Economics in Credit Scoring Models

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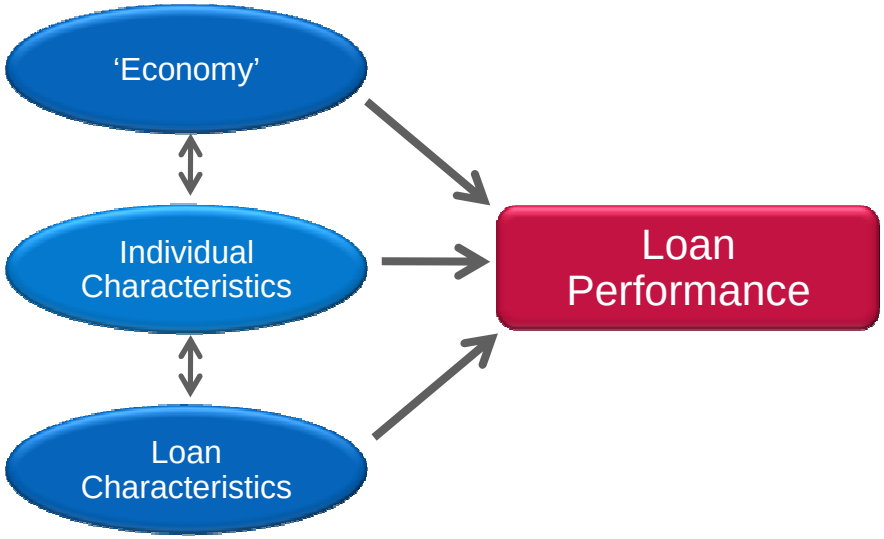
Outline

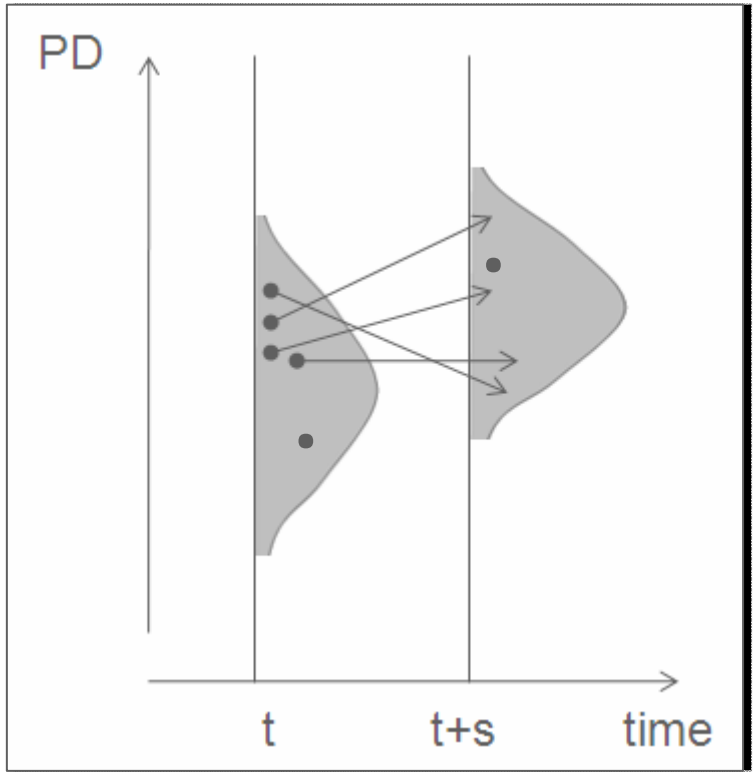
- Extensive evidence that economic conditions influence retail loan performance
- Variety of approaches have been proposed to augment conventional scorecards
- This paper:
  - Reviews issues arising in attempts to incorporate economic factors in retail credit scores
  - Implements alternative models within Experian bureau dataset
  - Evaluates results obtained from these approaches

Getting Economics into Scorecards



Homogeneous Conditions?

Homogeneous Effects?



Selecting Economic Variables

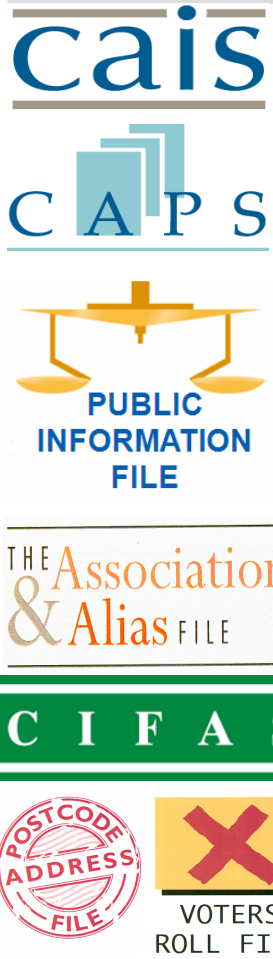
- Search space is enormous even if restricted to macroeconomic (aggregate) variables:
  - Many potentially-relevant variables
  - Functional forms?
  - Lag structures?
- What about disaggregated data (e.g. for geographical areas)?
- Finding 'correct' models hampered by:
  - Data availability
  - Estimation/Identification issues

Grid Search / Data Mining

Theory, priors & 'expert' judgement

Statistical Data Reduction Methods

UK Bureau Data – Consumer Databases



CAPS (Previous Searches)

Previous searches made as a result of credit applications, irrespective of the outcome of the application
Source: Lenders
Purpose: Audit trail, ID Authentication, Fraud prevention, Tracing
Update cycle: Real time
Retention Period: 1year
Volume: 85 million

Public Information

Includes County Court Judgements, Bankruptcies, Administration orders and Voluntary Arrangements.
Source: RTL, Official Gazettes, Insolvency Service
Purpose: Dispute resolution, Indebtedness, ID Authentication, Recovery
Update cycle: Weekly
Retention Period: minimum 6 years
Volume: 6.5 million (average value £1,555)

CAIS

Credit Account Information Sharing
Source: Lenders
Purpose: To understand the overall credit status of an individual
Update cycle: Monthly
Volume: 440 million

Electoral Register

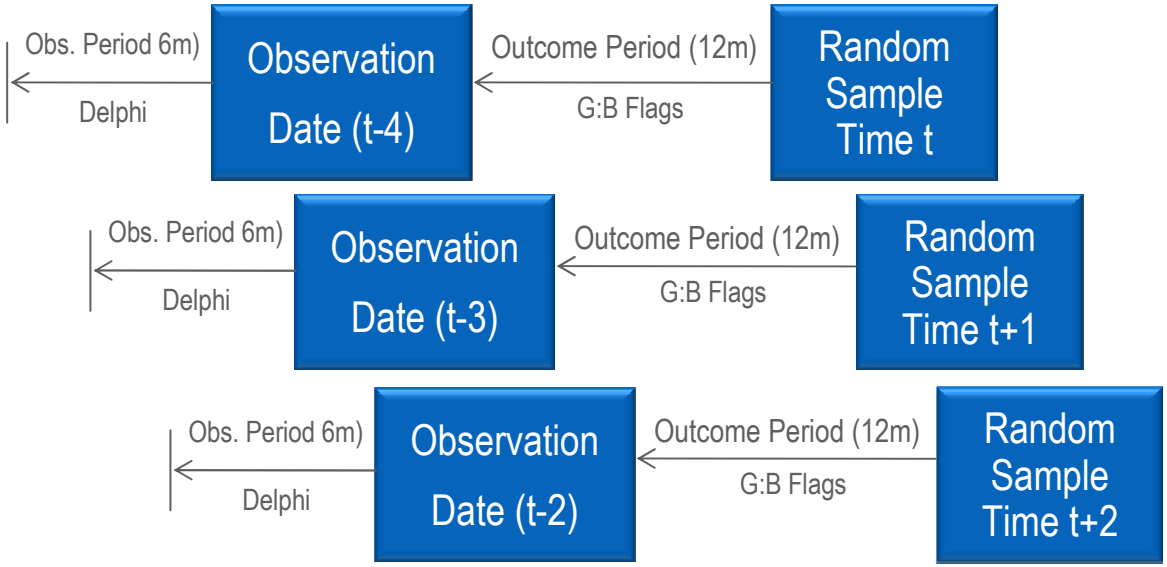
Current Electoral Register (including previous occupants)
Source: Local Authorities
Purpose: ID Authentication, Fraud prevention
Update cycle: Annually/Monthly
Retention Period: Indefinite
Volume: 45 million

Delphi Bureau Scores – DNB

- Several Variants depending on sectors (B&F, Retail, etc.) and data (CAIS vs non-CAIS)
- Predict likelihood that a new credit applicant will not default on any account
- Performance definition based on individual borrower rather than specific account
- Observation period 6 months; Outcome period 12m
- Goods: All accounts never more than 2 payments in arrears during the outcome period, and at most 1 payment in arrears at the outcome point and not 'over-indebted'
- Most important characteristics (B&F):
  - Time since most recent delinquent account
  - Consumer Indebtedness Index
  - Time since most recent CCJ, Bankruptcy order, IVA etc.
  - Worst CAIS status in the last 6 months

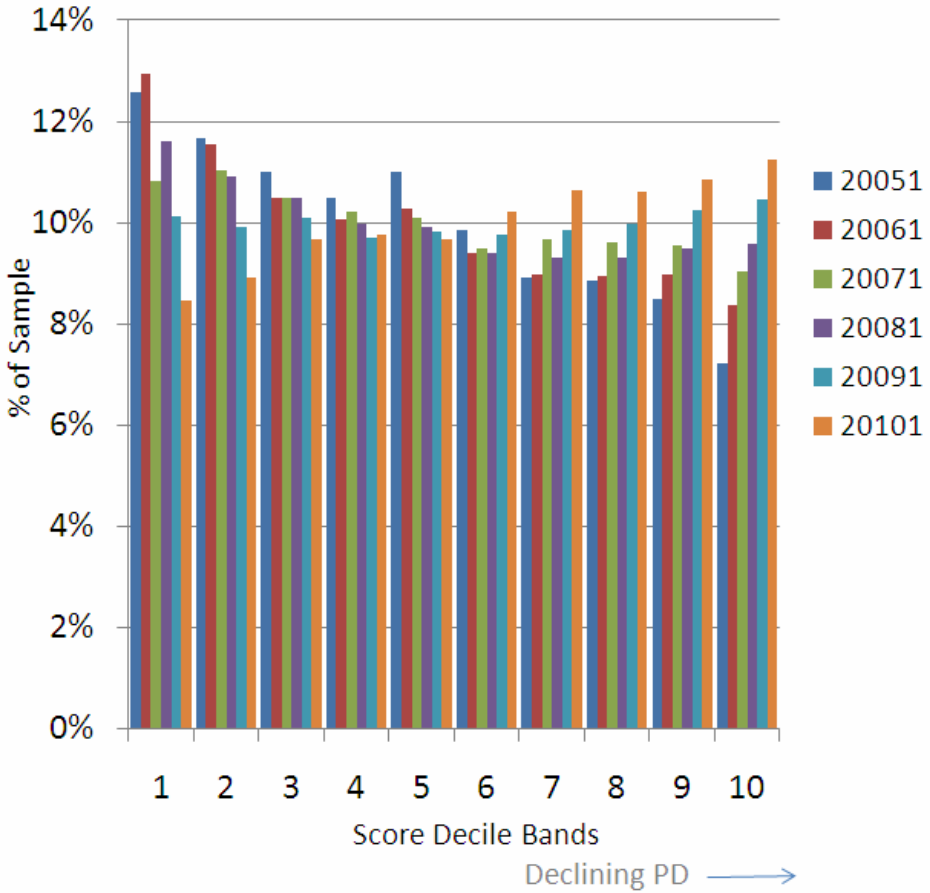
Data Structure

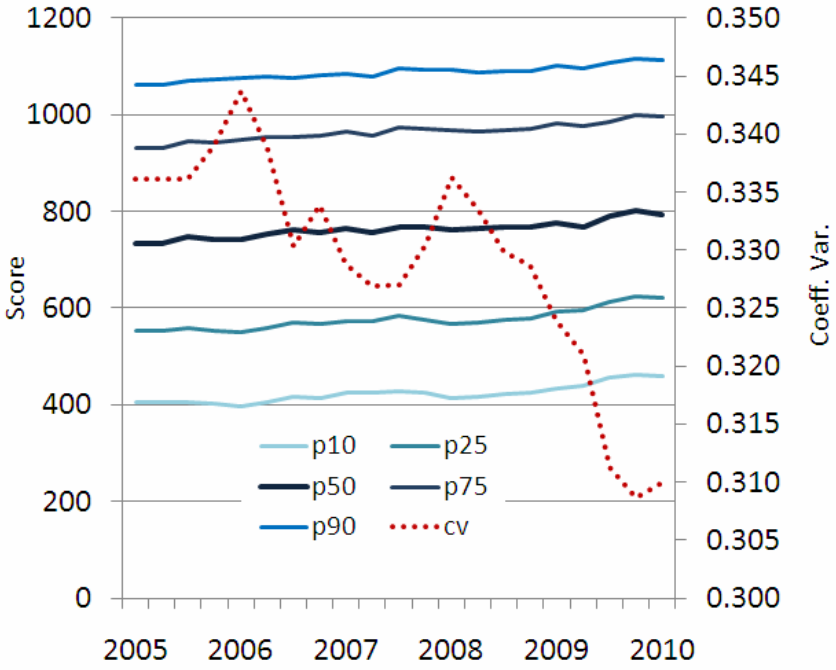
Pooled cross sections over time from repeated random samples of bureau data



Quarterly samples covering outcome periods ending 2006Q1 to 2010Q3

Changing sample composition by Delphi Score





Economic Data

UK Macroeconomic Data

Dataset of all standard UK macroeconomic variables

Models focus on variables plausibly related to households ability to service debts

UK Regions & Local Areas (LAD/UA)

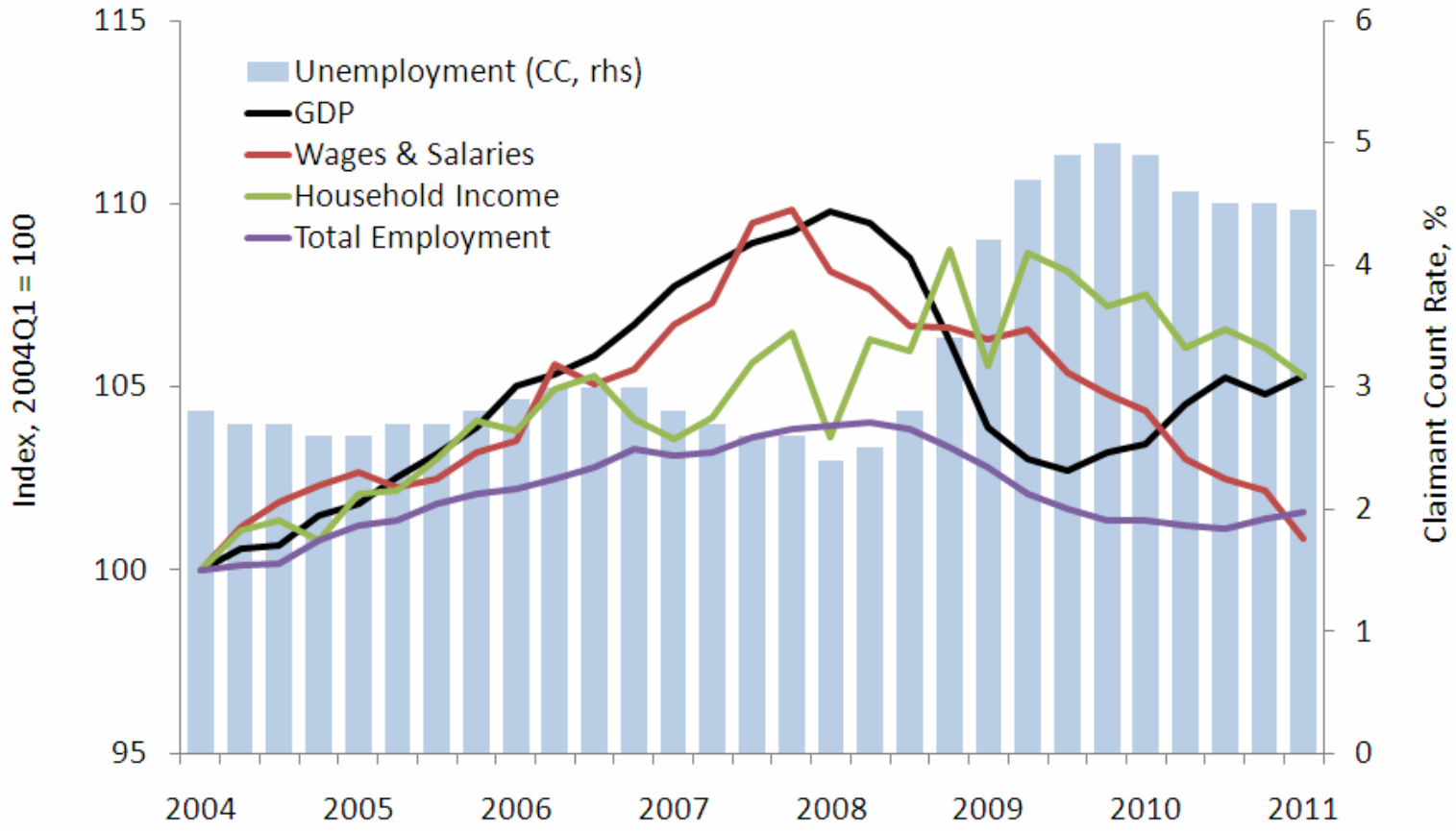
Data on household income, employment andUnemployment (CC, LFS), etc. for 12 Regions and 434 Local Areas

UK Household Segments

Data on household income and spending patterns and unemployment for 61 geo-demographic household types

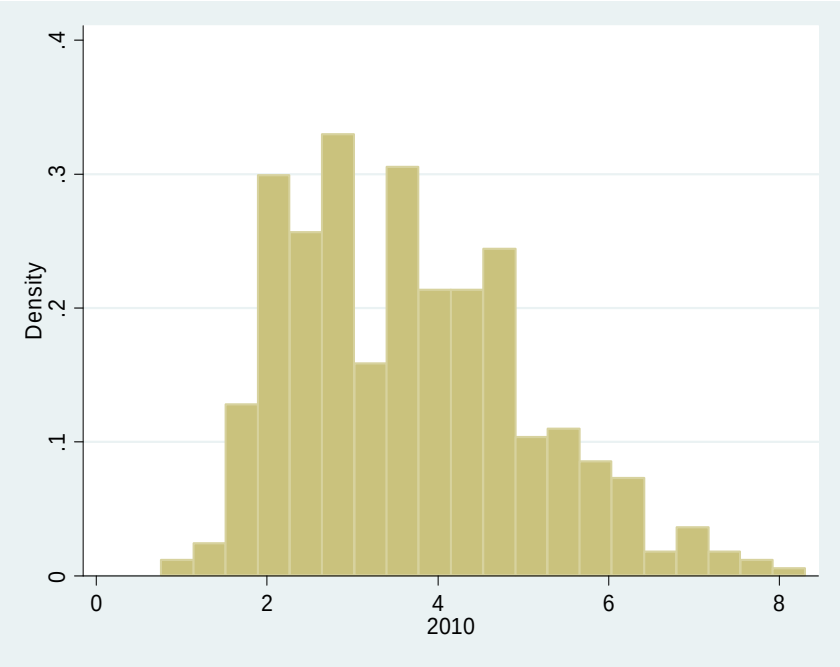
Historical and forecast data can be appended to sample data file based on residential address

UK Economy: 2004-2010

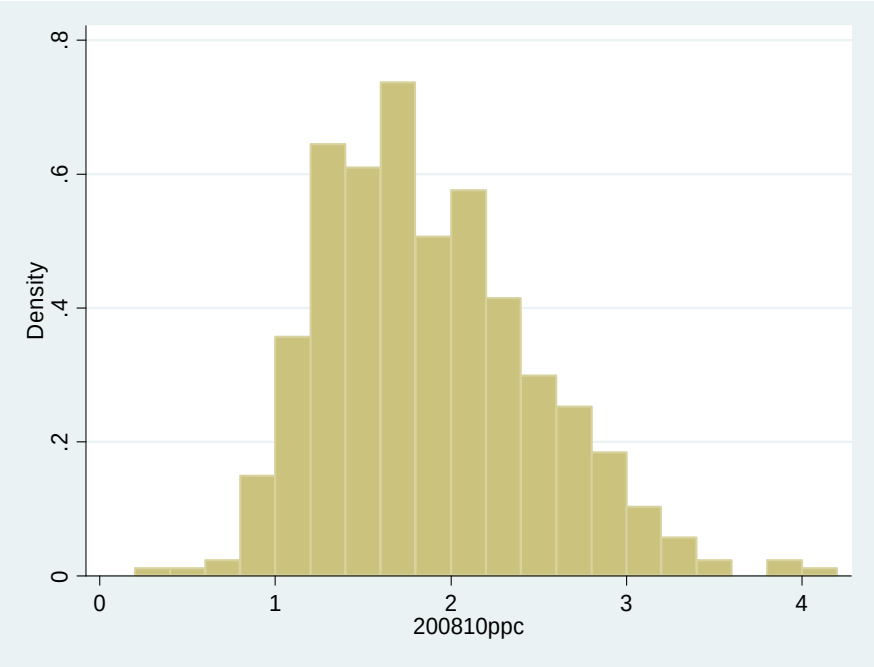


Heterogeneity of economic conditions: Claimant unemployment by local authority area

Claimant Count Rate (%) 2010Q1



Change in Claimant Count Rate, 2008Q1 – 2010Q1 (ppc)



Models & Evaluation

Aggregate Models:

$$\log\left(odds_{it}^{actual}\right) - \log\left(odds_{it}^{score}\right) = f\left(E_{it}\right)$$

Estimated by time series & panel regression for:

- All individuals
- by risk pool (decile groups of Delphi score)
- by geographical area (GOR)
- by geo-demographic segment (mosaic)

Disaggregate Models:

Binary outcome models estimated on pooled data with economic factors:

- by geography
- by geo-demographic segment
- by geography & segment

Evaluation Criteria:

Discrimination (ROC curves)

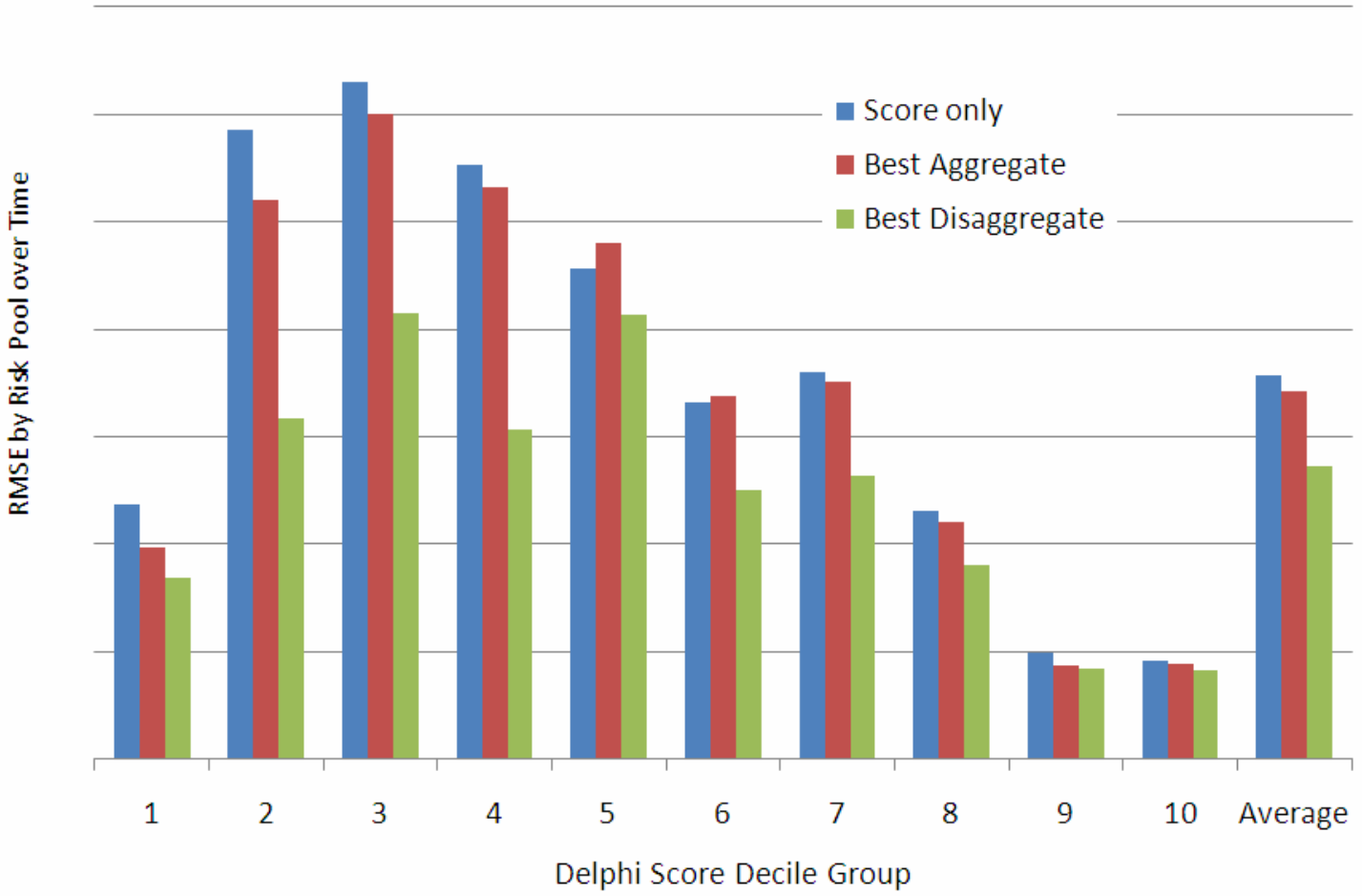
Calibration Accuracy & Stability

Assessed in hold-out (20%) sample within estimation period, and in post-estimation time periods

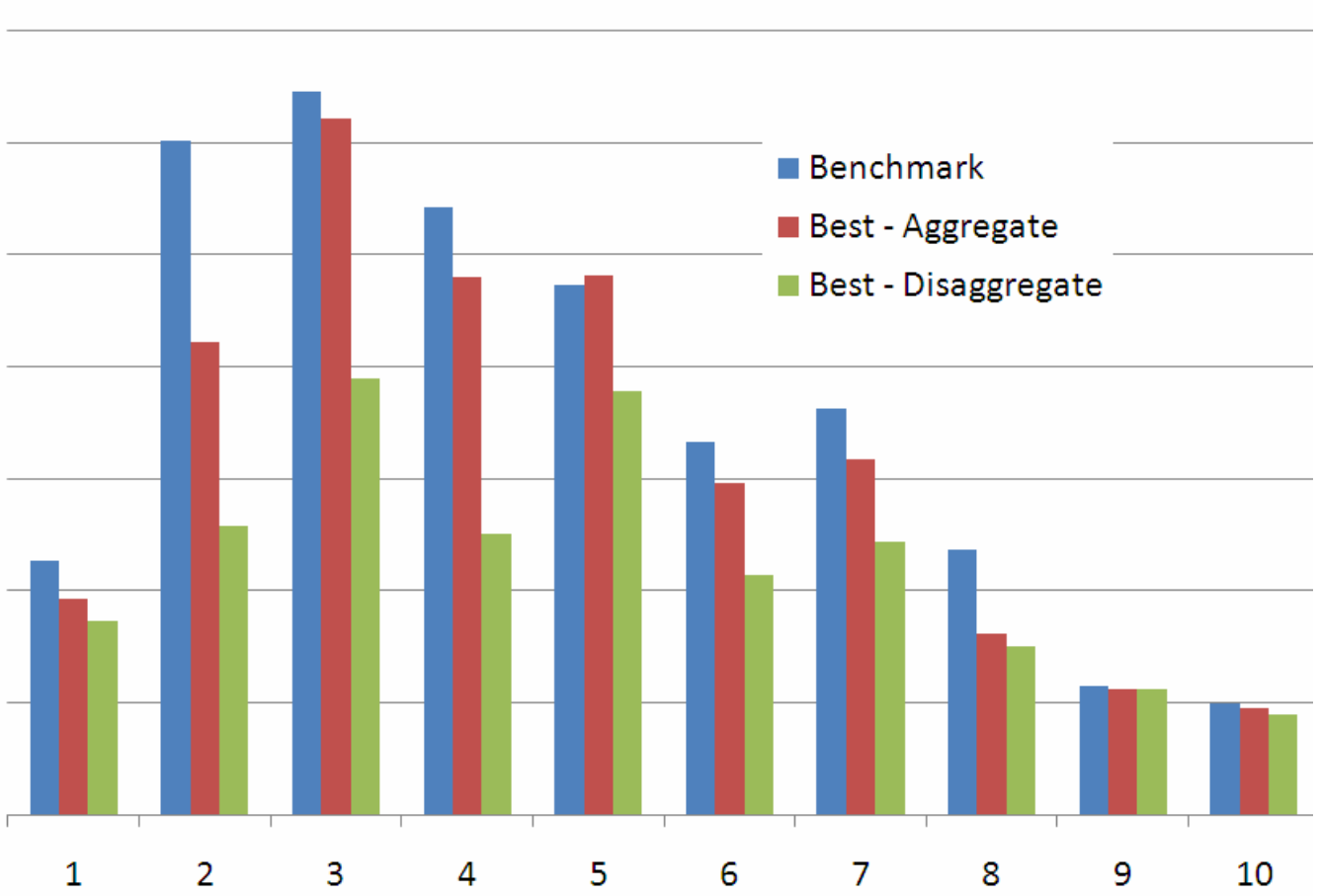
Augmented Score Performance relative to Delphi Score

				Calibration/Stability				
	R-square	Gini		RMSE for PD			St. Dev of Bad Rate	
		Average	Minimum	ALL	Over Time	Across Risk Pools	Average by Risk Pool	Max by Risk Pool
Benchmark								
(1) Base Score (DNB9)	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Aggregated Data - Time Series & Panel Regression								
Aggregate Model:								
(2) Macroeconomic Variables Only - Time Series	1.0002	1.0000	1.0000	0.9529	0.9330	0.9559	0.8870	0.9703
Disaggregated by Risk Pool:								
(3) Time Series	0.9757	0.9933	0.9989	0.9008	0.8730	0.8998	0.7803	0.7721
(4) Panel	0.9757	0.9931	0.9991	0.9877	0.9543	0.9547	0.8753	0.9615
Disaggregated by Geography								
(5) Time Series	0.9800	0.9928	1.0000	0.9649	0.9555	0.9640	0.8869	0.9848
(6) Panel	0.9797	0.9928	0.9997	1.0015	1.0008	1.0003	0.9275	0.9919
Disaggregated by Socio-Demographic Segments								
(7) Time Series	0.9802	0.9931	1.0037	1.0191	0.9865	1.0057	1.0092	1.0096
(8) Panel	0.9802	0.9931	1.0040	1.0242	1.0024	1.0123	1.0143	1.0295
Individual-level Data - Logistic Regression								
(9) Including Local Economic Variables	1.0021	1.0010	1.0000	0.6980	0.6654	0.6963	0.6390	0.6128
(10) Including Socio-Demographic Variables	1.0031	1.0012	1.0009	0.7028	0.6763	0.7022	0.6356	0.5918
(11) Including all Economic Variables	1.0031	1.0015	1.0009	0.6957	0.6593	0.6941	0.6355	0.5910

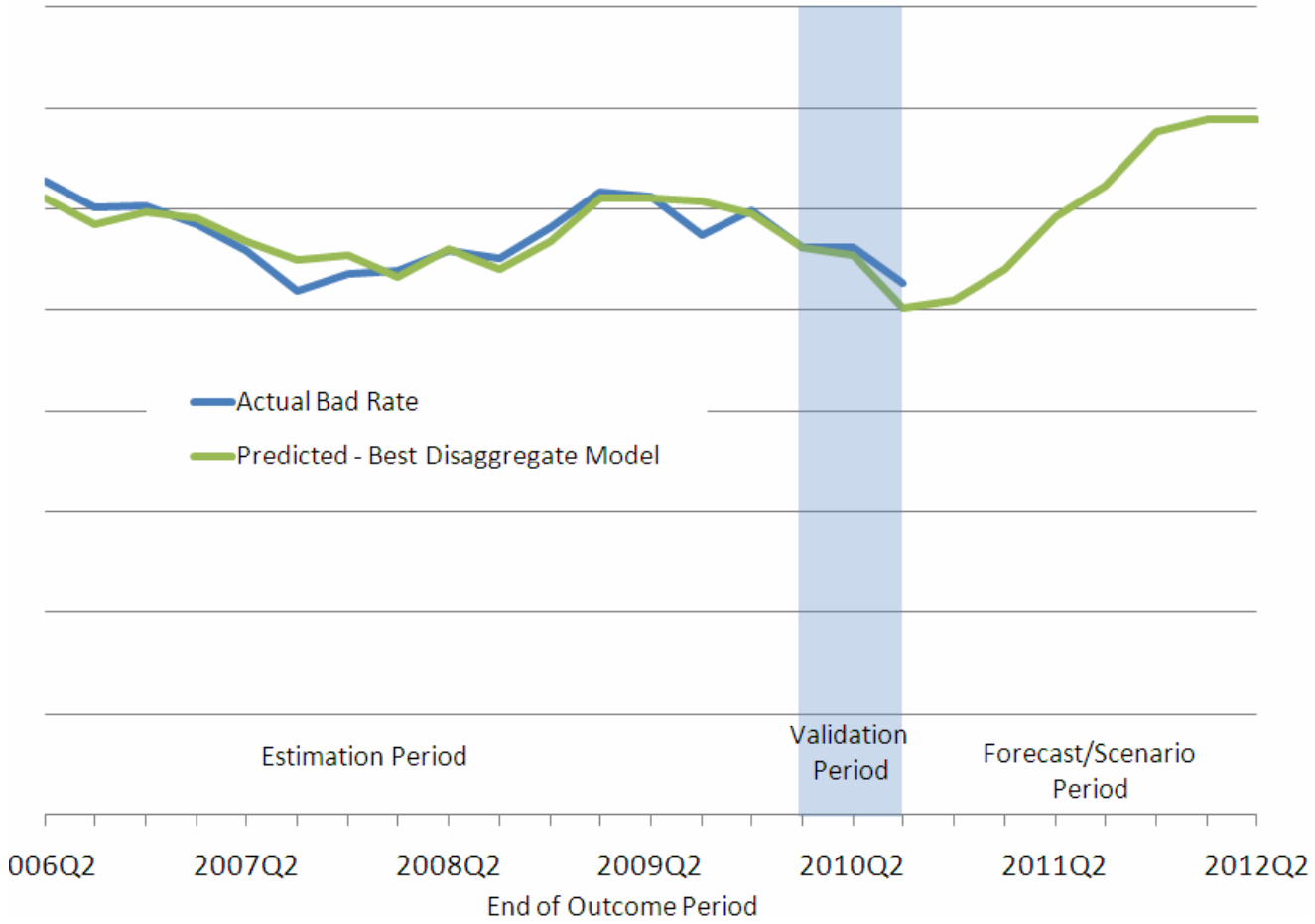
Predictive Performance: Bad Rate by Risk Pool



Calibration Stability: Standard Deviation of Actual Bad Rate by Augmented Score Risk Band



Predictive Performance: Total Bad Rate



Conclusions

- Establishing robust estimates of economic impacts on loan performance imposes significant challenges:
  - Variable selection
  - Lack of time series data
  - Simultaneity / endogeneity
- Homogeneity assumptions seem unjustified
- Exploiting disaggregated data helps
- Borrower-level models with disaggregated economics can improve calibration stability/predictive performance at no cost of discrimination
- Structure suited to forecasting and scenario analysis
- Need to be aware of uncertainties around models and assumptions in forecast/scenario applications