, and Vishny, (1994) and Bauman and Miller (1997) document that value stocks produce higher returns than growth stocks in the U.S. stock market. Recently Beneda (2002) examines the performance of growth versus value stock portfolios created during the period 1983-1987. Consistent with prior studies, the five-year returns of value stocks exceed those of growth stocks. However, the long-term buy-and-hold returns (up to 18 years) of growth stocks are higher than those of value stocks for portfolios created during the years included in the study. Nevertheless, it is likely that, after a five-year run-up, some value stocks would be classified as growth stocks. Furthermore, her time period mainly covers 1990s, a period when growth stocks perform exceptionally well. The stock returns are not adjusted for market returns as well.

In addition to the considerable empirical research for the U.S. stock market, some studies compare the performances of value and growth stocks in the stock markets in other countries. Value and growth stocks may perform differently in non-U.S. markets because of the variations in investors' behavior and/or market conditions. For example, Bauman (1996) observes that the availability, quality, and timeliness of research information vary substantially from one country to another. Capaul, Rowley, and Sharpe (1993), using price-to-book ratios (P/Bs), find that value stocks outperformed growth stocks in France, Germany, Japan, and the United Kingdom in the 1981-1992 period. Fama and French (1998) conclude that value stocks tend to have higher returns than growth stocks in 12 of 13 major markets during 1975-1995 period and the difference between average returns on global portfolios of high and low book-to-market stocks is 7.6% per year.

Researchers have offered two primary explanations for the performance difference. Fama and French (1992, 1996) suggest that price-to-book and firm size may proxy for risk. Thus the fact that value stocks might be considerably riskier than growth stocks account for their superior return. However, Fama and French (1992) find evidence to the contrary - stocks with low price to book value ratios are characterized by lower betas. If beta represents the systematic risk of a stock, value stocks with low price to book ratios are supposed to have higher beta than growth stocks.

Lakonishok, Shleifer, and Vishny (1994) argue that investors erroneously extrapolate past earnings growth too far into the future and therefore cause stock prices to deviate from their 'fundamental' value. Future earnings of firms that recently performed badly - more likely to be relatively small and have a high book-to-market ratio - are underestimated, whereas growth stocks or large stocks are overestimated. Based on the stock price reactions around earnings announcement for value and growth stocks over a five-year period after portfolio formation, La Porta, Lakonishok, Shleifer, and Vishny (1997) find that a significant portion of return difference between value and growth stocks is attributable to earnings surprises that are systematically more positive for value stock, which is inconsistent with a risk-based explanation for the return differential. Instead, they argue that value stocks have been underpriced relative to their risk and return characteristics. Bauman and Miller (1997) enhance the argument by showing that investment research analysts systematically overestimate the future earning per share (EPS) of growth stocks relative to value stocks; as a result, growth stocks experience lower returns subsequently when realized EPS growth rates are disappointingly lower than those that were expected.[1]

The greater information asymmetry inherited in growth stocks can make growth stocks sensitive to changes in investor sentiment. Copeland and Copeland (1999) suggest an investing strategy that involves switching between value stocks and growth stocks. When the estimate of expected future volatility goes up, the

[1] Bauman and Miller (1997) observe that the EPS growth rate has a mean-reversion tendency, over time, in which the high growth rates associated with growth stocks subsequently tend to decline whereas the low growth rates associated with value stocks tend to increase.

rising uncertainty about the future might lead to falling confidence in growth stocks and investors shift into value stocks. When the estimated future volatility goes down, investors are likely to shift into growth stocks on the assumption that decreases in expected volatility signal rising confidence in the future, a condition that favors growth stocks. They find evidence supporting the effectiveness of the strategy.

II. 2 Term Structure of Implied Volatility

Stein (1989) examines the term structure of implied volatilities, using two daily time series on implied volatilities for S&P 100 index options over the period from December 1983 to September 1987. Based on the assumption that the volatility follows a mean reverting process with a constant long-run mean and a constant coefficient of mean reversion, changes in long-term implied volatility should be less than those of short-terms. Instead, he finds that implied volatility of long-term and short-term options move almost in perfect lockstep. That is, the correlation between long-term and short-term implied volatility is close to one. Therefore, he concludes that this presents evidence for overreaction.

Nevertheless, the conclusion has been disputed by Diz and Finucane (1993) and Heynen, Kemna, and Vorst (1994). Diz and Finucane (1993) indicate that the relation between long and short options cannot be constant. They use changes in implied volatility as opposed to the level of implied volatility and find no evidence for overreactions for S&P 100 stock in dex. Heynen, Kemna, and Vorst (1994) utilize one year's data on the European Option Exchange and the

Amsterdam Stock Exchange. They test restrictions on implied volatilities under mean reverting model, GARCH model and EGARCH model and find that their conclusion about overreaction depends on the model specifying the process of price volatility. EGARCH model gives the best description of asset prices and the term structure of options' implied volatilities and indicates no overreaction. On the other hand, assuming mean reverting and GARCH models, the evidence is in favor of overreaction. Nevertheless, they find that none of the models is misspecified, as a result they cannot reach defined conclusions on whether investors overereact to information. Poteshman (2001) examines whether the long-horizon overreaction documented by Stein (1989) in the OEX market is present in the S&P 500 (SPX) index options market in a later period. Employing a standard variance model, he separates daily changes in instantaneous variance into expected and unexpected parts and assumes investors respond to the unexpected part when they set option prices. The evidence indicates that SPX options market investors underreact to daily information and overreact to extended periods of mostly similar daily information and exhibit increasing misreaction to daily information as a function of the quantity of previous similar information.

In summary, the empirical results on the term structure of implied volatility of options are mixed and the underlying reasons for the different performance between growth stock and value stocks still remain an open question.

III. Theoretical Framework and Hypotheses:

Stein (1989) assumes that instantaneous volatility σ_t evolves according to continuous-time mean reverting AR1 process as follows.

(Equation 1)

$$d\sigma_t = -\alpha(\sigma_t - \overline{\sigma})dt + \beta\sigma_t dz$$

At time t, the expectation of volatility as of time t+j is given by

(Equation 2)

$$E_t(\sigma_{t+j}) = \overline{\sigma} + \rho^j(\sigma_t - \overline{\sigma})$$

Where ρ is the autocorrelation coefficient of implied volatility of short term stock options at a one-day lag. $\rho = e^{-\alpha} < 1$. That is, volatility is expected to decay geometrically back towards its long-run mean level of $\overline{\sigma}$.

Denoted by $V_t(T)$, the implied volatility at time t on an option with T remaining until expiration should equal to the averaged expected instantaneous volatility over the time span [t, t+T]. Using Equation 1, this implies

(Equation 3)

$$V_t(t) = \frac{1}{T}\int_{j=o}^{T}[\overline{\sigma} + \rho^j(\sigma_t - \overline{\sigma})]dj = \overline{\sigma} + \frac{\rho^T - 1}{T\ln\rho}[\sigma_t - \overline{\sigma}]$$

Suppose there are two options of different terms to maturity: a short term option with time to expiration T and implied volatility $V_t^S(T)$, and a long term option with time to expiration K, which is n days longer than T (K=T+n) and implied volatility $V_t^L(K)$, the following relationship is expected to hold.

(Equation 4)

$$(V_t^L - \overline{\sigma}) = \theta(\rho, T) * (V_t^S - \overline{\sigma})$$

Where

$$\theta(\rho, T) = \frac{T(\rho^{T+n} - 1)}{(T+n)(\rho^T - 1)}$$

θ represents the theoretical elasticity of the implied volatility of long term stock options with respect to that of the short-term option. Given a movement in the implied volatility of short-term option V_t^S, there should be a smaller movement in the implied volatility of long-term option V_t^L. The exact proportion depends on the mean reversion parameter ρ, as well as on the times to expiration of the two options.

The model is testable without knowing the long-run mean level of $\overline{\sigma}$ by simply running an OLS regression of V_t^L against V_t^S. The coefficient of V_t^S represents the actual elasticity of the implied volatility of long term option contract relative to that of short term one. If the empirical beta is greater than the theoretical beta, then the long-term contracts overreact to the short-term contracts.

If the difference between empirical beta and theoretical beta is greater for growth portfolio than for value portfolio, then there is a greater degree of overreaction in growth portfolio than in value portfolio, or vice versa.

The main hypothesis to be tested in the paper is that the average variation of implied volatility of growth stock options over time is higher than that of the value stock options. In particular, implied volatility of growth stock options may demonstrate a greater degree of overreaction.

IV. Data and Methodology

Daily option data from July 2000 to December 2002 provided by Prophet Financial System, a relatively comprehensive database after Berkley Options database became unavailable, are used for the study. The dataset include open price, close price, high and low prices, trading volume and open interests for call and put contracts of stock options. Daily stock data, interest rates, and accounting data are extracted from CRSP and Compustat.

We restrict the sample to stocks within S&P 100 index to ensure relatively active trading of each stock and a continuous time-series of implied volatility for analysis. A continuous time series of implied volatility is critical to calculate ρ, the autocorrelation coefficient of the implied volatility of short term option series, an input for the latter computation of theoretical theta. The theoretical theta will not be reliable if ρ is found from a discontinuous time series. In addition, without active trading in a stock option, the implied volatility would be constant, which is against the objective of the study, to compare the degree of changes in implied volatility between value and growth stocks. S&P 100 stocks meet the criterion of the study since they are widely traded and comprise of stocks with various growth aspects, which enable us to classify them into growth and value portfolios. In the case of any possible non-trading days for certain sample stocks, I delete the observation before building the equally weighted implied volatility series of value and growth portfolios.

The finance literature generally classifies value stocks and growth stocks according to the earning yield and book-to-market value ratios. Typically, value stocks are those whose market price is relatively low in relation to earnings per share (Basu 1977), cash flow per share (Lakonishok, Shleifer, and Vishny 1994), book value per share (Fama and French 1992), and dividends per share (Blume 1980 and Rozeff 1984). In comparison, growth stocks have been defined as having relatively high prices in relation to those same fundamental factors, as well as high past rates of growth in EPS.

However, there was no one variable that appeared to be better than the others in identifying value stocks that outperformed the market. In Lakonishok, Schleifer, and Vishny's (1994) study, price/cash flow appears to be an indicator of value that leads to more significant mean difference than price/earnings or price/book value. In Bauman, Conover and Miller's (1998) study, price/book value rather than price/earnings, price/cash flow, or dividend yield is the indicator of value that reports a more significant mean difference. Fama and French (1998) classify value and growth portfolios formed on four measures, book-to-market

(B/M), earning to price (E/P), cash flow to price (C/P) and dividend to price ratios (D/P) respectively. The value portfolio includes firms whose B/M, E/P, C/P or D/P are among the highest 30% for a country, and growth firms include firms in the bottom 30%. In this paper, we rank the S&P 100 stocks by their price to earning ratio (P/E). The top 30% is classified as growth portfolio, and the bottom 30% falls into value portfolio. The remaining 40% are eliminated.

The initial dataset of S&P 100 contains about ten million records over the sample period from 2000 to 2002. Eliminating 40% of the initial set, that is neither growth nor value stock, we end up with six million observations. Since there might be multiple option contracts with different strike prices matured on the same day and not all of them contain active trading records, we need to screen the dataset and retain one option contract with a relatively large number of observations for each sample stock each month and build continuous short term and long term series. The screening criterion is to retain the contracts with the least number of observations with the same open price, close price, high price, and low price. This enables retaining contracts with active trading for the calculation of implied volatility.

For the purpose of estimating implied volatility, we use the Binomial Option Pricing model by Cox, Ross and Rubinstein (1979). It explicitly accounts for the dividend yield on the stock option and for the possibility of early exercise to calculate the implied volatility. After deriving the implied volatility of individual stock, we create two time series for both value and growth portfolios. The short term series consists of observations with one day up to one month to expiration. The long term series consists of observations with thirty one days up to two months to expiration.

Moreover, for each time series implied volatility is calculated by averaging the implied volatility of call and put contracts near the money. Then we build the equally weighted implied volatility of value or growth portfolios by averaging out the implied volatility of all the stocks in value or growth portfolios on each day. Eventually we have a total of 648 daily observations for each series from July 2000 to December 2002 for analysis. The last step is to derive the empirical theta and compare it with theoretical theta. We run OLS regressions of V_t^L against V_t^S for each portfolio and also t tests.

V. Empirical results

Table 1 shows the descriptive analysis of the short term and long term series of value and growth portfolios for the full sample period and for each year. Mean, median, standard deviation, minimum, and maximum implied volatilities are reported. The mean and median implied volatilities of growth portfolio are overall higher than those of value portfolio for both short term and long term series. For the whole time period from 2000 to 2002, the mean short term implied volatility of growth portfolio is 48.86%, whereas that of value portfolio is 39.79%. The mean long term implied volatility is shown to be a bit lower than short term one with 47.44% for the growth portfolio and 38.01% for the value portfolio.

We also compare the level and daily changes of implied volatility of value and growth portfolios for both series over the sample period as shown in Chart 1, Chart 2, Chart 3, and Chart 4. The daily changes in implied volatility of growth portfolios are consistently higher than those of value portfolios throughout the sample period from 2000 to 2002. For both portfolios daily changes in implied volatility are larger in 2000 and 2001 than in 2002, consistent with the fact that stock market got volatile starting early 2000.

Assuming the stochastic process of implied volatility follows a mean reversion process decaying geometrically back to its long-term mean, the serial correlation properties of the instantaneous volatility σ_t are of interest to derive theoretical upper bounds for the elasticity of long-term implied volatility with respect to short-term implied volatility. The estimates of ρ for value and growth portfolios are listed in Table 2. ρ of value portfolio is 0.845, and that of growth portfolio is 0.793. They are used in calculating the theoretical beta. The daily implied volatility at each lag length is also reported.

The theoretical theta depends on both the decay parameter ρ and the time to expiration T of the short term option series. Thus it varies over a range of values. The theoretical thetas for value and growth portfolios as shown in Equation 5 are calculated and presented in Table 3. Three ρ values and six possible terms to expiration ranging from 5 days to 30 days are used to calculate the theoretical theta. As the long term option series in the study has one month longer time to expiration than the short term series, the theoretical theta value ranges from 0.1768 to 0.5236, getting larger as ρ gets larger given the same time to expiration. For example, when ρ is 0.9 and the short term option contract has 30 days to expiration, the theoretical value of theta is 0.5212. That is, if the long term options of a stock are priced rationally relative to the short term options, then when the short term volatility is one point above its mean, the long term implied volatility should be at most about 0.5212 percent above its mean.

Table 4 shows the results of OLS regressions of V_t^L against V_t^S to test whether the theoretical theta holds empirically, for the full sample period and for each year run separately. For the full sample period, the coefficients of growth portfolio and value portfolio are 0.751 and 0.641, higher than the average plausible theoretical thetas of 0.3666 and 0.3343 respectively. That is, the long term option series overreacts to short term series for both value and growth portfolios. The difference between empirical theta and theoretical theta is 0.3844 for the growth portfolio, and 0.3067 for the value portfolio. The growth investors overreact to a greater degree than value investors by 0.0777 during the full sample period. For each single year, the coefficients are higher than theoretical values for both value and growth portfolios as well. In particular, Growth portfolios appear to have a larger difference of thetas than value portfolios.

T tests in Table 5 enhance the regression results by comparing daily data of the empirical theta with the theoretical theta. The empirical thetas are found significantly higher than the theoretical theta for the full sample period as well as each single year. Overall, the evidence indicates that growth portfolios overreact to a larger extent than the value portfolios, consistent with overreaction as an explanation to the value effect.

VI. Conclusions

The empirical results from the comparison of the degree of overreactions between value and growth portfolios using implied volatility from option prices contributes to the existing literature as a support to overreaction as an explanation to the value effect. Investors holding different portfolios are fundamentally different and have different expectations on the future volatility of the portfolios. The findings for the sample period from 2000 to 2002 do indicate a relatively large degree of overreactions in growth stocks. This implies that investors are not well diversified, and instead overreact more to news for growth stocks than for value stocks. Future research is expected to cover the comparison from 1997 up to 2000 to find out whether the degree of overreaction of growth and value portfolios varies across the up and down markets.

Table 1: Descriptive Analysis of the Implied Volatility of Short Term and Long Term Option Series of Value and Growth Portfolios over the Sample Period from 2000 to 2002

(S) represents the summary of short term series of option contracts, and (L) represents the summary of long term series of option contracts.

Sample Period		Mean	Median	Standard Deviation	Minimum	Maximum
<u>Value Portfolio:</u>						
Full Sample						
	(S)	0.3979	0.3855	0.0716	0.1931	0.6785
	(L)	0.3801	0.3743	0.0663	0.2013	0.5937
2000						
	(S)	0.4075	0.3902	0.0940	0.2128	0.6785
	(L)	0.4058	0.4133	0.0856	0.2246	0.5937
2001						
	(S)	0.4029	0.4026	0.0696	0.1931	0.5686
	(L)	0.3783	0.3782	0.0595	0.2013	0.5203
2002						
	(S)	0.3883	0.3756	0.0589	0.2489	0.5874
	(L)	0.3693	0.3582	0.0583	0.2654	0.5552
<u>Growth Portfolio:</u>						
Full Sample						
	(S)	0.4886	0.4724	0.0812	0.2493	0.7472
	(L)	0.4744	0.4638	0.0659	0.2781	0.6751
2000						
	(S)	0.4752	0.4646	0.0965	0.2493	0.7090
	(L)	0.4650	0.4588	0.0757	0.2781	0.6751
2001						
	(S)	0.5188	0.5184	0.0824	0.3430	0.7386
	(L)	0.5011	0.5012	0.0671	0.3455	0.6555
2002						
	(S)	0.4649	0.4458	0.0600	0.3356	0.6429
	(L)	0.4523	0.4359	0.0480	0.3485	0.5685

Table 2:

Autocorrelation and Partial Correlation Coefficients for the Implied Volatility of Short Term Option Series of Value and Growth Portfolios for the Sample Period from 2000 to 2002

Implied daily ρ is the autocorrelation raised to the 1/n power, where n is the lag length in days.

Lag length (days)	Autocorrelation		Partial Correlation		Implied daily ρ
Value Portfolio:					
1	0.845	(0.087)	0.845	(0.088)	0.845
2	0.776	(0.087)	0.215	(0.088)	0.881
3	0.660	(0.087)	-0.135	(0.088)	0.871
4	0.595	(0.086)	0.060	(0.088)	0.878
5	0.548	(0.086)	-0.104	(0.088)	0.886
6	0.502	(0.086)	-0.005	(0.088)	0.891
7	0.480	(0.085)	0.060	(0.088)	0.900
8	0.453	(0.085)	0.340	(0.088)	0.906
Growth Portfolio:					
1	0.793	(0.087)	0.793	(0.088)	0.793
2	0.701	(0.087)	0.197	(0.088)	0.837
3	0.631	(0.087)	0.081	(0.088)	0.858
4	0.591	(0.086)	0.092	(0.088)	0.876
5	0.539	(0.086)	0.011	(0.088)	0.883
6	0.544	(0.086)	0.152	(0.088)	0.904
7	0.493	(0.085)	-0.054	(0.088)	0.904
8	0.476	(0.085)	0.055	(0.088)	0.911

Table 3:

Theoretical Value of $\theta(\rho, T) = \dfrac{T(\rho^{T+n} - 1)}{(T+n)(\rho^{T} - 1)}$

θ represents the theoretical elasticity of the implied volatility of long-term options with respect to that of the short term options. ρ is the autocorrelation coefficient of implied volatility of short term options series at a one-day lag, T is the time to expiration of the short term option, and the time to expiration of the long term option is n days longer than T. (n=30 days for the Table)

T = No. of days	ρ=0.7	ρ=0.8	ρ=0.9
5	0.1717	0.2124	0.3401
10	0.2573	0.2800	0.3782
15	0.3349	0.3455	0.4161
20	0.4003	0.4047	0.4530
25	0.4546	0.4563	0.4882
29	0.5000	0.5006	0.5212

Table 4:

Regressions of the Long Term Implied Volatility onto the Short Term Implied Volatility of Value and Growth Portfolios for the Sample Period from 2000 to 2002

Sample Period	**Coefficient**	**Standard Error**	**R^2**
Value Portfolio:			
Full Sample	0.641	0.026	0.479
2000	0.645	0.047	0.488
2001	0.620	0.037	0.525
2002	0.637	0.058	0.421
Growth Portfolio:			
Full Sample	0.751	0.012	0.856
2000	0.759	0.017	0.938
2001	0.723	0.024	0.786
2002	0.731	0.020	0.832

Table 5:

One-Sample T-test of Empirical Value of Theta in Comparison with Theoretical Value of $\theta(\rho,T)=\dfrac{T(\rho^{T+n}-1)}{(T+n)(\rho^{T}-1)}$ **for the Sample Period from 2000 to 2002**

Theoretical theta below is the average theta value for the corresponding sample period. $\theta(\rho,T)$ represents the theoretical elasticity of the implied volatility of long term options with respect to that of the short term options. ρ is the autocorrelation coefficient of implied volatility of the short term option series at a one-day lag, T is the time to expiration of the short term option, and the time to expiration of the long term option is n days longer than T.

Sample Period	Empirical Theta	Theoretical Theta	T-Stat	p-value
Value Portfolio:				
Full sample	0.641	0.3343	34.770	0.000
2000	0.645	0.3515	20.165	0.000
2001	0.620	0.3272	24.758	0.000
2002	0.637	0.3288	12.006	0.000
Growth Portfolio:				
Full sample	0.751	0.3666	45.565	0.000
2000	0.759	0.3768	26.047	0.000
2001	0.723	0.3612	35.262	0.000
2002	0.731	0.3669	20.513	0.000

Chart 1: A Comparison of the Level of Implied Volatility of Short Term Option Series of Value and Growth Portfolios over the Sample Period from 2000 to 2002

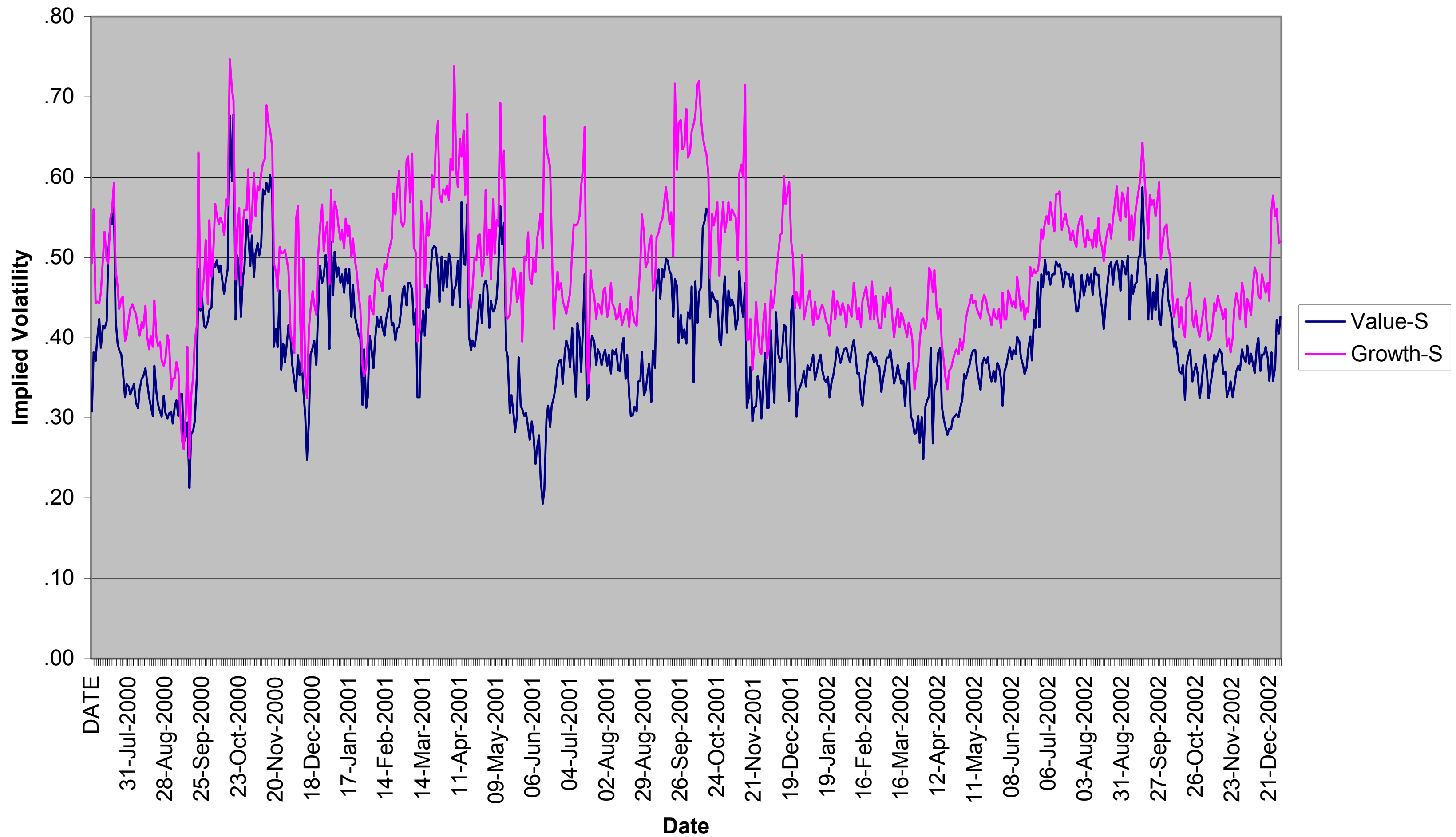


Chart 2: A Comparison of the Level of Implied Volatility of Long Term Option Series of Value and Growth Portfolios over the Sample Period from 2000 to 2002

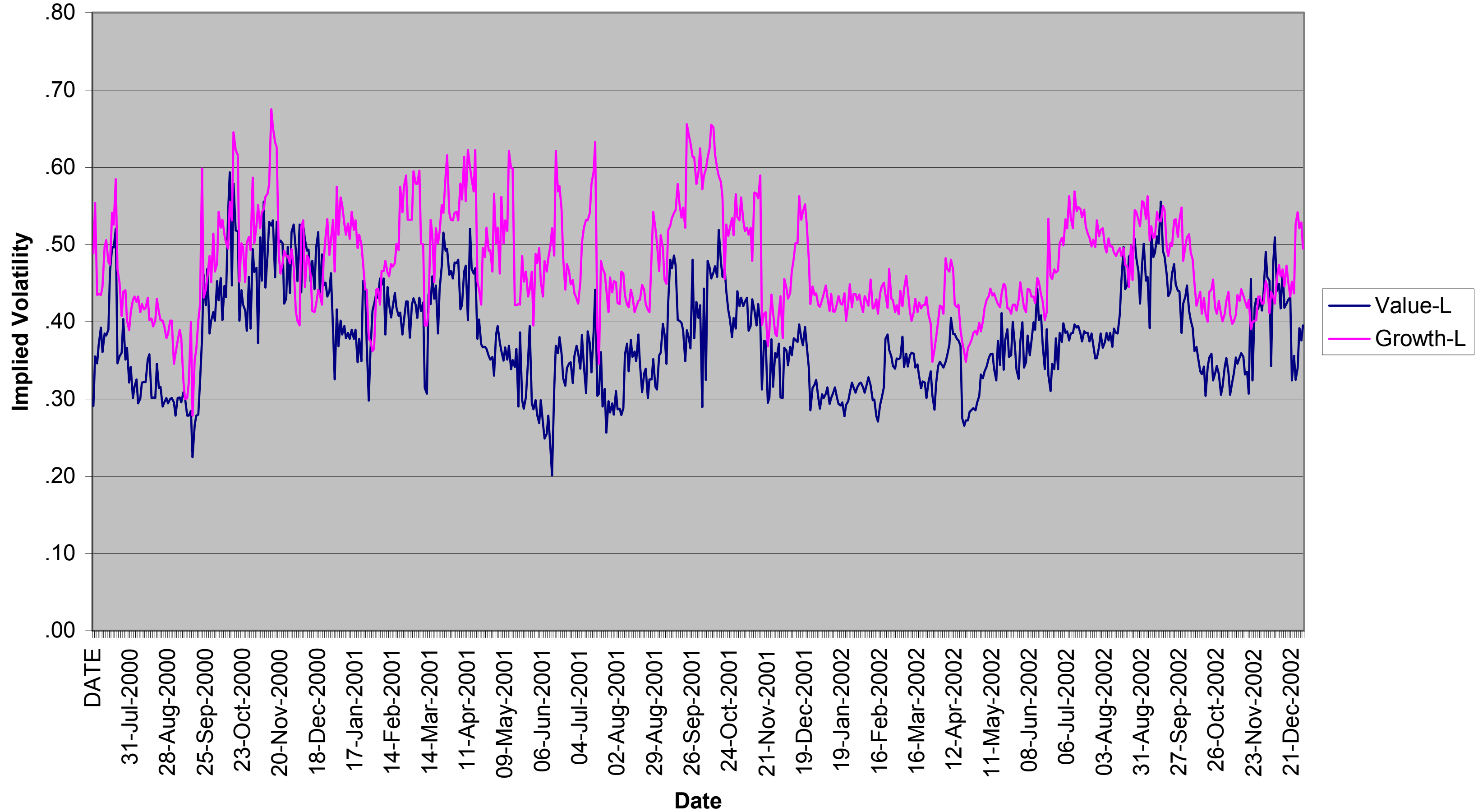


Chart 3: A Comparison of Daily Changes in Short Term Implied Volatility of value and Growth Portfolios over the Sample Period from 2000 to 2002

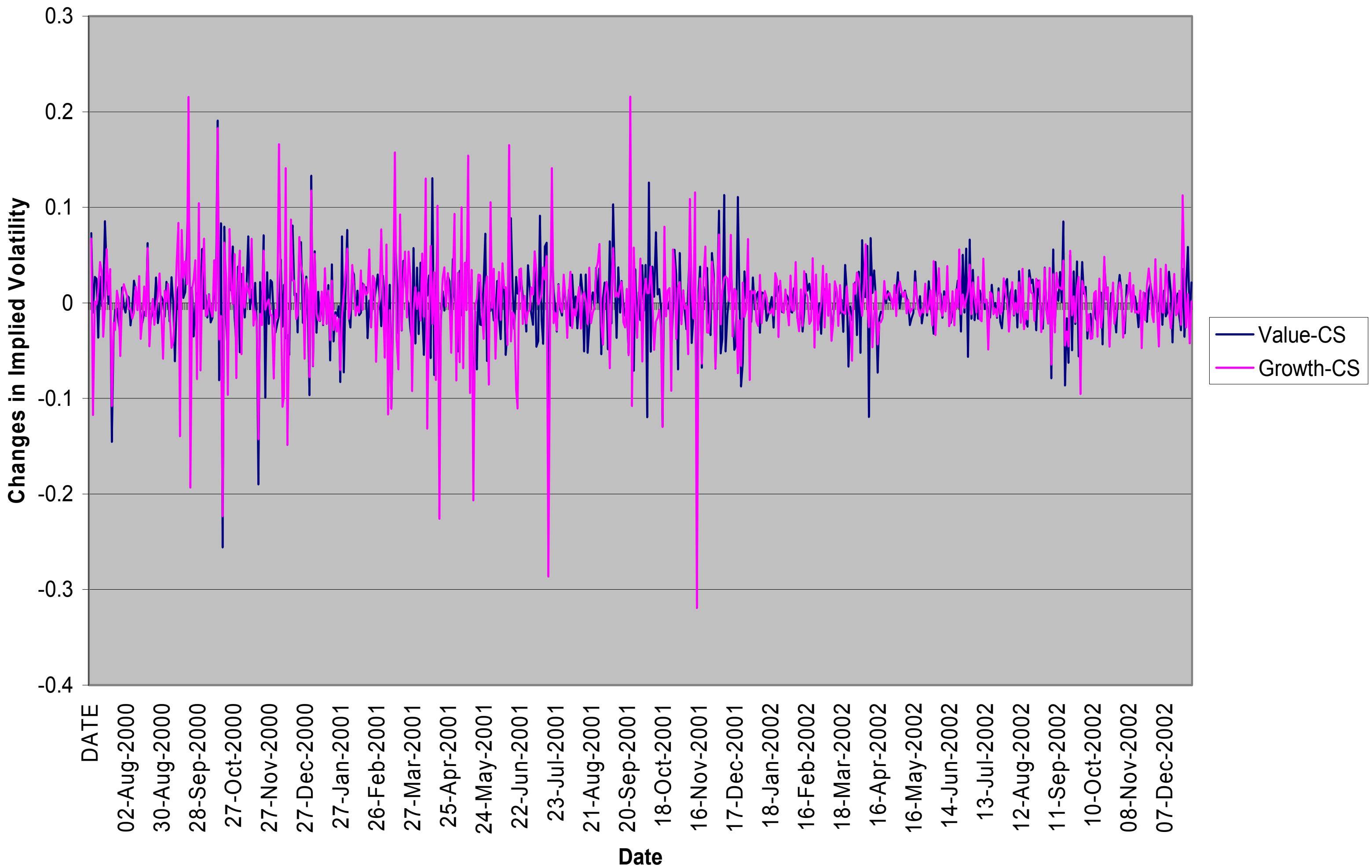
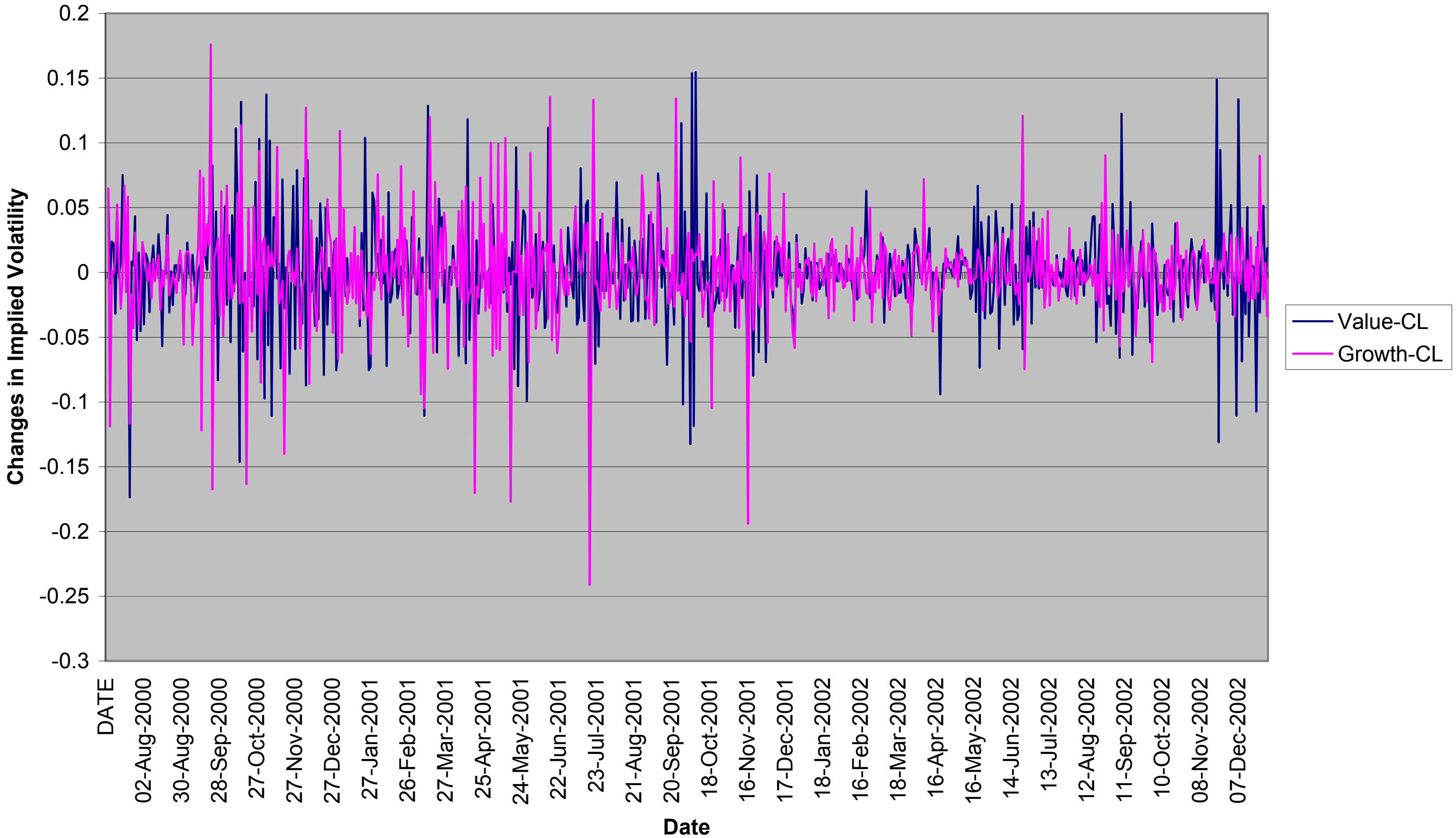


Chart 4: A Comparison of Daily Changes in Long Term Implied Volatility of Value and Growth Portfolios over the Sample Period from 2000 to 2002



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