FICO® Scores Through the Economic Cycle
Understanding Consumer Sensitivities to Economic Fluctuations

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Worries About the Next Recession

Goldman Sachs: Recession Fears Overblown

Yahoo Finance's Adam Shapiro, Julie Hyman, and Dan Roberts join Medley Global Advisors' Managing Director of Global Macro Strategy Ben Emons to discuss Goldman Sachs's report that recession fears are overblown.

Market turbulence: is US recession risk rising?

Stocktake: Investors shouldn't confuse a slowdown with a recession, 'that's just wrong'

© Tue, Jan 29, 2019, 05:00
FICO® Score – A Data Science Success Story

- World’s #1 credit bureau score, available in 25+ countries
- Used by 70,000+ businesses, rating agencies and secondary market to improve risk assessment, transparency, decisions
- 10 billion+ decisions/year
  - Originations
  - Underwriting
  - Account management
  - Collections
What’s in a FICO® Score Number?

• A FICO® Score is:
  • A number from 300-850
  • Based on information in consumers’ credit files
  • Designed to *rank-order* consumer risk (Odds)
What Happens in a Recession?

• Don’t assume that a given score will always reflect the same Odds
  • Rank-ordering of Odds is stable
  • Odds-to-score relation is variable

• Must monitor Odds-to-score relation and recalibrate when necessary
Variability of Odds to Score Relation Through Great Recession
“Of all my FICO 680’s tell me who will go bad in the next recession.”

Senior Executive of Large US Bank
Economic Cycle Impact on Odds to Score Relation

Do all 680’s drop by the same amount?
Hypothesis: Not Everyone (Even at the Same FICO Score) is Equally Impacted by a Recession

Economic Sensitivity Index (ESI) rank-orders consumers with respect to their sensitivity to the economic cycle.

ESI measures “Cycle Risk”, not “Credit Risk”.
Segmenting Consumers According to ESI

ESI Distribution of US Scoreable Population

- 20% most robust ones
- 20% most sensitive ones
Deterioration of Repayment Odds During Great Recession, by ESI Segment

US Scoreable Population (Total)

US Scoreable Population (by ESI Segment)

- Normal Economy
- Great Recession

Most Robust
Most Sensitive

- Normal Economy
- Great Recession, Most Robust
- Great Recession, Most Sensitive
# 90+ DPD Rates for FICO® Score 680 Consumers

## Worst Performance on Any Trade Line

<table>
<thead>
<tr>
<th>90+ DPD Rate</th>
<th>All Consumers @ FICO® Score ~680</th>
<th>20% Most Sensitive @ FICO® Score ~680</th>
<th>20% Most Robust @ FICO® Score ~680</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Economy</td>
<td>12.5%</td>
<td>14.0%</td>
<td>11.8%</td>
</tr>
<tr>
<td>Great Recession</td>
<td>20.7%</td>
<td>29.3%</td>
<td>13.7%</td>
</tr>
</tbody>
</table>
## Profiling Sensitive Versus Robust Consumers at FICO® Score 680

<table>
<thead>
<tr>
<th>Most Sensitive Consumers…</th>
</tr>
</thead>
<tbody>
<tr>
<td>…more actively search for credit</td>
</tr>
<tr>
<td>…have higher total balances</td>
</tr>
<tr>
<td>…more recently opened a new trade line</td>
</tr>
<tr>
<td>…have experienced fewer delinquencies(!)</td>
</tr>
</tbody>
</table>
Collider Bias and Spurious Correlations

Rain \rightarrow Wet \leftarrow Sprinkler
Conceptual Definition of Economic Sensitivity as a Causal Effect

Potential future scenarios

If normal economy: \( pD = 13\% \)

\( \downarrow \)

9% increase in \( pD \) caused by recession

If recessionary economy: \( pD = 22\% \)

• We solved the counterfactual problem
Counterfactual Analysis Approach

- Leverage natural experiments over the economic cycle, captured by credit bureau data
- Challenge: Distributional differences between “Stressed” and “Control” groups
- Approach: Matched sampling finds baseline-comparable “twins”

**Stressed**

Oct 2007

Matt

FICO 671
TOB 264 months
39% Utilization

Oct 2009

Default

**Controls**

Oct 2013

Mike

FICO 668
TOB 257 months
43% Utilization

Oct 2015

Good
Matched Sampling Based on Machine-Learned Propensity Score

1. Train Stochastic Gradient Boosting to learn likelihood of stress exposure

Increasing likelihood of stress exposure

- Stressed cases
- Control cases
Matched Sampling Based on Machine-Learned Propensity Score

Find matched pairs with similar exposure likelihood, but where one partner is exposed to stress and the other is a control.

Increasing likelihood of stress exposure

Method
“Caliper matching on the propensity score”
Example of Matching Success

- Prior to matching

- Post matching
Machine Learning of ESI Model from Matched Sample

Matched Sample

Stochastic Gradient Boosting

ESI

Prediction

Consumer attributes, Flag for economic condition

- Normal
- Great Recession

Joe

Consumer attributes only
Turning Machine Learned Black Box Into Explainable Scorecard

Scorecardizer Approach to xAI: Train Scorecard to approximate ESI generated by ML model
Add domain expertise to warrant explainability and palatability

Counterfactual analysis using machine learning

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Attributes</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of months since the most recent serious delinquency</td>
<td>No serious delinquency</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>0 — 5</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>6 — 11</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>12 — 23</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>24+</td>
<td>55</td>
</tr>
<tr>
<td>Overall utilization on revolving trades</td>
<td>No revolving trades</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Under 6%</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>7 — 19%</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>20 — 49%</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>50 — 89%</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>90% or more</td>
<td>15</td>
</tr>
</tbody>
</table>

*Purely illustrative, not part of actual model
ESI Applications for Decisioning
Refine Existing Strategies to Mitigate Economic Cycle Sensitivity

At similar credit risk scores:
- Increase exposure to robust consumers
- Deal more conservatively with sensitive consumers

New swap sets!
ESI Applications for Provisioning
Scenario-Adjusted FICO® Score

FICO® Score → pD component of Expected Credit Loss model → Point estimate of Odds

Other attributes → pD component of Expected Credit Loss model

FICO® Score

Scenario-adjusted FICO® Score → Unchanged model → Scenario-adjusted Odds

ESI

Other attributes
Discussion

- Created Economic Sensitivity Index to tell apart recession-sensitive from robust consumers
  - New insights who the sensitives are
  - Valuable for decisioning and provisioning

- Success “secrets”
  1. Start with great questions
  2. Proper problem formulation is half the solution
  3. Reason about causality/distinguish from correlation—Seek explanation not just prediction
  4. Machine Learning provides data mining efficiencies, but doesn’t help with 1.-3.
  5. Combine data-driven learning with domain expertise
Thank You!

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