

# **In and Outside the Tails: Making and Evaluating Forecasts**

# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>Interquantile Expectation Regression</b>	<b>7</b>
2.1	Introduction . . . . .	7
2.2	Theory . . . . .	10
2.2.1	Definitions . . . . .	10
2.2.2	Identification . . . . .	12
2.2.3	Estimation . . . . .	15
2.2.4	Inference . . . . .	16
2.3	Simulation experiment . . . . .	19
2.3.1	Definition of the data generating process . . . . .	20
2.3.2	Descriptive statistics of parameter estimates . . . . .	22
2.3.3	Coverage rates of standard errors . . . . .	23
2.3.4	Alternative simulation settings . . . . .	25
2.4	Application I: Expected shortfall forecasting . . . . .	26
2.5	Application II: Abnormal return decomposition of size and momentum strategies . . . . .	33
2.6	Concluding remarks . . . . .	39
2.A	Mathematical appendix . . . . .	43
2.A.1	Proof of Lemma 2.1 . . . . .	43
2.A.2	Proof of Theorem 2.1 . . . . .	43
2.A.3	Proof of Theorem 2.2 . . . . .	46
2.A.4	Proof of Theorem 2.3 . . . . .	51
2.A.5	Proof of Theorem 2.4 . . . . .	53

2.A.6	Additional lemmas . . . . .	53
2.B	Additional tables . . . . .	56
<b>3</b>	<b>General Predictive Ability Tests of Equal Economic and Statistical Loss</b>	<b>59</b>
3.1	Introduction . . . . .	59
3.2	Illustrative scenarios . . . . .	62
3.3	Theory . . . . .	63
3.3.1	Unconditional predictive ability tests . . . . .	65
3.3.2	Conditional predictive ability tests . . . . .	69
3.3.3	Benchmarks . . . . .	72
3.4	Simulation studies . . . . .	73
3.4.1	Simulation study I: Expected utility of portfolio strategies . . . . .	73
3.4.2	Simulation study II: Tail quantile forecasts of portfolio returns . . . . .	75
3.5	Empirical results . . . . .	79
3.5.1	Expected utility of minimum-variance and equally-weighted portfolio strategies . . . . .	81
3.5.2	Tail quantile forecasts of equity portfolio returns from GARCH-DCC and Riskmetrics models . . . . .	81
3.6	Concluding remarks . . . . .	83
3.A	Mathematical appendix . . . . .	85
3.A.1	Additional lemmas . . . . .	85
3.A.2	Proof of Theorem 3.3 . . . . .	86
3.A.3	Proof of Theorem 3.4 . . . . .	89
3.A.4	Proof of Lemma 3.3 . . . . .	89
3.A.5	Proof of Lemma 3.4 . . . . .	91
3.A.6	Proof of Theorem 3.1 . . . . .	93
3.A.7	Proof of Theorem 3.2 . . . . .	93
3.A.8	Proof of Lemma 3.1 . . . . .	93
3.A.9	Proof of Lemma 3.1 . . . . .	94
<b>4</b>	<b>The Effect of Estimation Error on A Joint Out-of-Sample Test of Value-at-Risk and Expected Shortfall</b>	<b>95</b>
4.1	Introduction . . . . .	95

4.2 Theory . . . . .	97
4.3 Tests . . . . .	103
4.4 Monte-Carlo experiments . . . . .	105
4.5 Concluding remarks . . . . .	109
4.A Assumptions . . . . .	119
4.B Mathematical appendix . . . . .	120
4.B.1 Proof of Theorem 4.1 . . . . .	124
4.B.2 Proof of Corollary 4.1 . . . . .	126
<b>Nederlandse samenvatting (Summary in Dutch)</b>	<b>127</b>
<b>Bibliography</b>	<b>129</b>