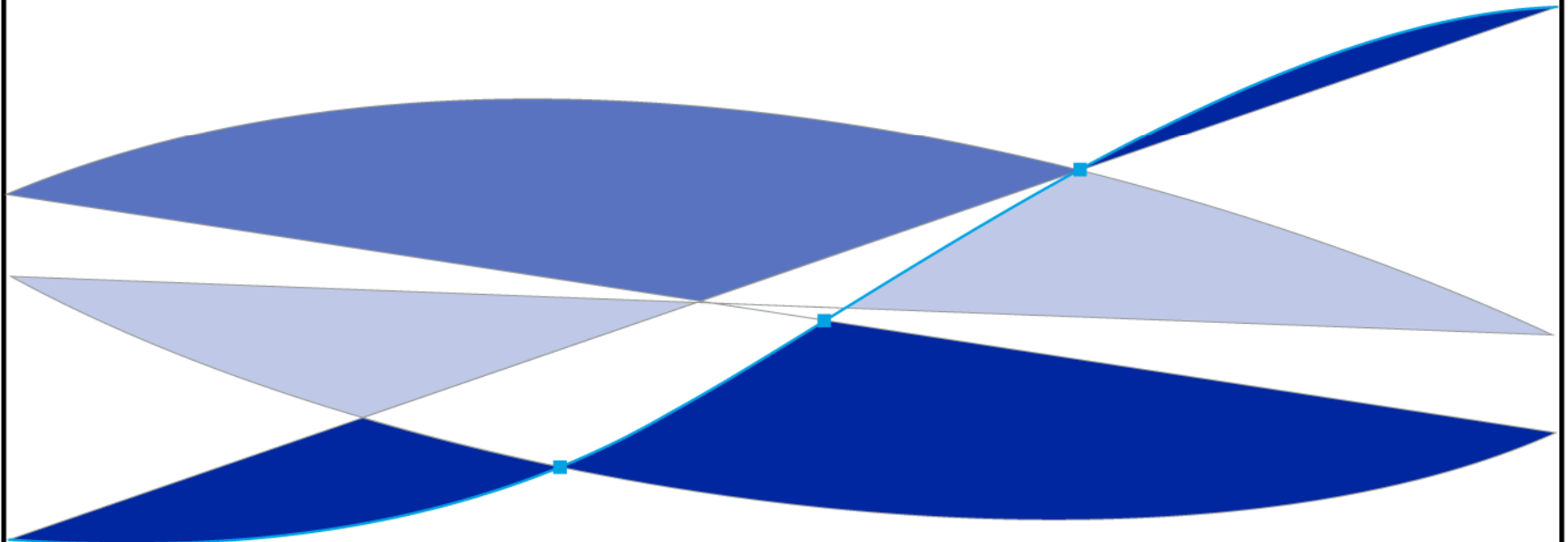


## Portfolio Retail Correlations



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# Agenda

1. Introduction
2. Estimation Methodology
3. Data and Estimation Results
4. Portfolio Impact



# Introduction

## Importance of Retail Correlations in the Bank Portfolio Risk

**Retail:** the lion's share of banks' portfolios

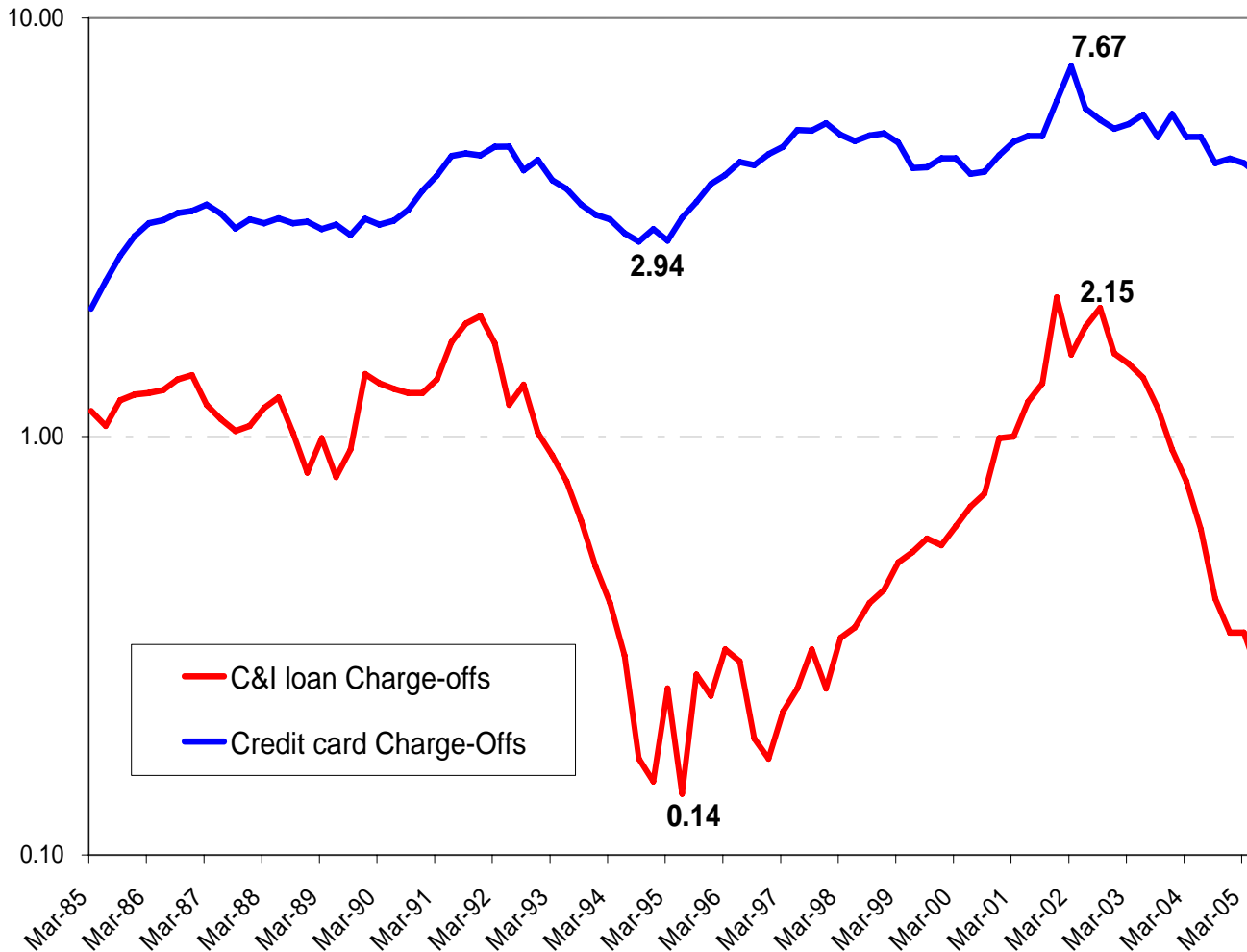
**Correlation:** a major driving factor for portfolio risk

- Lack of data and different data
- Lack of empirical/analytical work linking retail and corporate exposures

**Basel II:** conservative?

**MKMV's Goal:** A more accurate measure of risk for bank portfolios that include credit exposures to individuals.

# Bank Charge-Offs Through Time



- Retail Loans: Higher probability of default, but less volatility and more predictability (lower correlation)
- Evident positive correlation between retails and corporates

Source: The Federal Reserve Board

## Estimating Retail Correlations: The Approach

Analyze the performance of homogenous groups of retail accounts through time

The dynamics of “asset returns” represent the changes in the “asset value” or “credit state” of individual borrowers and retail product portfolios

Analyze the asset return series within the framework of MKVM Global Correlation Model

Provide a [common integrated framework](#) for combining retail and corporate exposures

## Modeling Retail Correlations in MKMV Global Correlation Model (GCM)

In the GCM framework, every single borrower needs two measures:

- **R-Squared:** a measure for the systematic portion of risk or volatility in the asset return of the borrower
- **Factor loadings to systematic factors:** sensitivity of each borrower to systematic factors

The extension of GCM for modeling retail loans requires us to estimate these two measures for various retail products.

## Modeling Retail Exposures in Moody's KMV Portfolio Manager

Portfolio Manager can model retail portfolios as “aggregates” or pools of homogeneous accounts

This requires defining homogeneous pools where risk and return dimensions can be described for the representative exposure:

- Size of Commitment / Outstanding
- Maturity
- Recovery / Loss Given Default
- Probability of Default

- Country or region (state)
- Industry or retail category/product
- R-squared

Retail Correlations

```
graph LR; A[Retail Correlations] --> B[Country or region (state), Industry or retail category/product, R-squared];
```

# 2

## Estimation Methodology

## Estimation Methodology: Panel of Historical Retail Data

The methodology is based on creating groups of homogeneous retail accounts.

In each group, each account has the same probability of default and correlation parameters.

The homogenous groups can be formed along multiple dimensions such as:

- Product type: credit card, auto loan, mortgage, etc
- Time from origination: vintage
- Credit quality of the borrower: FICO score
- Geographical region: states, countries

## Estimation Methodology: Two Steps

**Step 1)** Obtain the R-Squared (or level of systematic risk) for each retail group

**Step 2)** Obtain the retail group's factor loadings on systematic risk factors – estimate customized factor table with retail categories

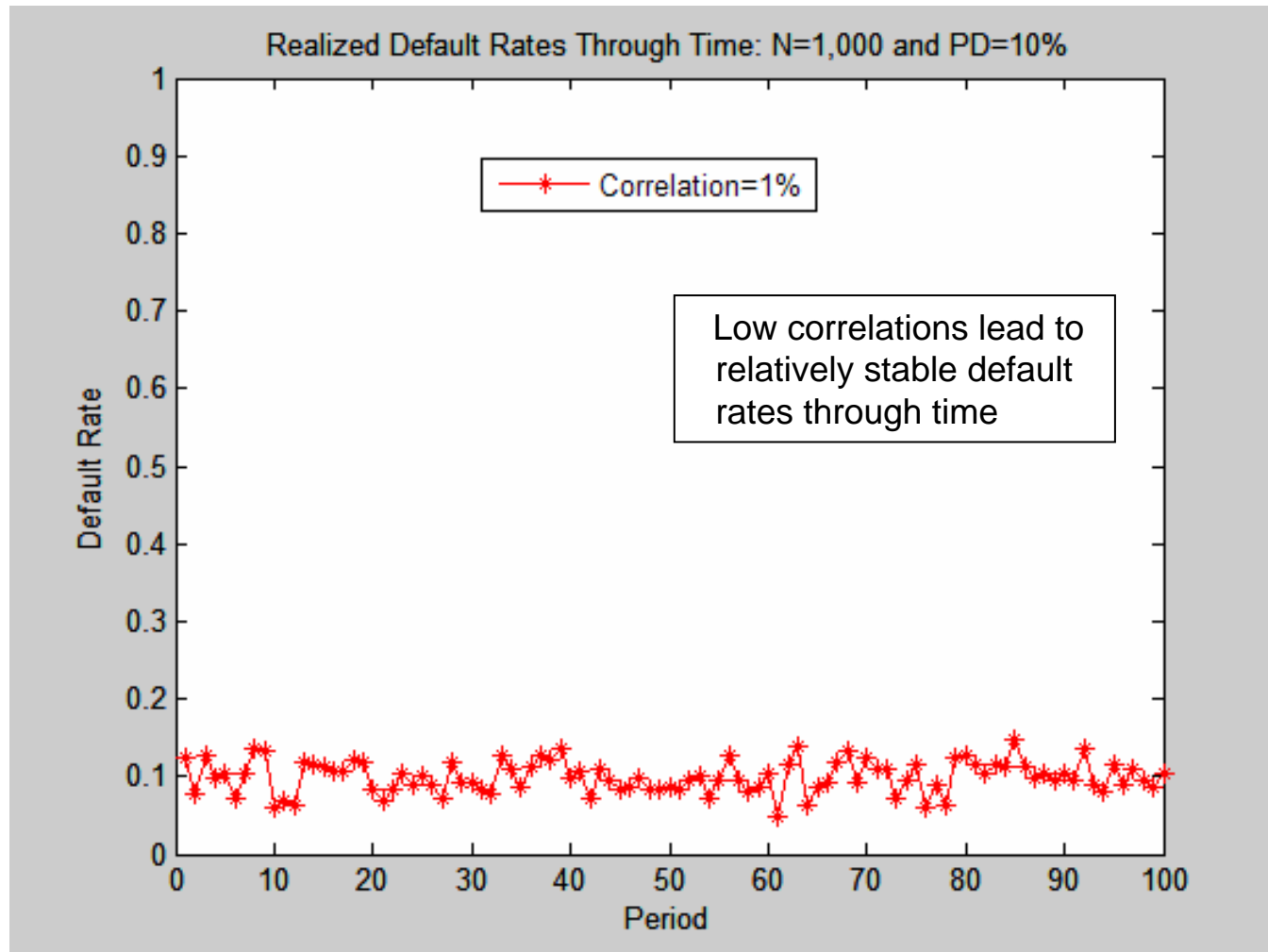
## Step 1) Estimation of R-squared Parameters for Retail Pools

The systematic portion of risk in each homogenous pool of retail accounts is obtained using the time series of realized defaults.

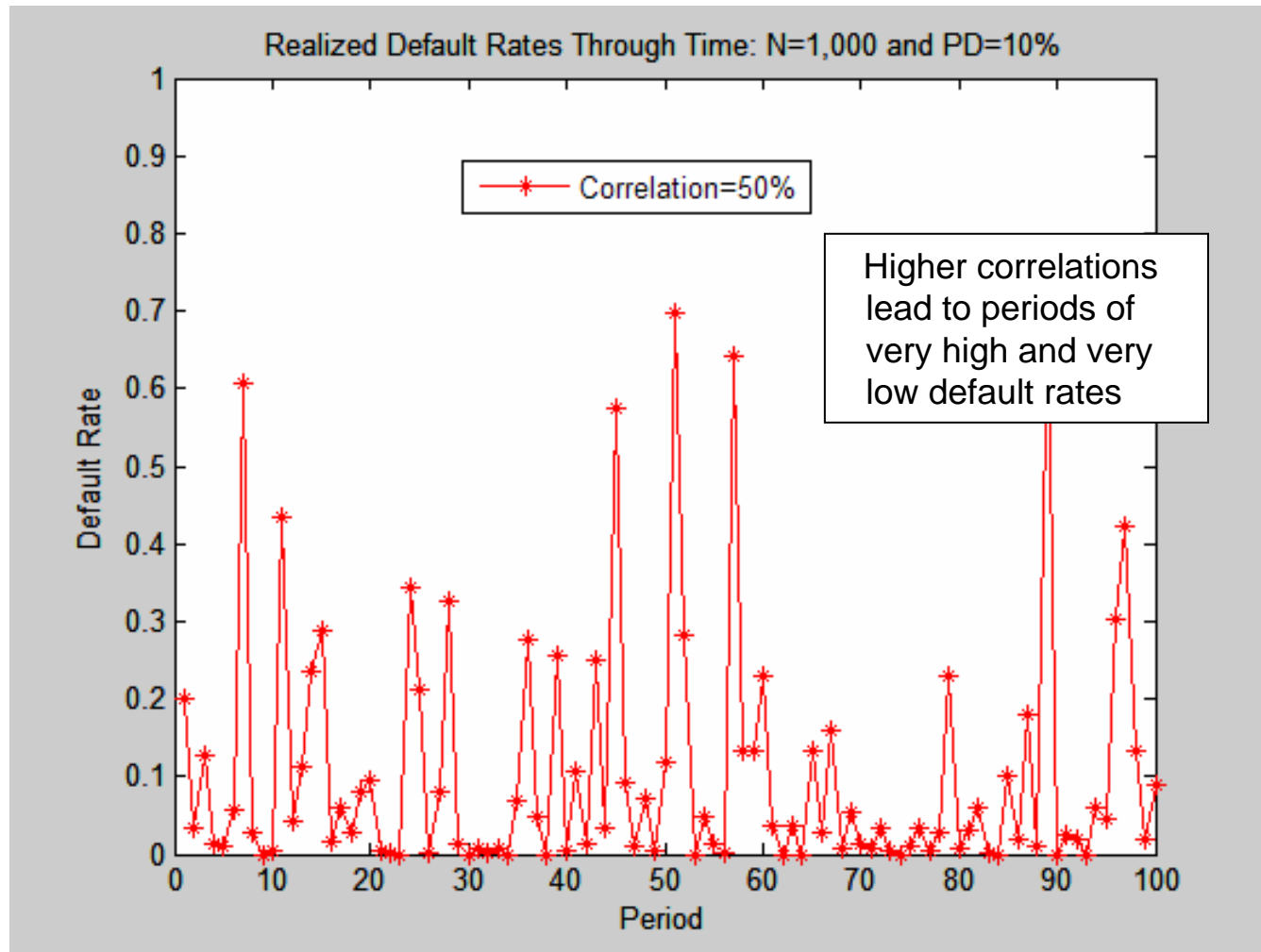
The correlation between defaults can be estimated using the observed variation of default rate in the pool and the estimate of variance for individual defaults.

The estimated correlation can then be readily translated to a measure of systematic risk, i.e. R-squared in a single factor model framework.

## Simulating Defaults: Low Correlation



## Simulating Defaults: High Correlation



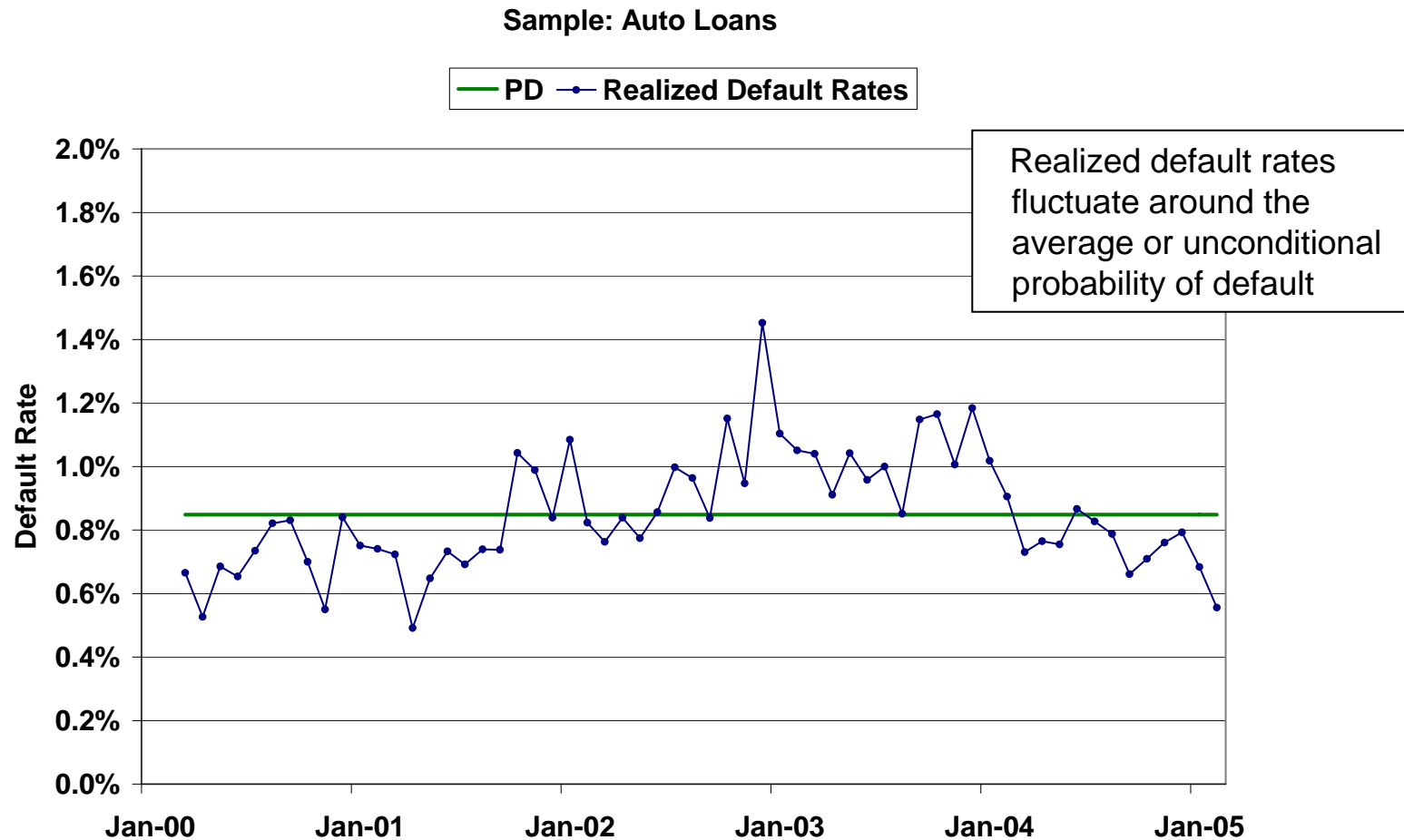
## Step 2) Adding Retail Factors to GCM

Estimate retail factors – to measure the impact of time varying state of the economy on the credit quality of each retail group.

Add new systematic factors and retail “industries” to improve the forecasting power in estimating correlations between retail accounts and corporate accounts.

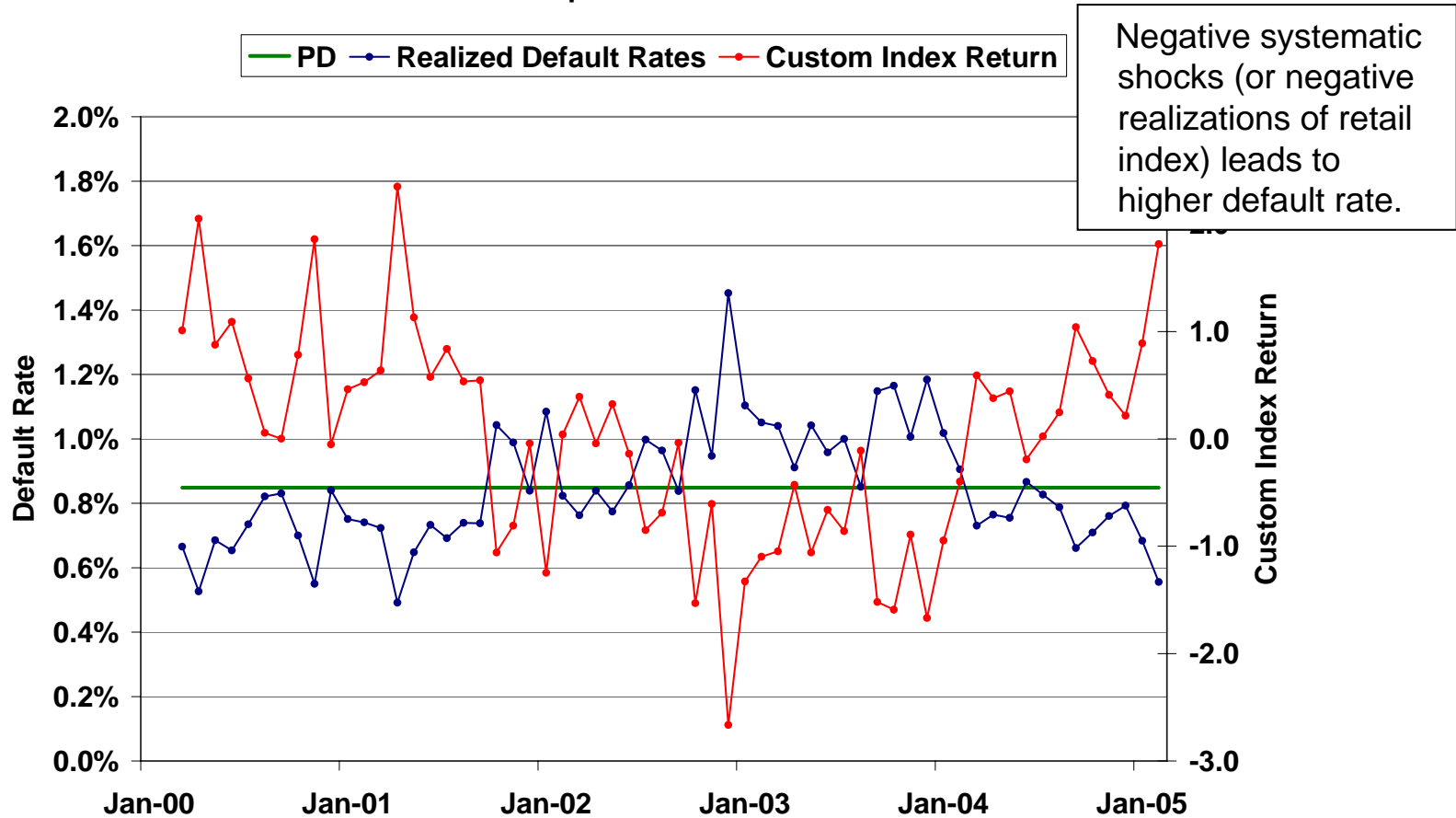
The number of additional retail industries will depend on how “synchronized” different pools of retail accounts behave with respect to the current factors in GCM and each other.

## Step 2) Estimating Retail Factors



# Step 2) Estimating Retail Factors

Sample: Auto Loans



# 3

## Data and Estimation Results

## Retail Data: Possible Sources

### Internal data from banks

- HSBC: Monthly delinquency/default rates for 9 retail categories since 1999.

### Banking associations and data vendors:

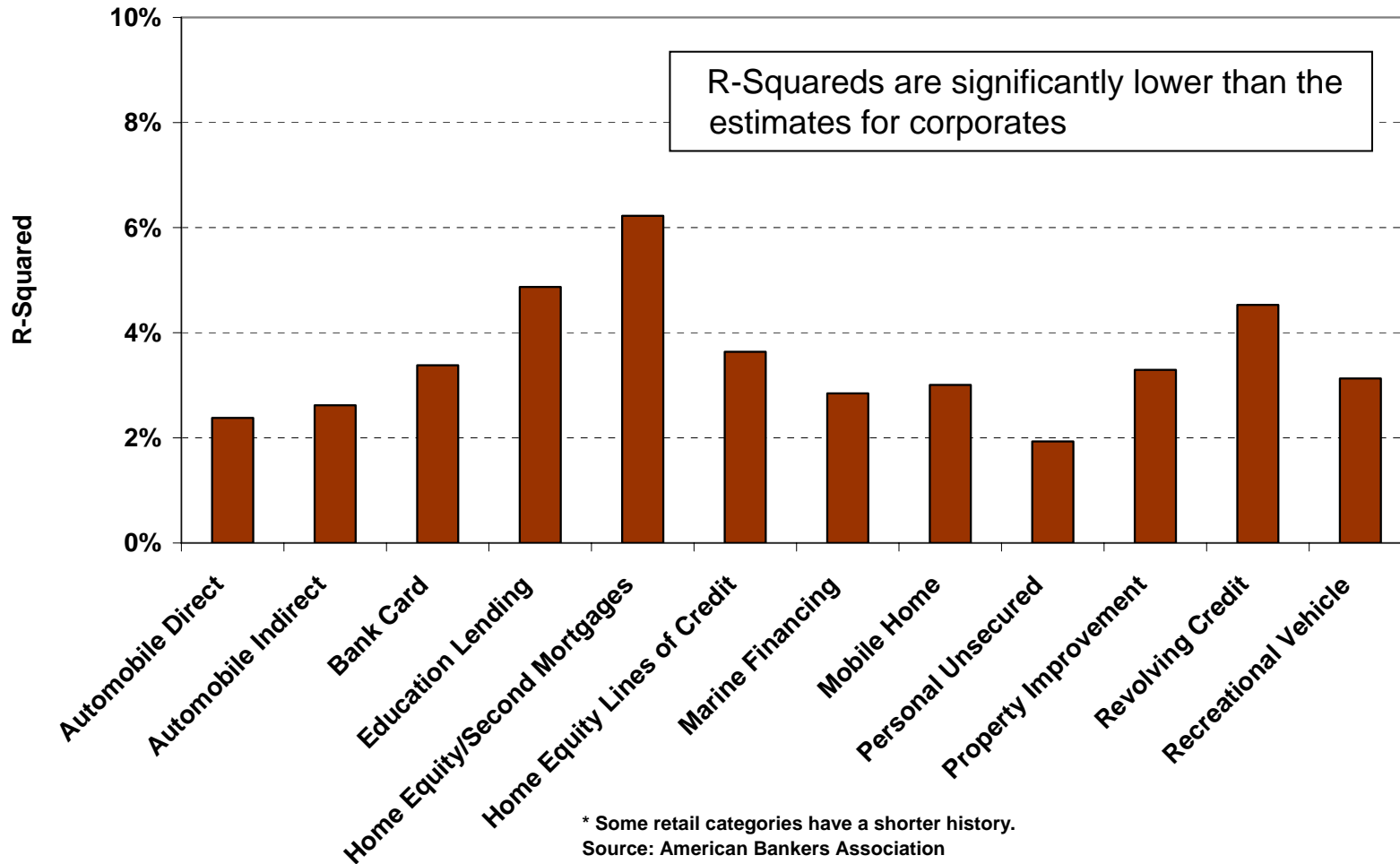
- American Bankers Association: Monthly delinquency rates for 12 retail categories since 1972 across US states

### Central banks

- Federal reserve: Quarterly charge-off/delinquency rates for 10 retail categories in the US since 1985.

# Preliminary Results: R-Squared

Estimates for R-Squareds (a measure of Systematic Risk) in retail Categories  
 Data: Monthly Delinquency Rates from 1972M1 to 2006M3\*



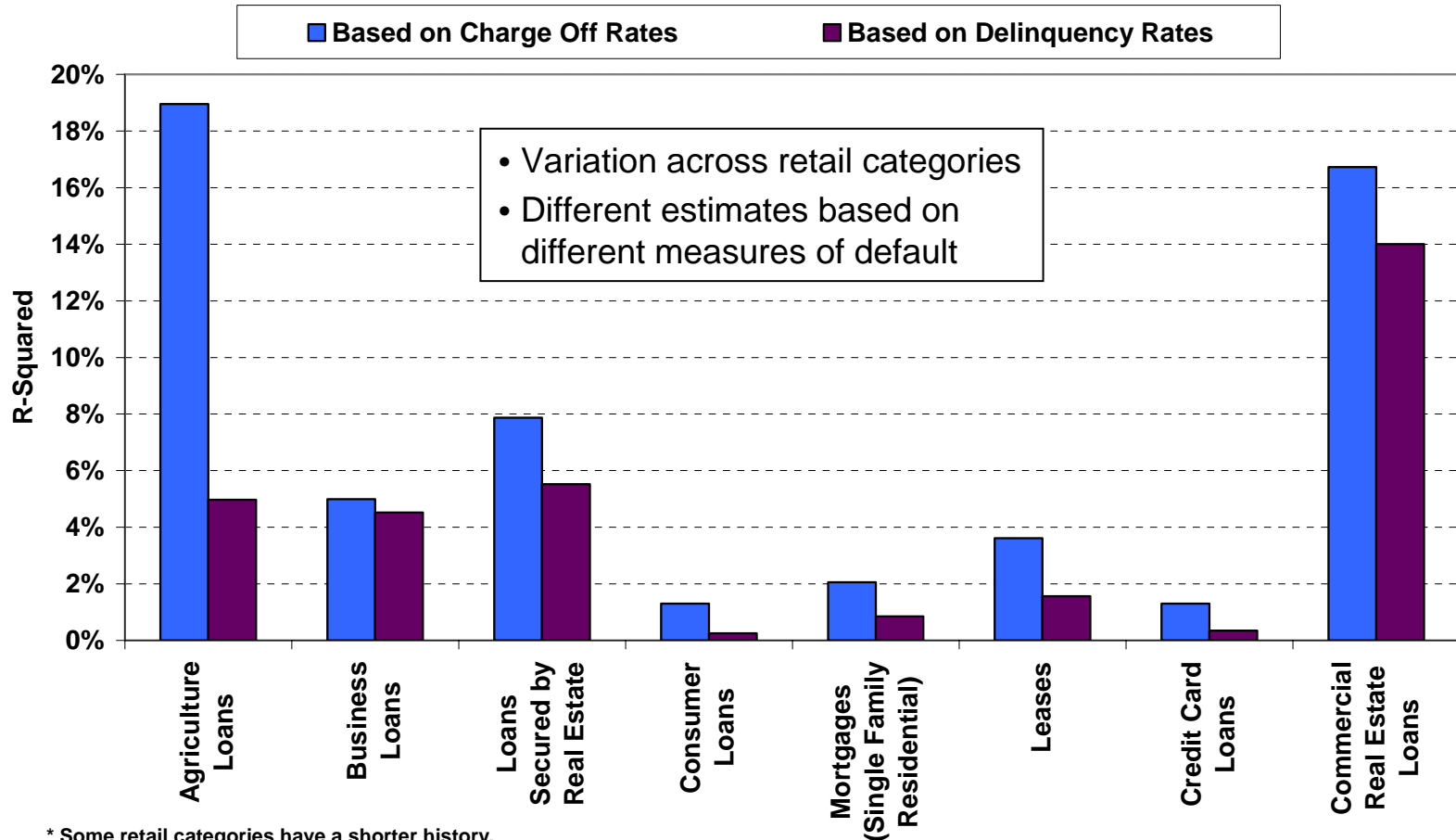
## Working with Proxies for Default Rates

Various measures for the performance of retail pools are assessed:

- *Rate of delinquency* – past due a certain number of days
- *Rate of charge-off* – charged-off by creditors
- *Rate of bankruptcy* – with a bankruptcy claim
- *Rate of foreclosure*, repossession, civil judgment, collection, etc.
- *Rate of defaults* – considered “defaulted”

# Preliminary Results: R-Squared

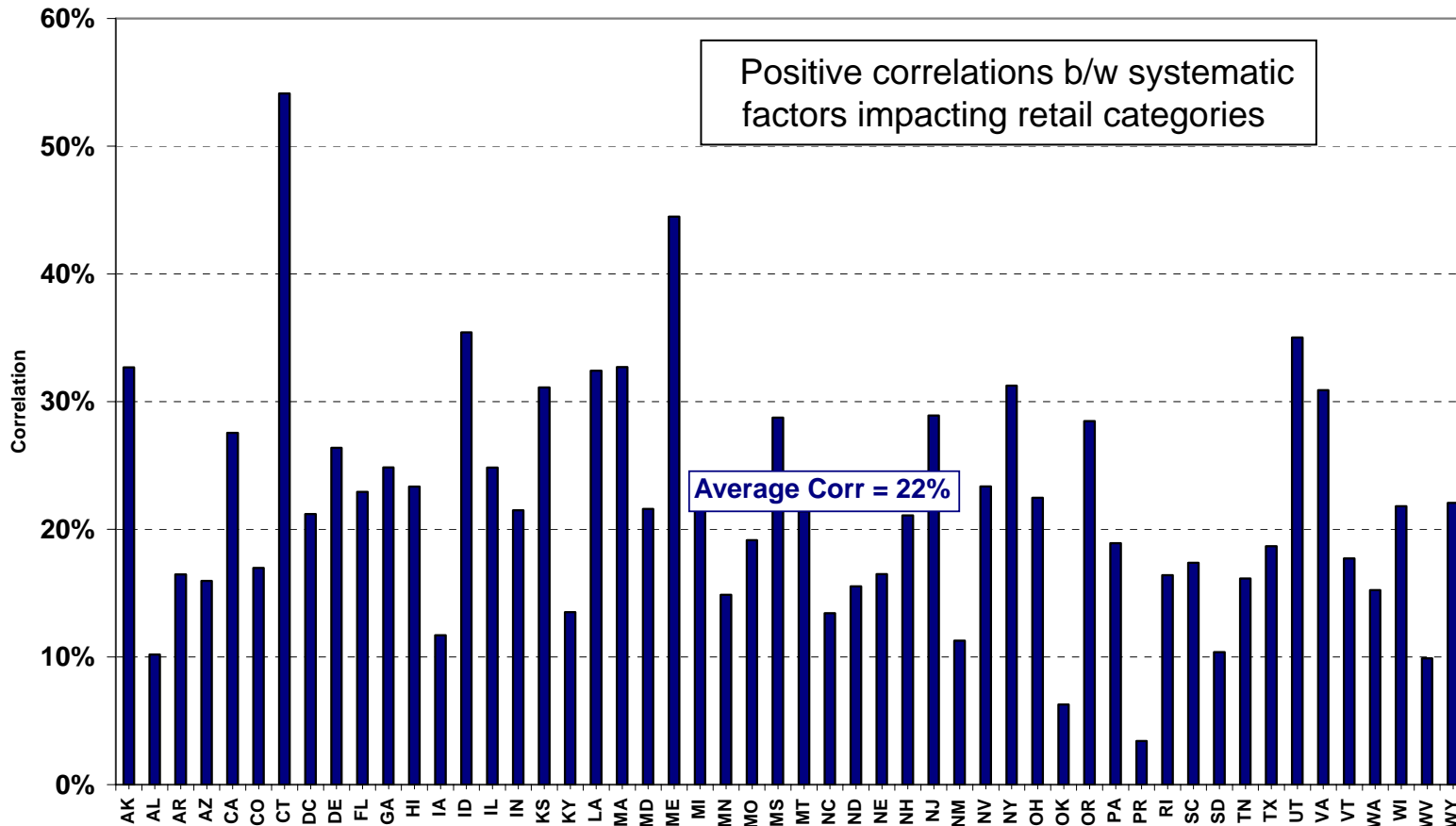
Estimates for R-Squareds (a measure of Systematic Risk) in retail Categories  
 Data: Quarterly Default Rates from 1985Q1 to 2006Q2\*



\* Some retail categories have a shorter history.  
 Source: The Federal Reserve Board

# Results: Factor Correlations – B/W Retail Categories within Each State

Average factor correlations between retail Categories within each state  
 Monthly Delinquency Rates from 1972M1 to 2006M3\*

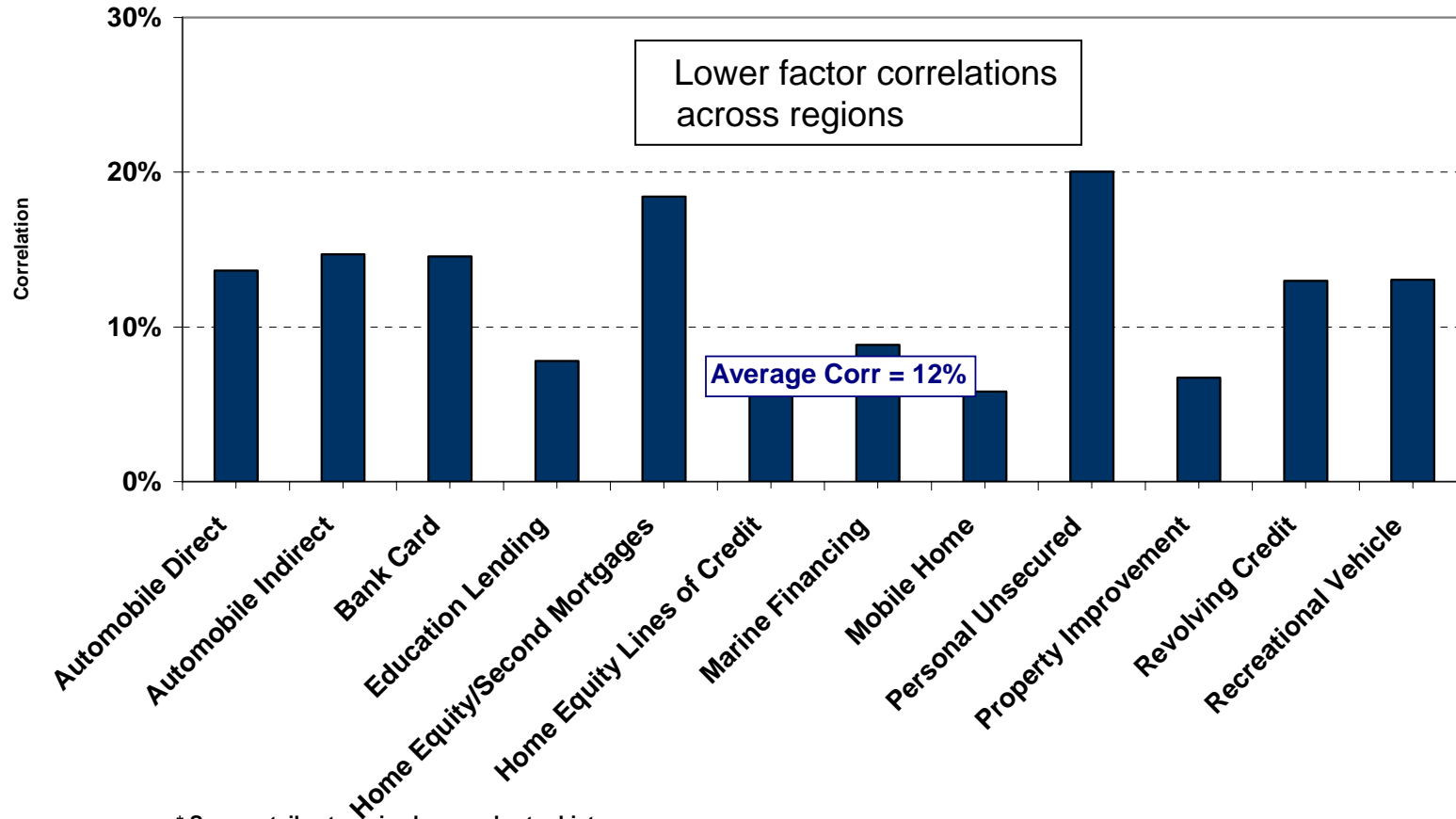


\* Some retail categories have a shorter history.

Source: American Bankers Association

# Results: Factor Correlations – B/W States for Each Retail Category

Average factor correlations between US states for each retail Category  
 Data: Monthly Delinquency Rates from 1972M1 to 2006M3\*



\* Some retail categories have a shorter history.  
 Source: American Bankers Association

# 4

## Portfolio Impact

## Portfolio Impact: Sample Retail Portfolio

No. Exposures 10,000  
No. Borrowers 10,000  
Commitments \$271 Mil

Portfolio Breakdown:	Weight
• Auto Loans	10%
• Consumer Loans	25%
• Mortgages	40%
• Credit Cards	25%

EDF = 0.0001 to 0.6

RSQ = 5%

LGD = 0.50

# Portfolio Analysis: Sample Retail Portfolio

	Single Unassigned Industry	Various Corporate Industries	Retail Industries
<b>No. Exposures</b>	10,000	10,000	10,000
<b>No. Borrowers</b>	10,000	10,000	10,000
<b>Commitments</b>	270,666,700	270,666,700	270,666,700
<b>Expected Loss</b>	13,079,311	13,079,311	13,079,311
<b>Unexpected Loss</b>	4,262,424	3,523,790	2,590,259
<b>Capital (5 bps)</b>	17,948,682	14,363,549	10,354,179
<b>Expected Loss</b>	5.09%	5.09%	5.09%
<b>Unexpected Loss</b>	1.66%	1.37%	1.01%
<b>Capital (5 bps)</b>	6.99%	5.59%	4.03%

Significant impact on portfolio risk

## Required Data: Dataset 1

Creating homogenous pools of retail accounts:

- Group ID: A unique ID for each pool
- Number of retail accounts in the pool
- Loan type: Credit Card, Mortgage, Car Loan, Student Loan, etc
- Issuer type: retailer, bank, etc
- Origination time: January 2001, February 2001, etc
- Geography: US-East, US-Midwest, US-West, UK, etc.
- Average credit quality or credit score of the underlying borrowers of retail account

## Required Data: Dataset 2

Tracking each retail pool through time:

- Time Period
- Group ID
- Number of open/active/current accounts
- Number of delinquent accounts
- Number of charge-off, bankrupt, default accounts

## Conclusion: Retail Correlations

### Data and Estimation Methodology

- Gather more granular data
- Improve estimation methodology

### Results

- Retail R-Squareds mostly range from 2% to 8%
- Factor correlations between retail categories: 10% to 60%

### Portfolio Impact

- Considerable impact on portfolio risk measures

## MKMV Offering: Retail Correlations

### Advisory project based on banks' internal retail data

- Data assessment and optimal pooling (aggregation)
- Estimating R-Squareds and systematic factors for retails categories
- A custom correlation model for modeling retails and corporates
- Knowledge transfer and training