The Pennsylvania State University
The Graduate School
School of Information Sciences and Technology

MARKETS AS AN INFORMATION AGGREGATION MECHANISM FOR DECISION SUPPORT

A Thesis in
Information Sciences and Technology
by
Yiling Chen

© 2005 Yiling Chen

Submitted in Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

December 2005
## Table of Contents

List of Tables ................................................................. x

List of Figures ............................................................... xii

Acknowledgments ............................................................. xiii

Chapter 1. Introduction ..................................................... 1
  1.1 Problem Statement ................................................... 1
  1.2 Motivation ............................................................. 2
  1.3 Purposes of the Study ............................................... 4
  1.4 Thesis Organization ................................................ 4

Chapter 2. Background .................................................... 7
  2.1 Fundamentals of Information Markets ............................ 7
  2.2 Related Work ....................................................... 11
    2.2.1 Theoretical Examination .................................... 12
    2.2.2 Experimental Studies ....................................... 14
    2.2.3 Evidence from Online Information Markets ............... 15
    2.2.4 Information Market Design ................................ 17

Chapter 3. Theoretical Properties of Information Markets ........... 18
4.3.2 Private information ........................................ 61
4.3.3 Dynamic market model ................................. 63
4.4 Results ....................................................... 65
  4.4.1 Aggregated behavior .................................. 65
  4.4.2 Individual behavior .................................. 75
4.5 Summary .................................................. 83

Chapter 5. Empirical Analysis of Information Markets .................. 85
  5.1 Overview ................................................. 85
  5.2 Review of Opinion Pools ............................. 86
  5.3 How Information Markets Work ........................ 89
  5.4 Design of Analysis .................................... 91
    5.4.1 Data Sets .......................................... 91
    5.4.2 Methods of Analysis ............................ 95
      5.4.2.1 Deriving Predictions .......................... 95
      5.4.2.2 Performance Measures ....................... 99
  5.5 Empirical Results ................................... 100
    5.5.1 Performance of Opinion Pools .................. 100
    5.5.2 Comparison of Information Markets and Opinion Pools 105
  5.6 Summary ............................................... 112

Chapter 6. Issues on Information Market Development .................. 116
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1</td>
<td>Overview</td>
<td>116</td>
</tr>
<tr>
<td>6.2</td>
<td>A Framework for Information Market Development</td>
<td>117</td>
</tr>
<tr>
<td>6.3</td>
<td>Planning and Assessment</td>
<td>117</td>
</tr>
<tr>
<td>6.4</td>
<td>Property Analysis</td>
<td>122</td>
</tr>
<tr>
<td>6.5</td>
<td>Mechanism Design</td>
<td>124</td>
</tr>
<tr>
<td>6.5.1</td>
<td>Security</td>
<td>124</td>
</tr>
<tr>
<td>6.5.2</td>
<td>Trading Mechanism</td>
<td>126</td>
</tr>
<tr>
<td>6.5.3</td>
<td>Incentive</td>
<td>128</td>
</tr>
<tr>
<td>6.5.4</td>
<td>Other Rules of Markets</td>
<td>130</td>
</tr>
<tr>
<td>6.6</td>
<td>Market System Analysis</td>
<td>131</td>
</tr>
<tr>
<td>6.7</td>
<td>Market System Design</td>
<td>133</td>
</tr>
<tr>
<td>6.8</td>
<td>Market Implementation</td>
<td>134</td>
</tr>
<tr>
<td>6.9</td>
<td>Market Support</td>
<td>134</td>
</tr>
<tr>
<td>6.10</td>
<td>Summary</td>
<td>135</td>
</tr>
<tr>
<td>7.1</td>
<td>Summary</td>
<td>136</td>
</tr>
<tr>
<td>7.2</td>
<td>Future Direction</td>
<td>138</td>
</tr>
<tr>
<td>A.1</td>
<td>Earnings</td>
<td>140</td>
</tr>
<tr>
<td>A.2</td>
<td>Information about Redemption Values</td>
<td>143</td>
</tr>
</tbody>
</table>