The Role of Information Asymmetry and the Level of Market Trading Activity in Shaping the Time-to-Maturity Pattern of Futures Return Volatility

by

Phan Hoang Long

Dissertation submitted for the degree of Doctor of Philosophy (PhD), School of Accounting and Finance, Business School, The University of Adelaide.

January 2018
## TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TABLE OF CONTENTS</td>
<td>i</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>iii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>vi</td>
</tr>
<tr>
<td>SYNOPSIS</td>
<td>vii</td>
</tr>
<tr>
<td>DECLARATION</td>
<td>viii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>ix</td>
</tr>
<tr>
<td>1. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>2. THE IMPACT OF INFORMATION ASYMMETRY ON THE VOLATILITY PATTERN</td>
<td>13</td>
</tr>
<tr>
<td>2.1. Introduction</td>
<td>14</td>
</tr>
<tr>
<td>2.2. Related literature</td>
<td>19</td>
</tr>
<tr>
<td>2.3. Data and methods</td>
<td>244</td>
</tr>
<tr>
<td>2.4. Empirical results</td>
<td>322</td>
</tr>
<tr>
<td>2.4.1. The time-to-maturity pattern of information asymmetry</td>
<td>322</td>
</tr>
<tr>
<td>2.4.2. The impact of information asymmetry on futures return volatility</td>
<td>377</td>
</tr>
<tr>
<td>2.4.3. The speculative effect and the price elasticity effect</td>
<td>40</td>
</tr>
<tr>
<td>2.5. An illustrative model of return volatility when uninformed liquidity hedgers are unaware of their informational disadvantage</td>
<td>455</td>
</tr>
<tr>
<td>2.6. Robustness tests</td>
<td>499</td>
</tr>
<tr>
<td>2.7. Conclusion</td>
<td>633</td>
</tr>
</tbody>
</table>
3. THE LEVEL OF FUTURES MARKET ACTIVITY AND THE SENSITIVITY PATTERN

3.1. Introduction
3.2. Data and method
3.3. Empirical results
  3.3.1. The time-to-maturity pattern of trading volume and open interest
  3.3.2. The sensitivity pattern
  3.3.3. Peak-to-maturity
  3.3.4. The tilt of the sensitivity pattern and its impact on the linear test for the volatility pattern
  3.3.5. Practical implications
3.4. Conclusion

4. CONTRIBUTIONS, LIMITATIONS AND POTENTIAL FUTURE RESEARCH

4.1. Contributions and practical implications
4.2. Limitations and potential future research

5. CONCLUSION

APPENDIX
REFERENCES
LIST OF TABLES

Table 2.1: Descriptive statistics................................................................. 28

Table 2.2: Univariate tests of the relationship between information asymmetry and
time-to-maturity ..................................................................................... 33

Table 2.3: Testing the time-to-maturity pattern of information asymmetry without
controlling for seasonality and liquidity.................................................. 35

Table 2.4: Testing the time-to-maturity pattern of information asymmetry with
controlling for seasonality and liquidity.................................................. 36

Table 2.5: Testing the impact of information asymmetry and time-to-maturity on
return volatility ....................................................................................... 38

Table 2.6: The speculative effect and the price elasticity effect ...................... 41

Table 2.7: Testing the mediating role of information asymmetry on the return
volatility – time-to-maturity relationship when controlling for
autocorrelation in return volatility .......................................................... 50

Table 2.8: Testing the mediating role of information asymmetry on the return
volatility – time-to-maturity relationship using Huang and Stoll’s (1997)
adverse selection component of the bid-ask spread .............................. 54

Table 2.9: Testing the mediating role of information asymmetry on the return
volatility – time-to-maturity relationship using the Madhavan, Richardson
and Rooman’s (1997) information asymmetry component measured as
percentage of the bid-ask spread.......................................................... 56
Table 2.10: Testing the mediating role of information asymmetry on the return volatility – time-to-maturity relationship during the 2007-2009 crisis period

Table 2.11: Testing the mediating role of information asymmetry on the return volatility – time-to-maturity relationship after the 2007-2009 crisis period

Table 3.1: Summary statistics

Table 3.2: Testing the time-to-maturity pattern of trading volume and open interest

Table 3.3: Univariate test for the change in SENSITIVITY over the futures contract life

Table 3.4: Testing the sensitivity pattern

Table 3.5: Testing the sensitivity pattern using only news headlines containing the name of the commodity

Table 3.6: Analysing the shape of the time-to-maturity pattern of trading volume, open interest and SENSITIVITY

Table 3.7: Testing the linear volatility pattern

Table 3.8: Comparing the volatility of the closest-to-peak and the closest-to-maturity futures price series

Appendix Table 1: Specifications of commodity futures contracts

Appendix Table 2: Historical maintenance margin during the period 2003-2016
Appendix Table 3: Testing the sensitivity pattern using ten-minute realized volatility

Appendix Table 4: Testing the sensitivity pattern using the natural logarithm of the number of days to maturity as time-to-maturity
LIST OF FIGURES

Figure 1.1: Hong’s proposal of the time-to-maturity pattern of information asymmetry, the speculative effect (Samuelson effect), the price elasticity effect, and the overall effect ................................................................. 5

Figure 1.2: Average trading volume and open interest over the contract life for September wheat futures contracts traded during the period 2003-2016 ........................................................................................................7

Figure 2.1: The mediation framework to separate the speculative effect and the price elasticity effect .................................................................................................................. 30

Figure 2.2: The impact of the speculative effect on the time-to-maturity pattern of return volatility .................................................................................................................. 43

Figure 3.1: The sensitivity pattern ........................................................................................................ 81
I consider two explanations for the mixed empirical results on the Samuelson effect, which postulates that futures return volatility increases closer to maturity when the futures price becomes more sensitive to information flows. First, I empirically investigate Hong’s (2000) theoretical suggestion that information asymmetry has an impact on the time-to-maturity pattern of commodity futures return volatility (the “volatility pattern”) by testing the relationships information asymmetry has with the time-to-maturity and return volatility of commodity futures. I find that information asymmetry rises as commodity futures near maturity and that this increases return volatility. Thus, this “speculative effect” amplifies return volatility and can potentially be a more significant driver of the volatility pattern than Samuelson’s (1965) price elasticity effect.

Second, I directly examine the time-to-maturity pattern of the sensitivity of futures return volatility to information flows (the “sensitivity pattern”) and find that it has an inverted U-shape. I point out that the results for tests of a linear volatility pattern are more significant when the inverted U-shape of the sensitivity pattern tilts more towards maturity. As an example of the practical implication of my findings, I show that a futures price series constructed based on contracts that are closest to the peak of the sensitivity pattern captures higher volatility (9.98% in-sample and 2.63% out-of-sample) than the often used closest-to-maturity series.
DECLARATION

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

I give consent to this copy of my thesis, when deposited in the University Library, being made available for loan and photocopying, subject to the provisions of the Copyright Act 1968.

I also give permission for the digital version of my thesis to be made available on the web, via the University’s digital research repository, the Library Search and also through web search engines, unless permission has been granted by the University to restrict access for a period of time.

......................................................
Phan Hoang Long
ACKNOWLEDGEMENTS

I am extremely grateful to my principle supervisor, Professor Ralf Zurbrügg, for his invaluable help and supervision. He has been very patient and guided me through every step through my PhD program. The knowledge and skills I learnt from him are invaluable. Without him, this thesis would not have been possible. I want to extend my sincere gratitude to my external supervisor, Professor Paul Brockman, for his invaluable expertise and instruction. I sincerely thank Yessy Peranginangin, my co-supervisor, for his constant help and encouragement. I am grateful to Jeffrey Chia-Feng Yu for teaching me Finance Theory and helping me develop the theoretical model in this thesis. My special thanks to Associate Professor Dirk Boehe who has helped me to broaden my knowledge in international business. I also wish to thank George Mihaylov for proofreading this thesis.

I also owe a debt of gratitude to Professor Richard Russell and Ms Sandy McConachy for introducing me to the University of Adelaide and helping me apply for the Beacon of Light Scholarship. I wish to extend my gratitude to all the staff at the Adelaide Business School for their help and support, especially Chee, Gary, and Phương. I thank my fellow PhD friends, particularly Long, Sylvia, Emon, Sasha, Sherley, Jin, Thanh, Dừong, Dung and My, for their kindness.

Last but not the least, I would like to thank my family for their understanding and enormous support. Without them, I would not have been able to complete this thesis.