

# OPTIONS AND HIGHER-ORDER RISK PREMIUMS

## OPTIES EN HOGERE-ORDE RISICOPREMIES

Thesis

to obtain the degree of Doctor from the

Erasmus University Rotterdam

by command of the

rector magnificus

Prof.dr. H.A.P. Pols

and in accordance with the decision of the Doctorate Board.

The public defense shall be held on Thursday,

23rd February 2017, at 15:30 hours

by

**Xiao Xiao**

# Contents

1	Introduction	1
2	The decomposition of jump risks in individual stock returns	7
2.1	Introduction . . . . .	7
2.2	Model . . . . .	11
2.2.1	Dynamics of market returns . . . . .	12
2.2.2	Dynamics of individual stocks returns . . . . .	16
2.2.3	Pricing Kernel and Expected Return . . . . .	20
2.3	Estimation Methodology . . . . .	23
2.4	Estimation Results . . . . .	25
2.4.1	Data . . . . .	26
2.4.2	Estimation Results for the market returns . . . . .	27
2.4.3	Estimation Results for the individual returns . . . . .	30
2.5	Pricing jump risk in the expected stock returns . . . . .	36
2.5.1	Decomposing the expected stock return . . . . .	39
2.5.2	Portfolio performance . . . . .	42
2.6	Conclusion . . . . .	45
2.7	Appendix . . . . .	46
2.7.1	Scaling Returns . . . . .	46
2.7.2	Derivation for conditional $\beta^i_{t t-1}$ . . . . .	47
2.7.3	Filter jump and diffusion terms from the market return	48

2.7.4	Filter jump and diffusion terms from individual stock returns . . . . .	49
2.7.5	Expected Return for the market and individual stocks . . . . .	50
<b>3</b>	<b>The entropy-based implied volatility and its information content</b>	<b>55</b>
3.1	Introduction . . . . .	55
3.2	The entropy-based implied volatility . . . . .	59
3.2.1	The maximum entropy method . . . . .	59
3.2.2	Constructing the confidence interval of the EBIV . . . . .	62
3.3	The performance of the EBIV: a numerical study . . . . .	64
3.3.1	Three methods for backing out implied volatility . . . . .	64
3.3.2	The underlying risk neutral distributions in the numerical study . . . . .	66
3.3.3	Results . . . . .	67
3.3.4	Robustness and discussion . . . . .	72
3.4	The information content of EBIV . . . . .	77
3.4.1	Data . . . . .	78
3.4.2	Descriptive statistics of different volatility measures . . . . .	81
3.4.3	Forecasting the stock market volatility . . . . .	86
3.4.4	Forecasting stock market returns . . . . .	92
3.5	Conclusion . . . . .	97
3.6	Appendix . . . . .	99
3.6.1	Calculation of the Model-free implied moments . . . . .	99
<b>4</b>	<b>Firm leverage and equity option returns</b>	<b>101</b>
4.1	Introduction . . . . .	101
4.2	Pricing Options on leveraged equity with endogenous default and jump risk . . . . .	107
4.2.1	Asset model . . . . .	109

4.2.2	Debt, equity and market value of the firm . . . . .	111
4.2.3	Delta-hedged returns of options on the levered equity .	112
4.2.4	Implications of the Propositions . . . . .	115
4.2.5	Simulations and implications of the model . . . . .	118
4.3	Data . . . . .	121
4.3.1	Option data and delta-hedged option return . . . . .	121
4.3.2	Stock and balance sheet data . . . . .	123
4.3.3	Summary statistics . . . . .	124
4.4	Cross sectional analysis of delta-hedged option return . . . . .	125
4.4.1	Average delta-hedged option return . . . . .	125
4.4.2	Delta-hedged option returns, size and leverage . . . . .	125
4.4.3	Controlling for volatility misestimation, idiosyncratic volatility and option illiquidity . . . . .	128
4.4.4	Delta-hedged return and the covenant effect . . . . .	130
4.4.5	The nonlinear effect of book leverage and asset volatility	133
4.5	Leverage-based trading strategy . . . . .	135
4.5.1	Double sorts on size and leverage . . . . .	136
4.5.2	Double sorts on asset volatility and leverage . . . . .	138
4.6	Conclusion . . . . .	140
4.7	Appendix . . . . .	143
4.7.1	Derivation of debt and equity value of the firm . . . . .	143
4.7.2	Proof of Proposition 1 . . . . .	145
4.7.3	Proof of Proposition 2 . . . . .	147
4.7.4	Details of the simulation procedure . . . . .	149
	<b>Summary</b>	<b>151</b>
	<b>Samenvatting</b>	<b>153</b>
	<b>Bibliography</b>	<b>157</b>