Predicting the Future:
The Use of Prediction Markets in the Context of Labor Market Information

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Outline

• What are prediction markets?
• Are prediction markets accurate?
• How can prediction markets be used in forecasting labor vacancies?

What Are Prediction Markets?

• Futures and options markets with
  – Payoffs tied to events of interest
  – Designed specifically to
    • Aggregate information
    • Forecast
• Example: The Iowa Electronic Markets (IEM)
  – www.biz.uiowa.edu/iem
Some Prediction Markets and Markets with Prediction Style Contracts

- Iowa Electronic Markets
  - www.biz.uiowa.edu/iem
- Hedge Street/North American Derivatives
  - www.nadex.com
- Chicago Board of Trade
  - www.cbot.com
- Chicago Mercantile Exchange
  - www.cme.com
- InTrade
  - www.intrade.com
- Cantor Fitzgerald / Hollywood Stock Exchange
  - http://www.hsx.com/
- ForeSight Exchange
  - www.ideosphere.com

Some Prediction Contracts

- Iowa Electronic Markets
  - Political
  - Federal Funds
  - Economic Indicators
  - Stock prices and Returns
  - Corporate Earnings
  - Movie Box Office Takes
  - Influenza
  - Hurricane landfall
  - IPOs
- Hedge Street/NADEX
  - Federal Funds Rates
  - CPI
  - Crude Oil and Natural Gas
  - Housing Prices
- Chicago Board of Trade
  - Federal Funds Rates
- Chicago Mercantile Exchange
  - Event (Landfall) Markets based on Carvill Hurricane Index (CHI)
  - Heating/Cooling Degree Days
  - Cumulative Average Temperature
  - Snowfall and Frost
- Cantor Fitzgerald / Hollywood Stock Exchange
  - Movie Box Office Takes
  - Other entertainment
- InTrade/ForeSight Exchange
  - Wide-range

Example: 2008 IEM Presidential Markets

- Tied to Election Outcomes
  - “Vote-Share” Market
    - UDDEM08_VS
      - Pays $1 x Democratic % of 2-party vote
    - UREP08_VS
      - Pays $1 x Republican % of 2-party vote
- “Winner-Takes-All” (Binary Option) Market
  - DEM08_WTA
    - Pays $1 if Democratic % of 2-party vote > 50%
  - REP08_WTA
    - Pays $1 if Republican % of 2-party vote > 50%
- “Interval” (Binary Option) Market
  - DEM04_50-52
    - Pays $1 if Democratic % of 2-party vote > 50% & < 52%
    - Intervals span range
How do Prediction Markets Work?

Mechanics

• Traders
  – Open account and
  – Place orders through the internet
• Exchange
  – Accepts orders in a time and price ordered queues
  – Clears trades when orders cross or are accepted
• IEM allows traders to create contracts
  – Unit portfolios (1 of each contract) can be purchased
    from or sold to exchange at any time
• Market design may imply prices should equal expected outcome values

How do Prediction Markets Work?

Practice

• Current laboratory and field work suggests the following avenues:
  – Information sharing
  – Information aggregation
  – Information production
  – Dynamic feedback
  – Trader self-selection
  – Trader role selection

Are Markets Accurate

• Evidence from IEM vote share market
  – Point predictions of election vote share

• Evidence from Flu prediction markets
  – “Range” predictions of flu activity

• Type of prediction determined by contract definition
IEM Vote Share Accuracy

IEM and Poll Accuracy, 2008
Presidential Race, Election Eve

IEM Vote Share Accuracy

Returns appear to follow efficient (Bayesian) random walk

Sources:
IEM Influenza Markets

- CDC Reports Influenza Activity by State:
  - No Activity or Sporadic: White/Yellow
  - Sporadic: Green
  - Local: Purple
  - Regional: Blue
  - Widespread: Red

- Market forecasts CDC report
  - Importance of trader pool

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Week 52 CDC Report

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Influenza Markets: Contemporaneous Forecasts

Influenza Markets:
2 Week Advance Forecasts


Generating Forecast Distributions:
The Intuition

But, what if the prices are inconsistent with a “nice” distribution? (10/2/2000)
IEM Election Market Distributions

- IEM Election Markets
  - Prices inconsistent with common distributional assumptions
  - Underlying distributions can exist, but not
    - Unimodal symmetric
    - Symmetric nor
    - Common parametric
- Computational Method
  - Non-parametric, Bayesian method for estimating distributions
- Research Results
  - Distributions are more informative than historical distribution, but precision may not increase over time
  - Mean shifted toward the outcome

Optimization & Constraints

- Use combination of vote share and interval market prices
  - constraints on CDF
- Other constraints
  - Smoothness
  - Compactness (concentration)
- Result: quadratic programming problem

Estimation Results

- Asymmetries often exist
  - Often required to fit otherwise “inconsistent” prices across contracts
- Multiple modes often exist
- Distributions change across time at variable rates
- Means of the estimated distributions
  - Shift toward outcome if outcome differs from mean of historical prior
- Volatilities of the estimated distributions
  - Are generally (but not always) lower than historical prior
  - Often approach the theoretical lower bond
  - Are more stable than logistic normal implied volatilities
  - But, show no general tendency to fall across time

1992 1996
2000 2004
Labor Vacancy Markets
The Big Picture

• What information is valuable?
  – Changes/improves decisions
  – More timeliness desired
  – More accuracy desired

• Who has that information?
  – Dispersion versus concentration

• Is information well defined enough to write a contract?
  – Fact versus opinion

Labor Vacancy Markets
Market Prototype

• Information
  – Overall vacancies one year out
  – Breakdown by job category

• Traders
  – Major employers, placement agencies, training agencies

• Payoff Basis: Minnesota Labor Vacancy Survey

Job Vacancies in MN

Figure 1: Job Vacancies in Minnesota by Quarter

Source: Minnesota Labor Vacancy Survey
http://www.deed.state.mn.us/lmi/publications/jobvacancy.htm
Labor Vacancy Market
Job Vacancies in MN at June 2010

<table>
<thead>
<tr>
<th>Contract</th>
<th>Payoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>MN_LT25</td>
<td>Fewer than 25K</td>
</tr>
<tr>
<td>MN_25-35</td>
<td>Between 25K and 35K</td>
</tr>
<tr>
<td>MN_35-45</td>
<td>Between 35K and 45K</td>
</tr>
<tr>
<td>MN_45-55</td>
<td>Between 45K and 55K</td>
</tr>
<tr>
<td>MN_GT55</td>
<td>Greater than 55K</td>
</tr>
</tbody>
</table>

Source: Minnesota Job Vacancy Survey
http://www.deed.state.mn.us/lmi/publications/jobvacancy.htm

Percent Vacancies by Occupation

<table>
<thead>
<tr>
<th>Contract</th>
<th>Payoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>MN_HC</td>
<td>Health Care &amp; Social Asst.</td>
</tr>
<tr>
<td>MN_Retail</td>
<td>Retail Trade</td>
</tr>
<tr>
<td>MN_Food</td>
<td>Accommodation &amp; Food Serv.</td>
</tr>
<tr>
<td>MN_C&amp;M</td>
<td>Construction &amp; Manufacturing</td>
</tr>
<tr>
<td>MN_Other</td>
<td>All other jobs</td>
</tr>
</tbody>
</table>

Figure 2: Minnesota Job Vacancies by Industrial Division, Fourth Quarter 2008

Source: Minnesota Job Vacancy Survey
http://www.deed.state.mn.us/lmi/publications/jobvacancy.htm
### Alternate Labor Vacancy Market
### Percent Vacancies by Occupation

<table>
<thead>
<tr>
<th>Contract</th>
<th>Payoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>MN_Nurse</td>
<td>Nursing</td>
</tr>
<tr>
<td>MN_OtherHC</td>
<td>Other healthcare</td>
</tr>
<tr>
<td>MN_Office</td>
<td>Office work</td>
</tr>
<tr>
<td>MN_Const</td>
<td>Construction</td>
</tr>
<tr>
<td>MN_Other</td>
<td>All other jobs</td>
</tr>
</tbody>
</table>

### Issues

- Would this combination of markets be valuable?
  - What would be more valuable
- Is the time horizon about the right length?
- Who has pieces of this information early?
  - Are they willing traders?
- What exactly do prices mean?