

Dr. Heinz Kubli

# Feedback Effects from Dynamic Hedging on Selected Stocks

An Empirical Analysis in the Swiss Stock Market

G

Verlag Paul Haupt  
Bern - Stuttgart • Wien

# Table of content

<b>1.</b>	<b>Introduction</b>	<b>1</b>
1.1	Standard derivative pricing theory and newer models	2
1.2	Definitions	3
1.3	Processing	4
<b>2.</b>	<b>Black-Scholes pricing formulas</b>	<b>7</b>
<b>3.</b>	<b>Greeks</b>	<b>9</b>
3.1	Delta	10
3.1.1	Definition of delta	12
3.1.2	Dynamics of delta	14
3.1.3	Put-call-parity	16
3.1.4	Delta positions versus contract positions	17
3.2	Gamma	18
3.2.1	Definition of gamma	18
3.2.2	Dynamics of gamma	19
3.3	Theta	20
3.3.1	Definition of theta	21
3.3.2	Dynamics of theta	22
3.4	Relationship between delta, theta and gamma	24
3.5	Vega	25
3.6	Rho	26
<b>4.</b>	<b>Volatility</b>	<b>29</b>
4.1	Return distribution	31
4.2	Historical volatility	34
4.3	Exponentially-weighted historical volatility	36
4.4	Realised or actual volatility	37
4.5	Implied volatility	38
4.6	Forecasted volatility	38
4.7	Theoretical volatility	38
<b>5.</b>	<b>Random walk</b>	<b>39</b>
<b>6.</b>	<b>Hedging</b>	<b>43</b>
6.1	Hedge intention	43
6.2	Covered and dynamically hedged warrants	43
6.3	Black-Scholes replicating portfolio and delta hedging	44
6.3.1	Delta hedging	44
6.3.2	Variations of rebalancing	47

<b>7.</b>	<b>Hedging Error Simulations</b>	<b>49</b>
7.1	Derivation of the hedging error.....	49
7.2	Monte Carlo simulations of hedging errors	50
7.2.1	Rehedging once a day, once a week, . . . . .	59
7.2.2	Rehedging, when delta has changed X deltas	63
7.2.3	Rebalancing, when stock has moved X currency units	67
7.3	Gamma trading.....	72
7.4	Vega trading . . . . .	76
<b>8.</b>	<b>Considerations on hedging errors</b>	<b>77</b>
8.1	Outliers and skewness	77
8.2	Transaction costs. . . . .	79
<b>9.</b>	<b>Trading rules</b>	<b>85</b>
9.1	General optimisation	85
9.2	Optimizing gamma trading	86
9.3	Optimization for the warrants market maker	86
9.4	Consequence of trading rules	87
<b>10.</b>	<b>Dynamic asset allocation</b>	<b>89</b>
10.1	Constant-mix strategy.....	89
10.2	Portfolio Insurance.....	92
10.2.1	Constant Proportion Portfolio Insurance	92
10.2.2	Option-based portfolio insurance	94
10.3	Summary of dynamic asset allocation and the relation to the dynamic hedging of options.....	97
<b>11.</b>	<b>Data sources.....</b>	<b>99</b>
11.1	Warrants.....	99
11.1.1	Individual adjustments per underlying . . . . .	99
11.1.2	Estimation of warrants amount outstanding . . . . .	102
11.1.3	Reliability of warrants data . . . . .	104
11.2	Dividends . . . . .	104
11.3	Interest rates . . . . .	104
11.4	Implied volatilities . . . . .	105
11.5	Volumes	106

<b>12. Feedback effects.</b>	<b>107</b>
12.1 Problem set	107
12.2 Interdependence of volumes, delta and return	108
12.3 Measuring feedback effects	111
12.3.1 Events definitions;	111
12.3.2 Event windows.	115
12.3.3 Measuring abnormal returns	116
12.3.4 Summary of hypothesis.	116
12.3.4.1 Listing.	116
12.3.4.2 Expiration.	117
12.3.4.3 Large aggregated market gamma	118
<b>13. Feedback effects - empirical results</b>	<b>119</b>
13.1 Listing effects.	119
13.2 Expiration effects	125
13.3 Large aggregated market gamma effects	133
13.4 Conclusions.	137
13.5 Comparable studies	138
13.5.1 Listing of equity futures....	138
13.5.2 Expiration of equity futures.....	139
13.5.3 Listing of equity options.....	139
13.5.4 Listing of equity warrants.....	140
13.6 Further issues	140
<b>Appendix A:</b>	
<b>Profit and loss histograms from the replicating portfolio</b>	<b>143</b>
<b>Appendix B:</b>	
<b>Mathematica codes for hedge error simulations</b>	<b>157</b>
<b>Bibliography.</b>	<b>163</b>
Cited literature with quoted author	163
Cited literature without quoted author.	169
Cited homepages	170