September 23rd, 2008

Behavioral Economics: Implications for an Aging Population's Wealth & Health Decisions

Anand S. Rao

For more information contact:

Anand S. Rao
Partner
Anand.Rao@diamondconsultants.com
Mobile: 617.633.8354
Agenda

What is Behavioral Economics (BE)?

What is the relevance of BE in Health/Wealth Decisions?

How can we model, simulate, and implement behavioral change?
Reflexive & Reflective Systems of the Brain

**REFLEXIVE SYSTEM**
(Automatic)
- People are Emotional
- Driven by social influence
- Averse to losses
- Have bounded resources

**REFLECTIVE SYSTEM**
(Thinking)
- People are Rational
- Driven by self-interest
- Maximize utility
- Have unbounded resources

Source: Diamond Analysis; *Your Money and Your Brain* by Jason Zweig
Rules of Thumb of our Reflexive System

- ANCHORING
- STATUS QUO BIAS
- MENTAL ACCOUNTING
- ENDOWMENT EFFECT
- RELATIVITY & CHOICE
- HOT vs COLD STATES
- BANDWAGON EFFECT
- LOSS AVERSION
- HYPERBOLIC DISCOUNTING

Source: Diamond Analysis; *Nudge* by Richard Thaler and Cass Sunstein; *Predictably Irrational* by Dan Ariely

NOT EXHAUSTIVE
Behavioral Economic Principles: Anchoring

**ANCHORING**
People start with a reference point and make (inappropriate) adjustments while answering questions and making choices.

1. How Happy are you?
2. How often are you dating?

**CORRELATION: 0.11**

1. How often are you dating?
2. How Happy are you?

**CORRELATION: 0.62**

Source: *Nudge* by Richard Thaler and Cass Sunstein
Behavioral Economic Principles: Status Quo Bias

‘STATUS QUO’ BIAS & POWER OF DEFAULTS
People have a strong ‘status quo’ bias and often fail to take pro-active action to change the default

- Why is organ donation in Denmark below 5%, while in neighboring Belgium is close to 100%?

Source: *Nudge* by Richard Thaler and Cass Sunstein
Mental accounting is an internal control mechanism of the ‘reflexive’ part of the brain to compartmentalize complex decision-making.

Scenario A
You have just won $30. Now choose between

1. A 50% chance to gain $9 and 50% chance to lose $9
2. No further gain or loss

Choice 1: 70%
Choice 2: 30%

Scenario B
You have just lost $30. Now choose between

1. A 50% chance to gain $9 and 50% chance to lose $9
2. No further gain or loss

Choice 1: 40%
Choice 2: 60%

Scenario C
You have just lost $30. Now choose between

1. A 33% chance to gain $30 and 67% chance to gain nothing
2. A sure $10

Choice 1: 60%
Choice 2: 40%

Source: Mental Accounting Matters by Richard Thaler in Journal of Behavioral Decision Making, 1999
## Additional Behavioral Economic Principles

<table>
<thead>
<tr>
<th>Rule of Thumb</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Endowment Effect</strong></td>
<td>People place a higher value on objects they own relative to objects they do not</td>
</tr>
<tr>
<td><strong>Relativity &amp; Choice</strong></td>
<td>Offering customers excessive options to choose from can result in purchase paralysis; People rarely choose something in absolute terms; they focus on the relative value amongst options</td>
</tr>
<tr>
<td><strong>Hot vs Cold States</strong></td>
<td>People’s decisions under aroused or ‘hot’ states tend to be significantly different from ‘cold’ calculated decisions</td>
</tr>
<tr>
<td><strong>Bandwagon Effect</strong></td>
<td>People have a strong tendency to conform to the social norms and often do things because others do</td>
</tr>
<tr>
<td><strong>Loss Aversion</strong></td>
<td>People prefer avoiding losses rather than acquiring gains. Studies suggest that losses are as much as twice as psychologically powerful as gains</td>
</tr>
<tr>
<td><strong>Hyperbolic Discounting</strong></td>
<td>Consumption now and in the near future is preferred to consumption into the farther future; The greater the uncertainty about this future the less the preference</td>
</tr>
</tbody>
</table>

Source: Diamond Analysis; *Nudge* by Richard Thaler and Cass Sunstein; *Predictably Irrational* by Dan Ariely
Behavioral policy interventions with respect to retirement savings is showing early signs of 'nudging' consumers towards higher savings rate.

### Employee-Weighted Participation Rate (Post-PPA)

- % of Employees
  - Hired Under Voluntary Enrollment: 45%
  - Hired Under Auto-Enrollment: 86%

### Median Contribution Rate (Post-PPA)

- % of Salary Contributed
  - Participant-Weighted: 5%
  - Employee-Weighted
    - Hired Under Voluntary Enrollment: 2.90%
    - Hired Under Auto-Enrollment: 0% (2.60%)

### BE Interventions

1. **Pension Protection Act (PPA) 2006**
   - Automatic enrolment of employees in 401(K) with explicit opt-out instead of voluntary opt-in (Default)
   - Automatic increase of the percentage of salary directed to the plan (Pre-commitment)
   - Default investment into three broadly diversified investments – balanced funds, lifestyle funds, and managed accounts (Choice)

2. **Save More Tomorrow (SMaRT)**
   - Employees pre-commit to increase in contributions well before their scheduled pay increases or bonus payment (Pre-commitment, Loss Aversion)
   - Employees can opt-out at any time (Default)

Source: Diamond Analysis, Measuring the Effectiveness of Automatic Enrollment, Vanguard Center for Retirement Research
In the absence of policy intervention Federal spending on healthcare will rise from 16% of GDP in 2007 to 25% of GDP in 2025.
Slightly over 4% of the Medicaid enrollees account for close to 50% of the Medicaid expenditure.
Simple behavioral interventions can influence what people eat and how much they eat.

**OBESITY**

<table>
<thead>
<tr>
<th>&lt;20 yrs</th>
<th>20-74 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>31%</td>
<td>15%</td>
</tr>
</tbody>
</table>

1. Obesity causes at least 300,000 excess deaths
2. Obesity in adults resulted in health care costs of $93 billion in 2002
3. Lifetime costs related to diabetes, heart disease, high cholesterol, hypertension and stroke among obese are $10,000 more than the non-obese

**BE Interventions**

1. Placing candies three feet away from one’s desk reduced volume of chocolate consumption by 5 to 6 chocolates a day (**Self-control**)
2. Subjects provided with a bowl of M&Ms in 10 colors ate 77% more than people given a bowl with only 7 colors (**Visceral effects**)
3. Food stamp benefits raise food expenditure more than an equal amount in cash (**Mental Accounting**)
4. Pre-ordered healthy-pack options encouraged healthy eating by Food Stamp Beneficiaries in Connecticut and North Carolina (**Defaults**)
5. Having more unhealthy choices reduces the chances of health options being selected – Salad, Hamburger, Cake vs Salad and Hamburger (**Choice Relativity**)

Source: Could Behavioral Economics help improve Diet Quality for Nutrition Assistance Program participants, USDA, Economic Research Service, Diamond Analysis
Addressing more fundamental issues, such as medical malpractice tort costs may require policy interventions by Government.

**MEDICAL MALPRACTISE COSTS (in $Bn)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Cost ($Bn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>1.2</td>
</tr>
<tr>
<td>1961</td>
<td>1.4</td>
</tr>
<tr>
<td>1962</td>
<td>1.7</td>
</tr>
<tr>
<td>1963</td>
<td>2.0</td>
</tr>
<tr>
<td>1964</td>
<td>2.5</td>
</tr>
<tr>
<td>1965</td>
<td>3.0</td>
</tr>
<tr>
<td>1966</td>
<td>3.5</td>
</tr>
<tr>
<td>1967</td>
<td>4.0</td>
</tr>
<tr>
<td>1968</td>
<td>4.5</td>
</tr>
<tr>
<td>1969</td>
<td>5.0</td>
</tr>
<tr>
<td>1970</td>
<td>5.5</td>
</tr>
<tr>
<td>1971</td>
<td>6.0</td>
</tr>
<tr>
<td>1972</td>
<td>6.5</td>
</tr>
<tr>
<td>1973</td>
<td>7.0</td>
</tr>
<tr>
<td>1974</td>
<td>7.5</td>
</tr>
<tr>
<td>1975</td>
<td>8.0</td>
</tr>
<tr>
<td>1976</td>
<td>8.5</td>
</tr>
<tr>
<td>1977</td>
<td>9.0</td>
</tr>
<tr>
<td>1978</td>
<td>9.5</td>
</tr>
<tr>
<td>1979</td>
<td>10.0</td>
</tr>
<tr>
<td>1980</td>
<td>10.5</td>
</tr>
<tr>
<td>1981</td>
<td>11.0</td>
</tr>
<tr>
<td>1982</td>
<td>11.5</td>
</tr>
<tr>
<td>1983</td>
<td>12.0</td>
</tr>
<tr>
<td>1984</td>
<td>12.5</td>
</tr>
<tr>
<td>1985</td>
<td>13.0</td>
</tr>
<tr>
<td>1986</td>
<td>13.5</td>
</tr>
<tr>
<td>1987</td>
<td>14.0</td>
</tr>
<tr>
<td>1988</td>
<td>14.5</td>
</tr>
<tr>
<td>1989</td>
<td>15.0</td>
</tr>
<tr>
<td>1990</td>
<td>15.5</td>
</tr>
<tr>
<td>1991</td>
<td>16.0</td>
</tr>
<tr>
<td>1992</td>
<td>16.5</td>
</tr>
<tr>
<td>1993</td>
<td>17.0</td>
</tr>
<tr>
<td>1994</td>
<td>17.5</td>
</tr>
<tr>
<td>1995</td>
<td>18.0</td>
</tr>
<tr>
<td>1996</td>
<td>18.5</td>
</tr>
<tr>
<td>1997</td>
<td>19.0</td>
</tr>
<tr>
<td>1998</td>
<td>19.5</td>
</tr>
<tr>
<td>1999</td>
<td>20.0</td>
</tr>
<tr>
<td>2000</td>
<td>20.5</td>
</tr>
<tr>
<td>2001</td>
<td>21.0</td>
</tr>
<tr>
<td>2002</td>
<td>21.5</td>
</tr>
<tr>
<td>2003</td>
<td>22.0</td>
</tr>
<tr>
<td>2004</td>
<td>22.5</td>
</tr>
<tr>
<td>2005</td>
<td>23.0</td>
</tr>
<tr>
<td>2006</td>
<td>23.5</td>
</tr>
</tbody>
</table>

**BE Interventions**

1. Unbundle healthcare premiums to include cost of medical malpractice litigations (**Accessibility and Salience**)

2. Health insurance companies must be permitted to offer plans with and without the right to sue for negligence (**Choice**)

3. Make ‘waiving’ the right to sue as the default and retaining the right would cost more (**Defaults**)

4. Change the ‘right to sue’ only for intentional or reckless wrongdoing and not for negligence to reduce malpractice premiums

Source: Diamond Analysis; Insurance Information Institute; *Nudge* by Richard Thaler and Cass Sunstein
Agent-oriented behavioral modeling and simulation offers a systematic way of designing and implementing behavioral interventions.

**Agent-Oriented Behavioral Modeling & Simulation**

- **Behavioral Economics**
  Understand ‘reflexive’ BE principles that determine health and wealth decisions.

- **Market Research**
  Understand consumer beliefs, aspirations, attitudes, behaviors, and demographics.

- **Predictive Analytics**
  Use multiple data sources (diagnostics, prescription, demographics) to predict risk groups and costs.

**Agent-Oriented Behavioral Modeling & Simulation**

- Modeling consumer beliefs, desires, and behaviors to simulate different scenarios and evaluate impact of consumer health/wealth decisions on physical and financial well-being.

**Feedback Loop**

Source: Diamond Analysis
Diamond's market research on baby boomer health and wealth attitudes and behaviors identified five significant clusters of consumers:

- **Aspirants**: 31% (56yrs/$50K)
  - Percent of population
  - High Financial Confidence
  - High Health Consciousness

- **Affluent Sophisticates**: 24% (62yrs/$98K)
  - Percent of population
  - High Financial Confidence
  - High Health Consciousness

- **Retired Settlers**: 15% (66yrs/$50K)
  - Percent of population
  - Low Financial Confidence
  - Low Health Consciousness

- **Survivors**: 10% (57yrs/$24K)
  - Percent of population
  - Low Financial Confidence
  - Low Health Consciousness

- **Moderates**: 20% (57yrs/$31K)
  - Percent of population
  - Average Age/Average Income
  - Low Financial Confidence
  - Low Health Consciousness

Source: Diamond Retirement Study, 2008
The five segments are clearly differentiated in terms of their health consciousness (e.g., regular exercise, health insurance cover, health risk during retirement).

**Increasing Health Consciousness**

<table>
<thead>
<tr>
<th>Segment</th>
<th>Regular Exercise (%)</th>
<th>Adequate Health Insurance (%)</th>
<th>Physical Health Risk (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderates</td>
<td>15%</td>
<td>17%</td>
<td>20%</td>
</tr>
<tr>
<td>Survivors</td>
<td>27%</td>
<td>23%</td>
<td>42%</td>
</tr>
<tr>
<td>Aspirants</td>
<td>29%</td>
<td>50%</td>
<td>39%</td>
</tr>
<tr>
<td>Retired Settlers</td>
<td>30%</td>
<td>60%</td>
<td>63%</td>
</tr>
<tr>
<td>Affluent Sophisticates</td>
<td>49%</td>
<td>84%</td>
<td>71%</td>
</tr>
</tbody>
</table>

Source: Diamond Retirement Study, 2008
The five segments are also differentiated in terms of their financial confidence (e.g., financial preparedness for retirement and healthcare issues, longevity risk).

### Increasing Financial Confidence

<table>
<thead>
<tr>
<th>Segment</th>
<th>% Confident of Being Financially Prepared for Retirement</th>
<th>% Confident of Being Financially Prepared for Healthcare Issues that Arise Later in Life</th>
<th>% Who Ranked Finances as Most at Risk During Retirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affluent Sophisticates</td>
<td>82%</td>
<td>76%</td>
<td>17%</td>
</tr>
<tr>
<td>Retired Settlers</td>
<td>57%</td>
<td>43%</td>
<td>31%</td>
</tr>
<tr>
<td>Aspirants</td>
<td>22%</td>
<td>10%</td>
<td>51%</td>
</tr>
<tr>
<td>Survivors</td>
<td>3%</td>
<td>10%</td>
<td>47%</td>
</tr>
<tr>
<td>Moderates</td>
<td>0%</td>
<td>1%</td>
<td>62%</td>
</tr>
</tbody>
</table>

Source: Diamond Retirement Study, 2008
Findings from Behavioral Economics, Market Research, and Predictive Analytics can be combined to model individuals as software agents.

Agent-Oriented Modeling

Beliefs
- Informational state
- Facts about the world
- Beliefs about other agents

Desire/Goals
- Motivational state
- Committed desires are goals
- Social influence on individual goals

Intentions
- Deliberative state
- Commitment to abstract sequence of goals or specific actions

Example: Cardiovascular Disease

- Demographic data
- Beliefs about diet & exercise
- Impact of diet & exercise on cholesterol, stroke, etc.
- Current diet and exercise behaviors
- Social influence on beliefs

- Diet and exercise goals
- Level of commitment or self-control to goals
- Impact of social influence on goals

- Patterns of different diet and exercise patterns (e.g., regular vs sporadic)
- Varying impact of diet and exercise on cardiovascular events – stroke, Myocardial infarction (MI), etc.

Behaviors of thousands of consumers can be modeled and simulated to evaluate impact of behavioral interventions on individual well being as well as healthcare costs.

Source: Diamond Analysis
Simulating over 1,000 individuals as software agents helps determine the impact of behavioral interventions on total cost and well being.

**Cardiovascular Disease**

*Source: Diamond Analysis; AnyLogic Simulation*
Conclusions

• Behavioral Economics embodies principles that explain the workings of the 'reflexive' brain and help in developing interventions to change our behaviors

• Behavioral Economics principles are being successfully used to change how people make decisions with respect to their health and wealth

• Combining predictive modeling and behavioral intervention already practised within the healthcare sector, with agent-based behavioral modeling offers a unique way to model, simulate, and implement behavior changes