Auto Days 2011
Predictive Analytics in Auto Finance

Vick Panwar
SAS Risk Practice

Agenda

Introduction

Changing Risk Landscape

- Key Drivers and Challenges

Sample Predictive Analytics for Vehicle Finance Organizations

- ❑ Manage credit risk and protect your portfolio
- ❑ Establish in-house credit scoring
- ❑ Real time Decisioning
- ❑ Predict loan exposure, reduce the risk of loan losses
- ❑ Optimize lease offers
- ❑ Collections Optimization

Best Practices – Case Study

Questions and Answers

New Era of Financial Services Firms:
Earnings Quantity to Earnings Quality

Leading Firms are investing in the ability to provide account holder "event" level information to manage customer relationships, risk, regulatory drivers, and return on capital.

"The goal is to increase quality of relationships with profitable customers"

Enhanced Operational & Capital Advantage

- Capital Allocation is directly tied to accounts & product profitability
- Risk processes are as integral as accounting & forecasting
- Velocity of financial analysis is changing

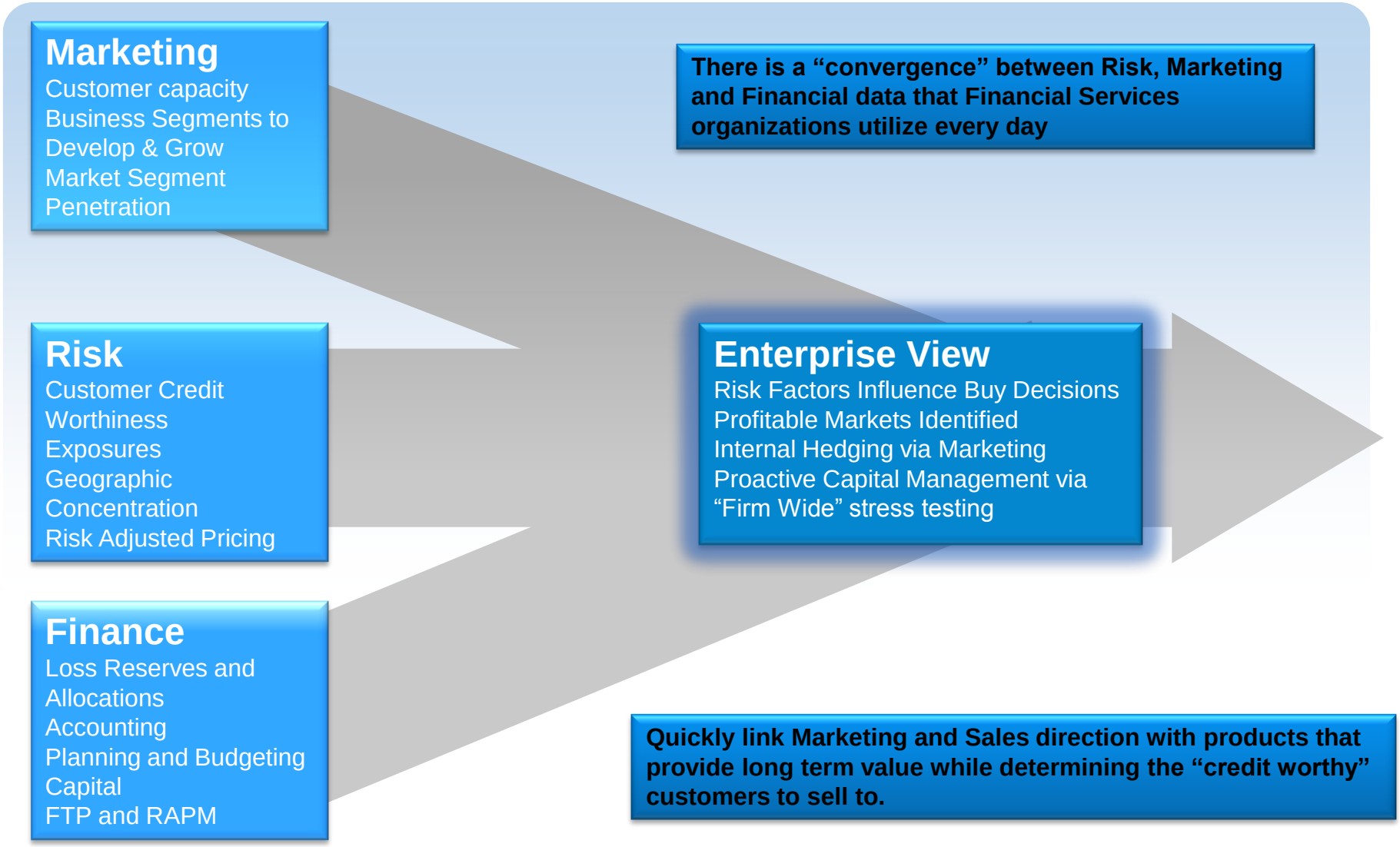
Enhanced Regulatory Reporting Capability

- Proactive risk & financial reporting to internal & external agencies
- Ability to report in multi jurisdictions
- Strategy embedded in forward looking capital planning

Enhanced Customer Relationships

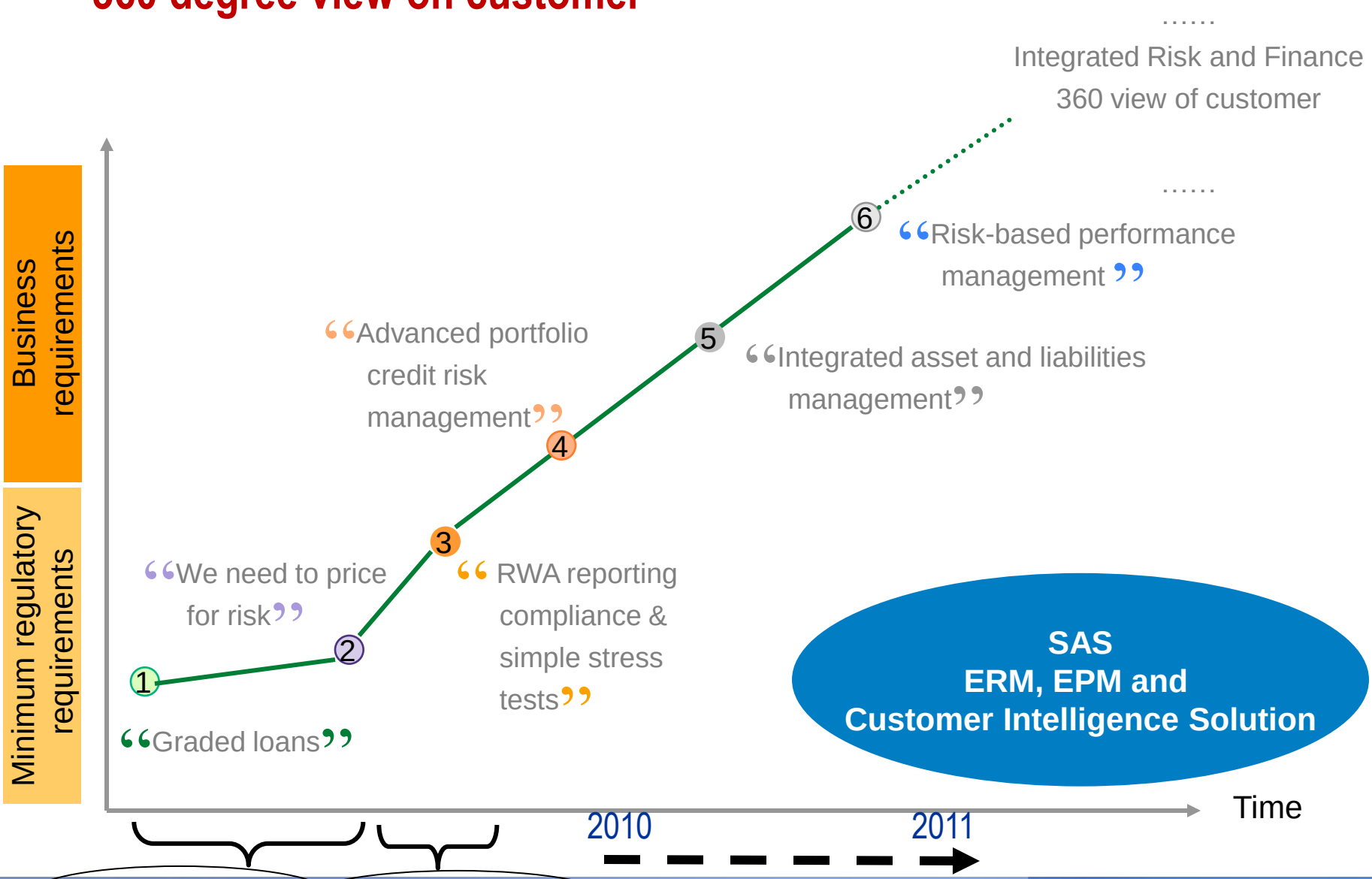
- Siloed Channels replaced with "Events"
- Products are offered at anticipate life or firm level events
- Customer RM balanced by Risk RM

Convergence of Capabilities



Integration of Risk & Finance

360 degree view on customer



SAS Analytical Solutions

Performance Management			
Strategy Management	Balance Sheet Planning	Funds Transfer Pricing	Risk Adjusted Perf.
Profitability	Forecasting & Budgeting	Activity Based Costing	Risk Based Pricing

SAS Analytical Application Platform

Common Infrastructure supporting SAS solutions

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Questions and Answers

Analytics for Auto Finance

Typical Predictive Analytics

Forecasting

- Loan Losses
- Cost of funds (Treasury, Interest Rates)
- Residual values at future point in time (behavioral)
- Loan Exposure

Data Mining

- Regression based models
  - PD, LDG at origination and on going
- Residual value at lease origination
- Optimal down payment
- Segmentation

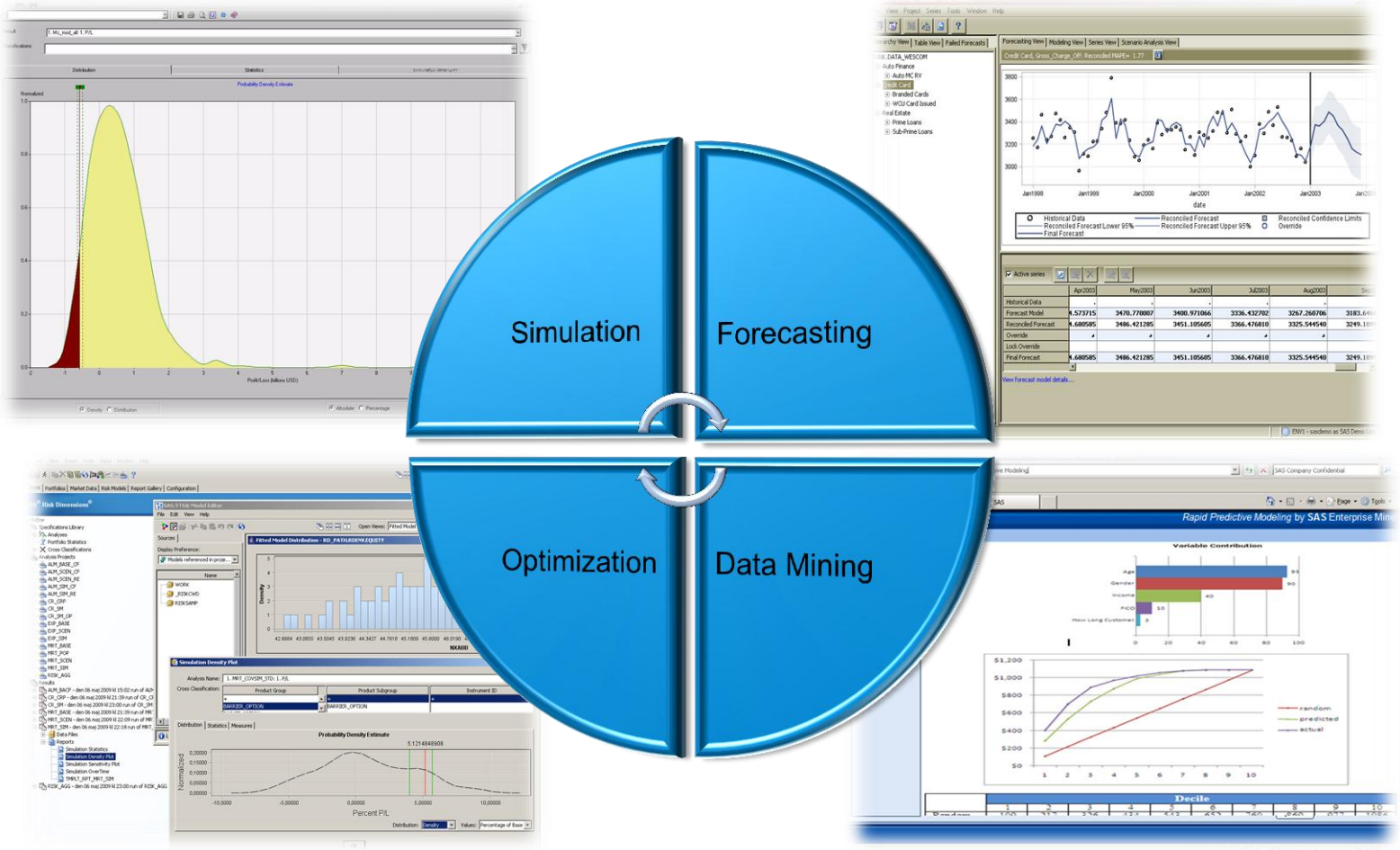
Simulation

- Portfolio risk
  - Credit Risk
  - Liquidity Risk
  - Capital Management
- Forecasting Roll Rates

Optimization

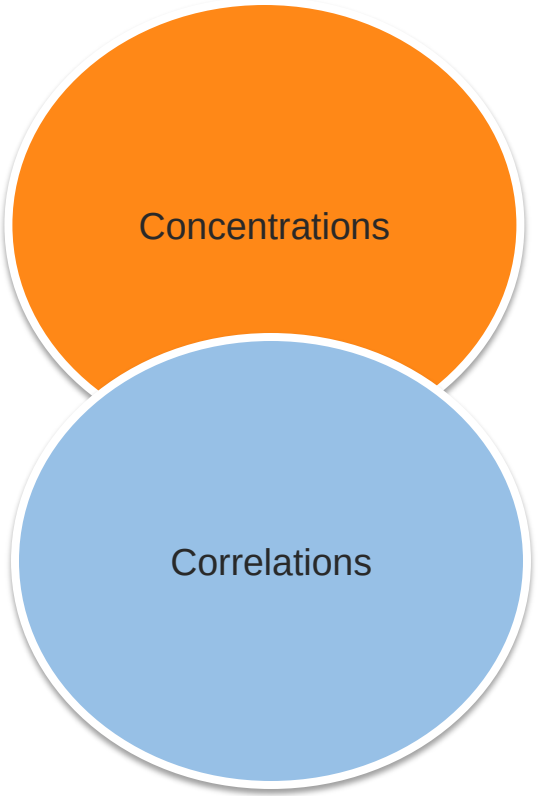
- Optimization
  - Pricing
  - Lease offers & Buy backs
  - Collections
- Design of Experiment

Brief Overview Analytics Solutions



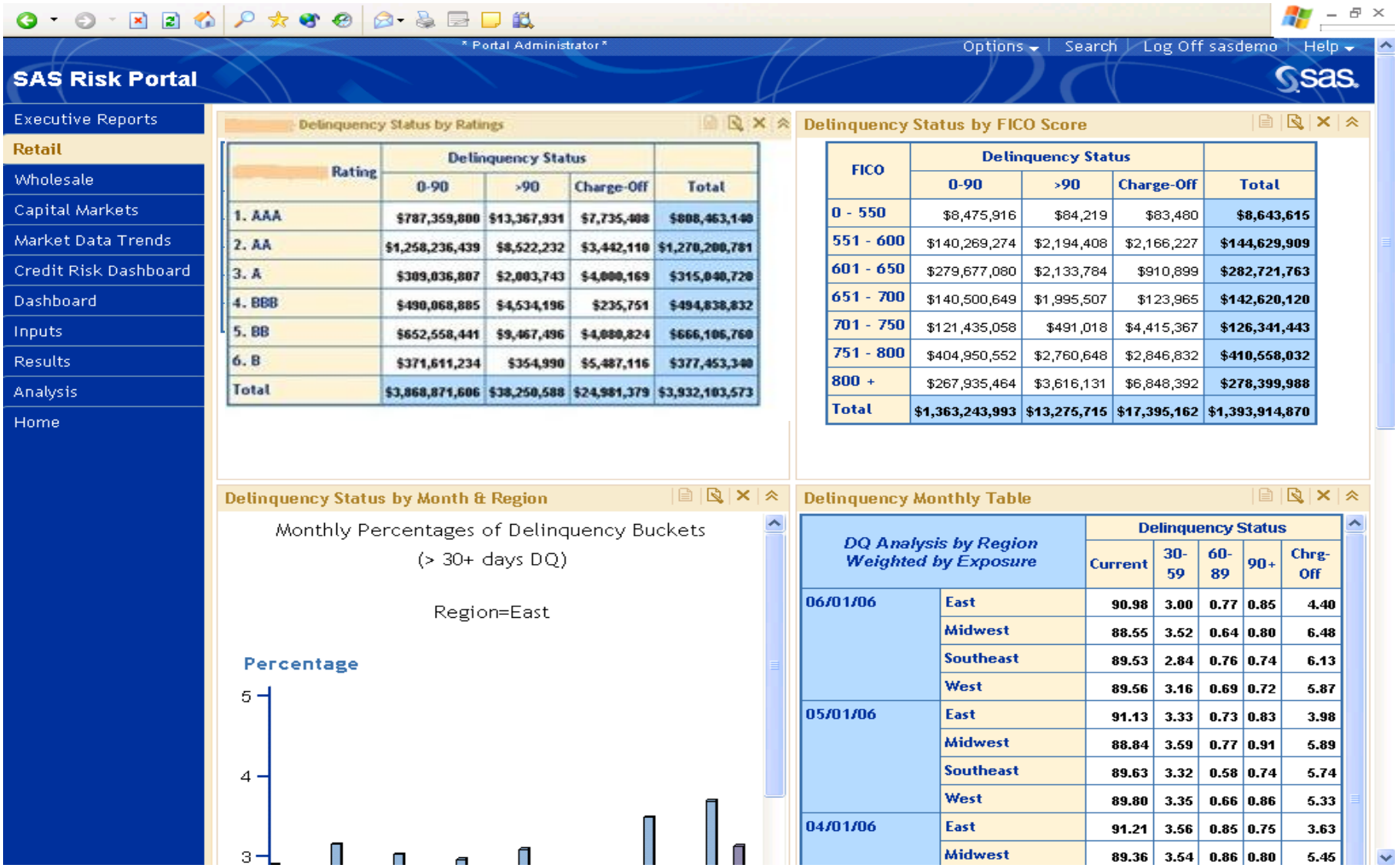
Manage credit risk and protect your portfolio

- What is credit risk?
  - Default and Delinquency Analysis
  - Estimation at Origination vs. Behavior
  - Ratings Migration
  - Concentration Analysis
- How do I protect my portfolio?
  - Early warning systems
  - Behavioral scoring
  - Hedging
- How much capital should be held
  - Matching capital to assets
- Risk based pricing



Credit Performance Reporting

Delinquency Reporting



Establish in-house credit scoring

- 3 Choices
  - Using FICO or similar scores
  - Outsourcing modeling
  - In housing credit scoring

Why?

Develop analytical skills in house

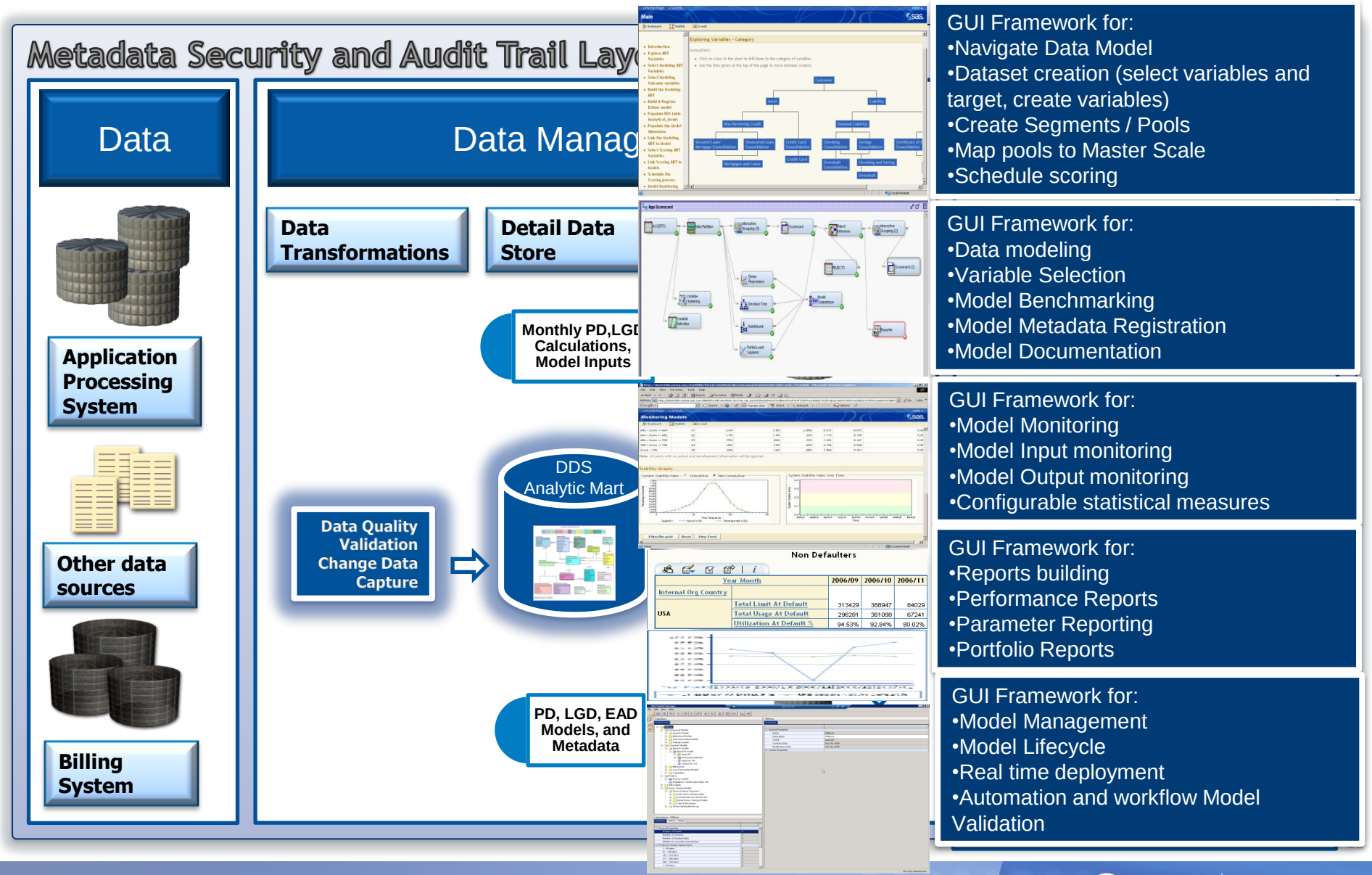
Gain deeper insight into credit portfolio and customer behavior

Ability to use analytics develop for other uses
(PD, Delinquency, Collections, Marketing Campaigns)

Aligning risk, finance, and marketing

In house Credit Scoring Framework

Real Time Decisioning or Batch Processing



GUI Framework for:
- Navigate Data Model
- Dataset creation (select variables and target, create variables)
- Create Segments / Pools
- Map pools to Master Scale
- Schedule scoring

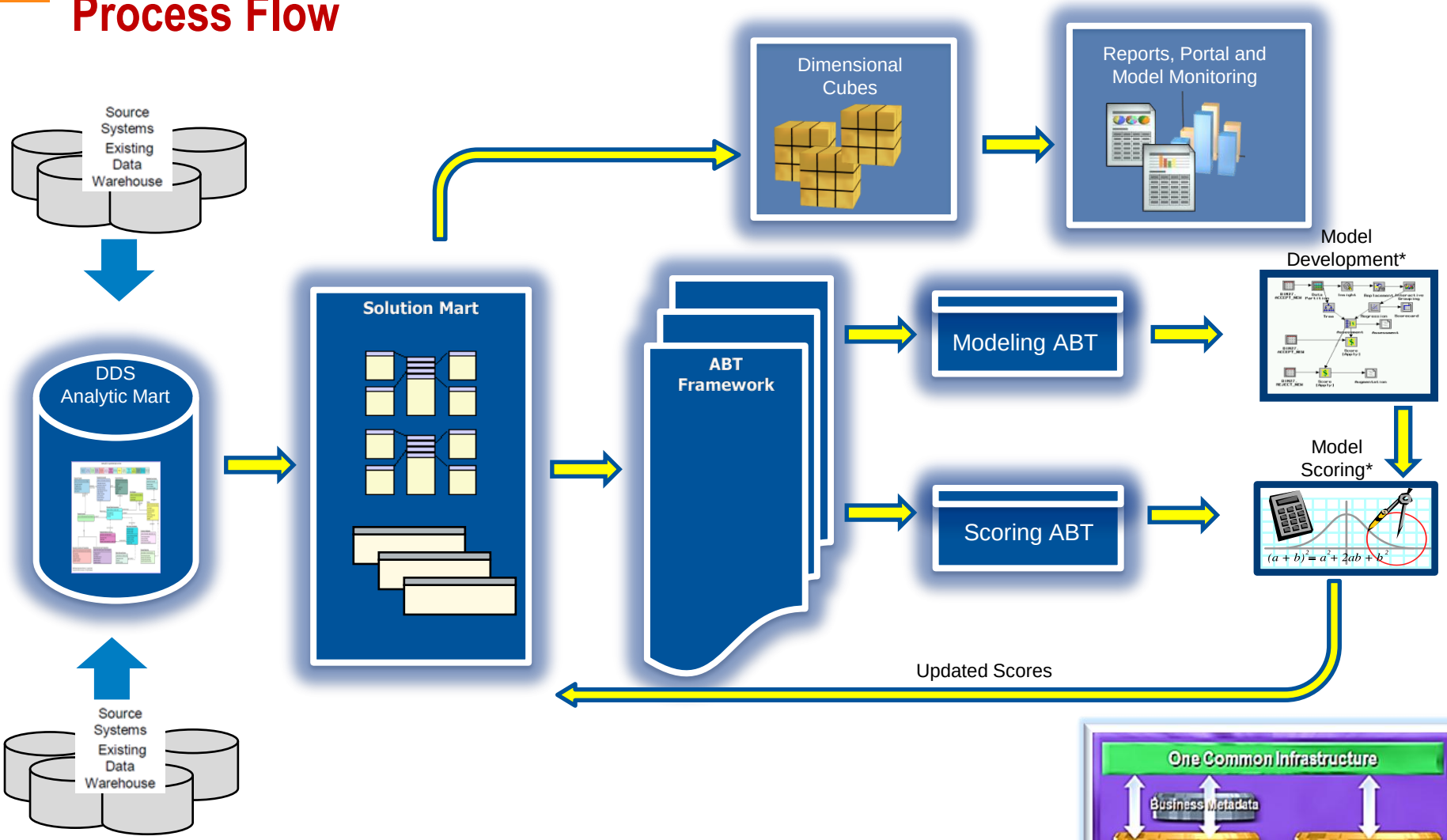
GUI Framework for:
- Data modeling
- Variable Selection
- Model Benchmarking
- Model Metadata Registration
- Model Documentation

GUI Framework for:
- Model Monitoring
- Model Input monitoring
- Model Output monitoring
- Configurable statistical measures

GUI Framework for:
- Reports building
- Performance Reports
- Parameter Reporting
- Portfolio Reports

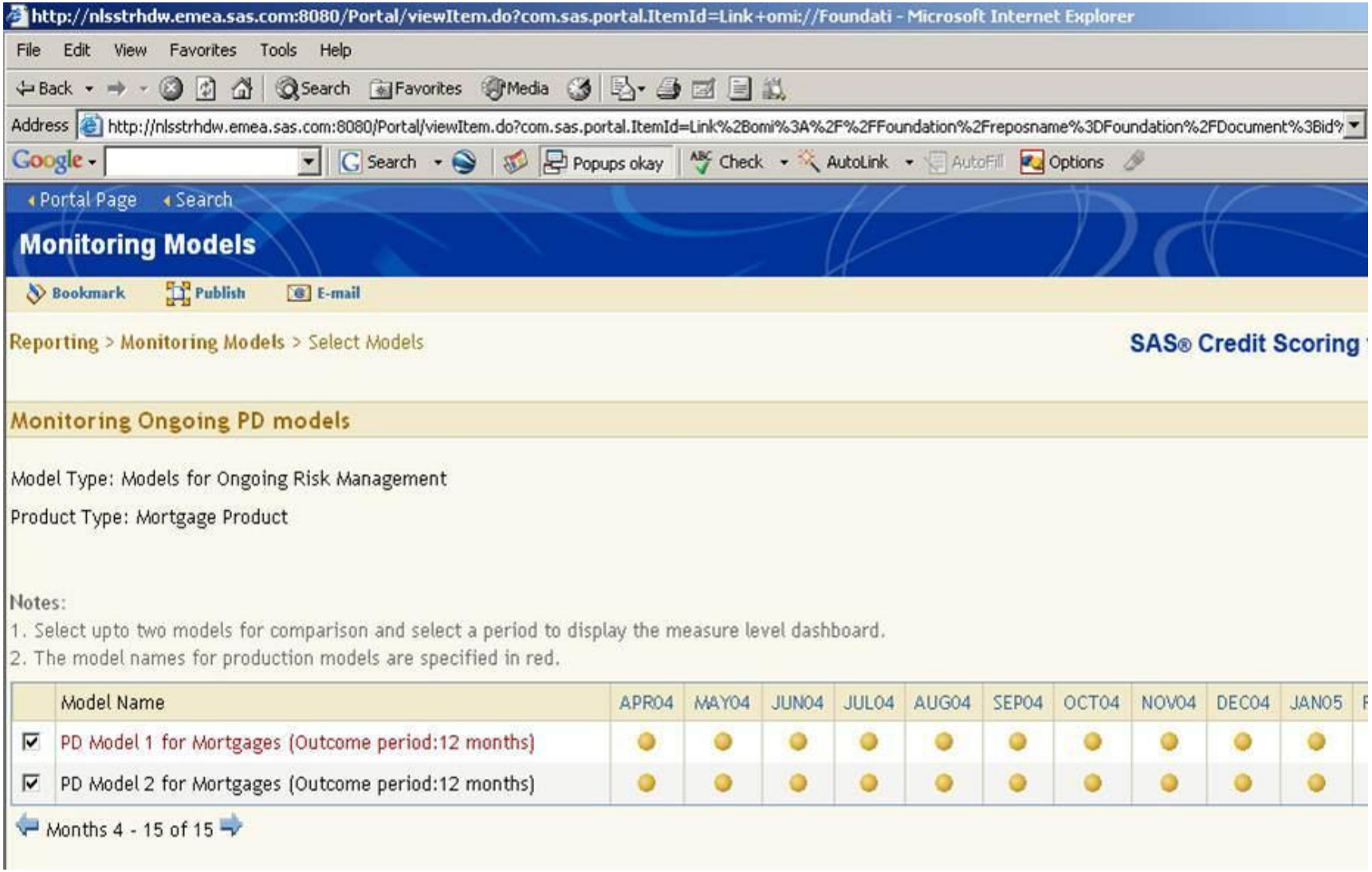
GUI Framework for:
- Model Management
- Model Lifecycle
- Real time deployment
- Automation and workflow Model Validation

Credit Scoring Solution
Process Flow



DDS = Detailed Data Store
ABT = Analytic Base Table

Credit Scoring Analytics Solution
Model Monitoring & Validation



Real Time Auto-Decisioning Criteria
What-if analysis

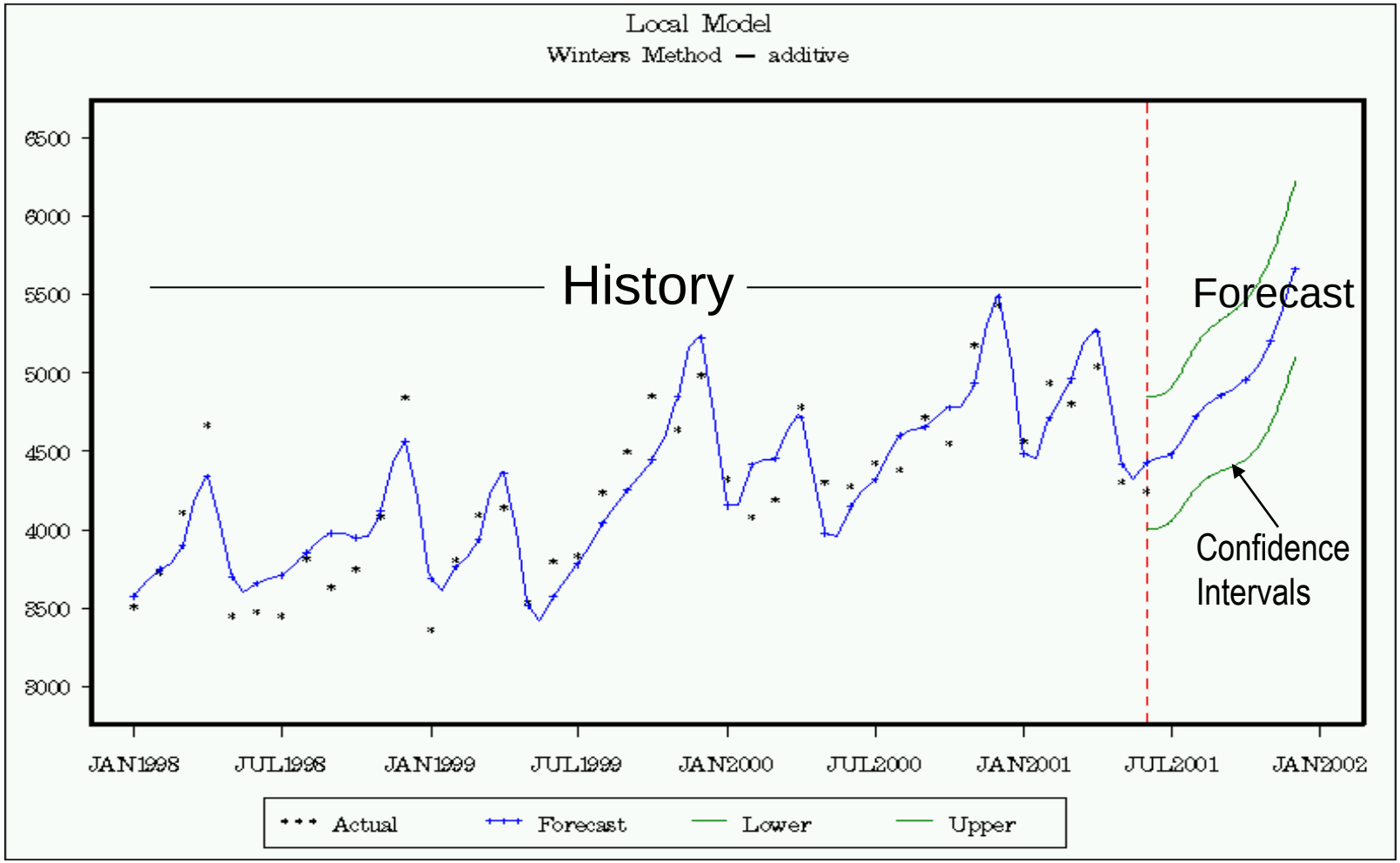
- Enable business analysts to easily access suite of models built by 3rd-party vendor
- Enable deeper / more robust auto-loan/lease application analysis
- Monitor population score shifts & model input calibration
- Enable what-if / scenario analysis based on changes to
  - » Population of applicants (perturbing input data)
  - » Auto-decisioning criteria
  - » Both (decisioning criteria and characteristics of applicants)
- Process flow templates processes to catalog and automate library of *what-if analysis* scenarios

Predict Loan exposure, reduce the risk of loan losses

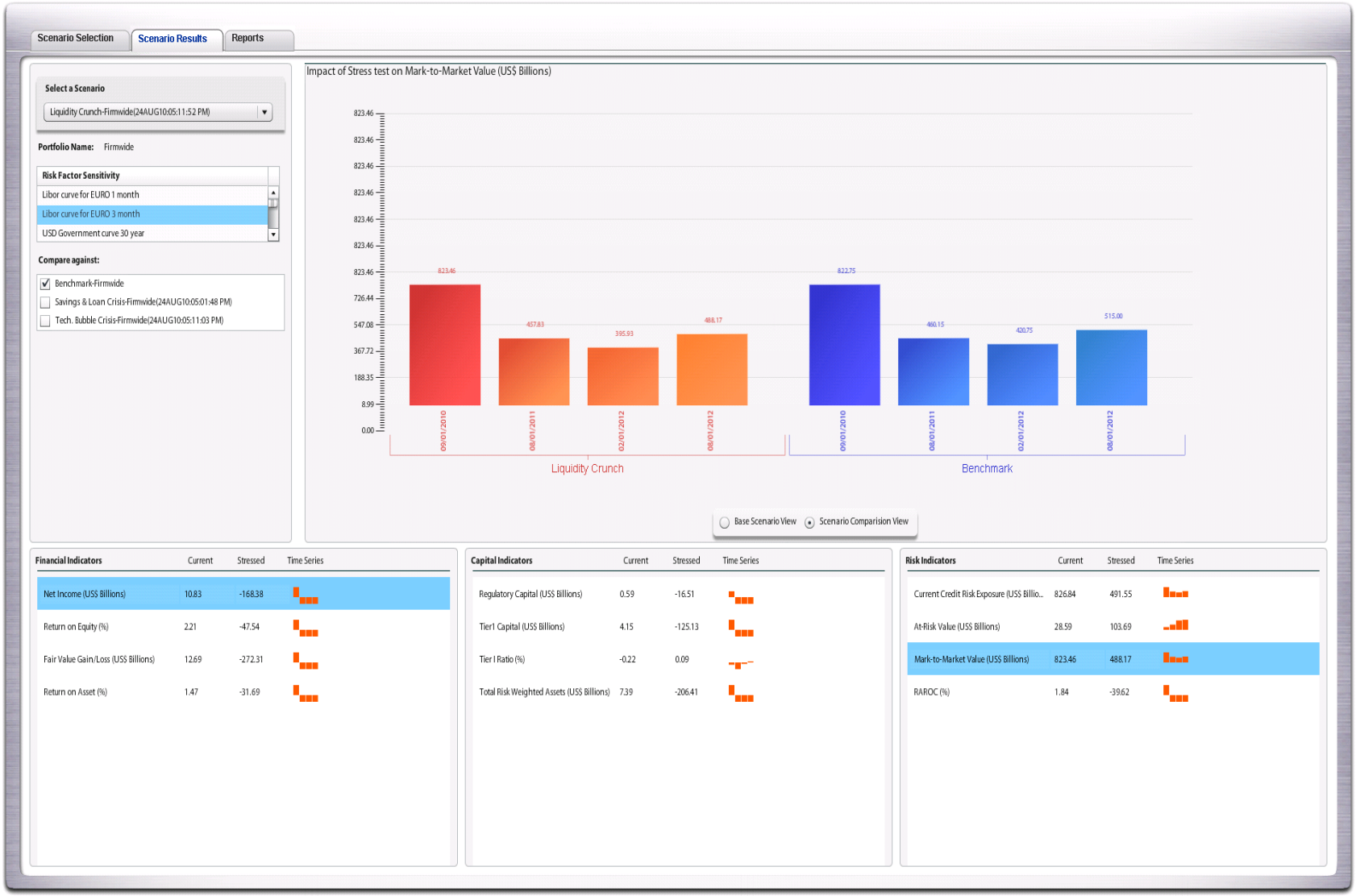
- Loan Loss Forecasting
  - Accounting based
  - Predictive Analytics
    - » Data Mining or Econometric Time Series Based
    - » Multi-Level Forecast
- Stress test
  - Economic factors
  - Sales volumes
  - Promotions

Goal: Historical Time Series and Forecast

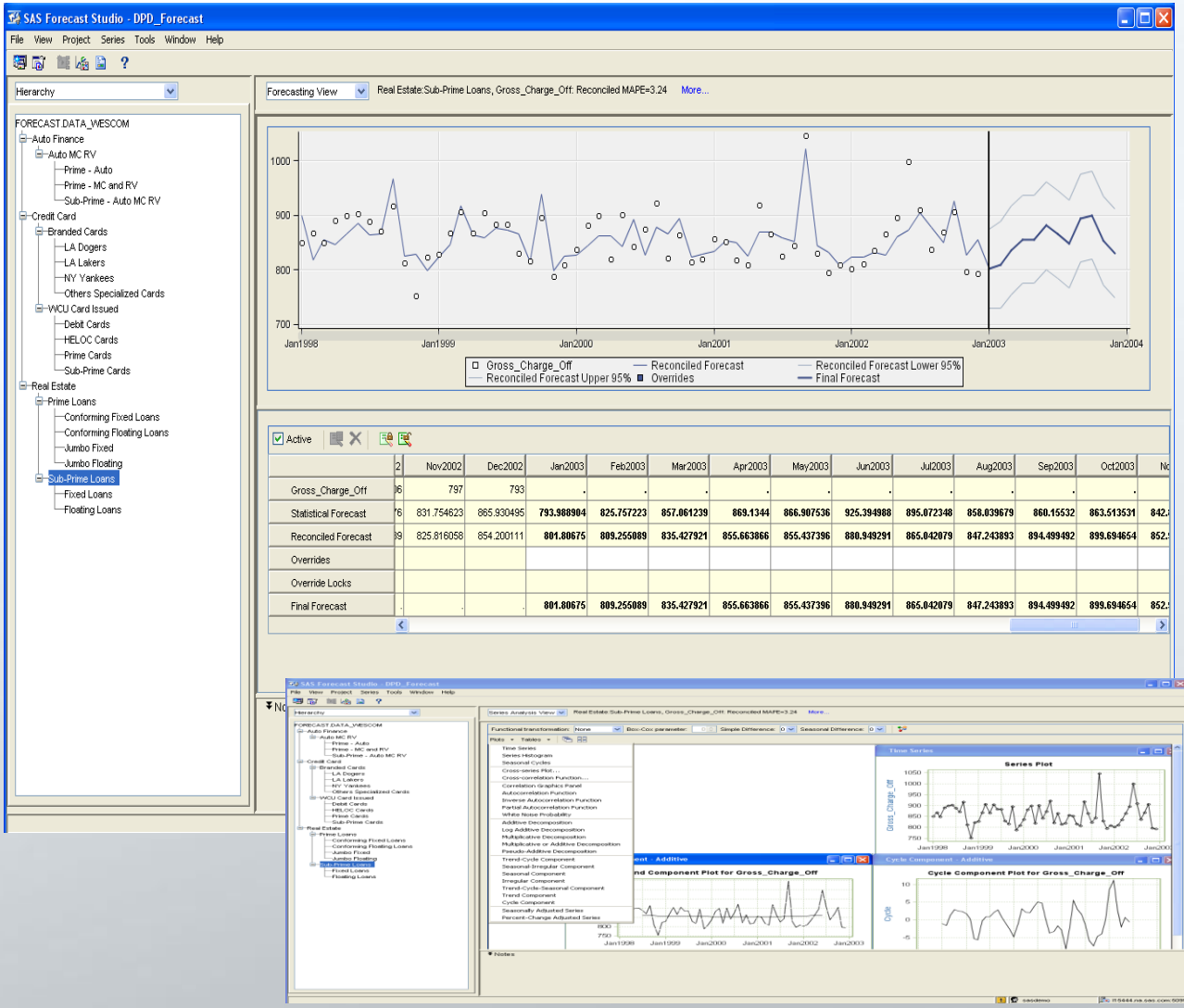
E.g. Auto Loan Loss Forecast



Stress Testing Analytics



Forecast Server



- Automatic model diagnosis and selection
- Can be run batch or interactively
- Incorporates Event Calendars and discrete event modeling
- Deconstructs forecast into seasonal, cyclical, trend and “unobserved” components

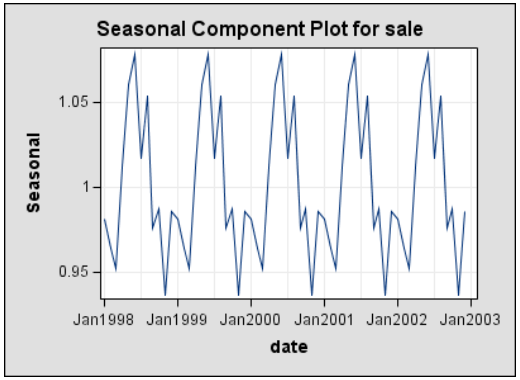
Popular Forecasting Methods

- ARIMA
- Exponential Smoothing
- UCM
- Croston’s Method
- Intermittent Demand Model
- Curve Fitting
- Moving Average (window)
- Multiple Regression
- Random Walk
- SAS Code
- Compare models

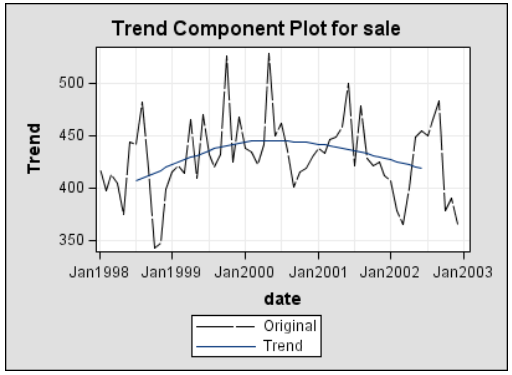
Forecasting Process

Primary Elements

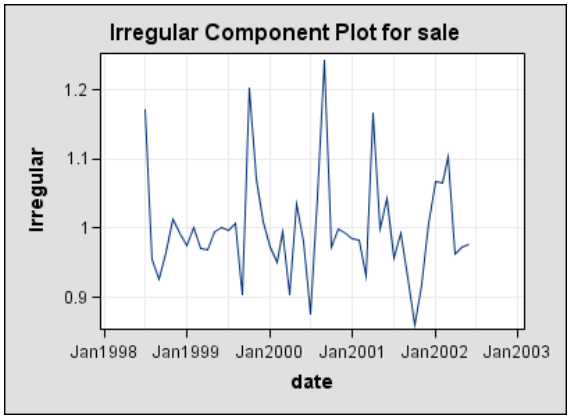
- **Seasonality***



- **Trend*** (up, down, or function)



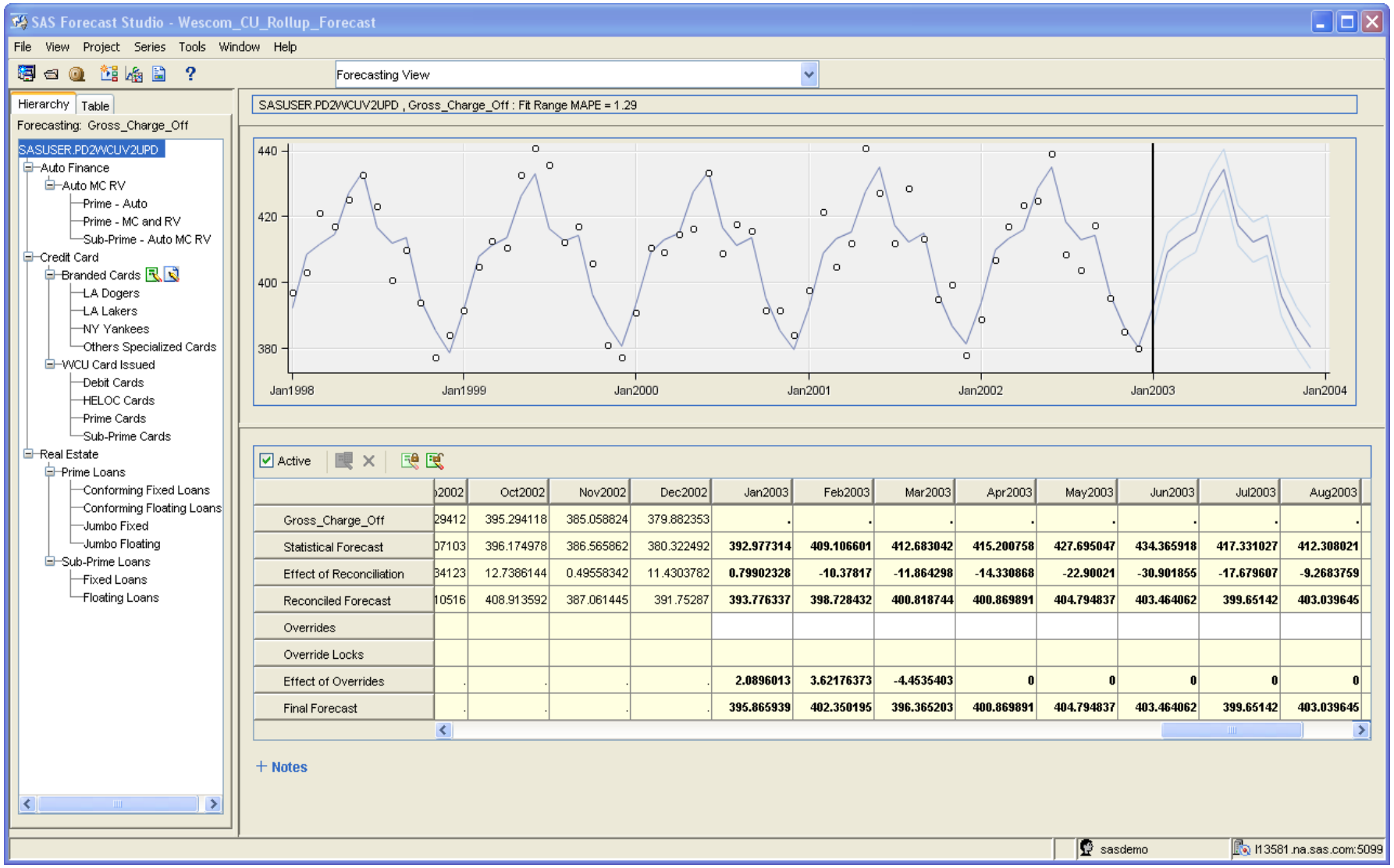
- **Random** (error)



**** Sometimes it is helpful to add causality (known as regressors, explanatory, or independent variables) to explain the 1st and 2nd components***

Multi Level Forecasting

Automatic Reconciliation



	2002	Oct2002	Nov2002	Dec2002	Jan2003	Feb2003	Mar2003	Apr2003	May2003	Jun2003	Jul2003	Aug2003
Gross_Charge_Off	29412	395.294118	385.058824	379.882353	.	.	.	.	.	.	.	.
Statistical Forecast	07103	396.174978	386.565862	380.322492	**392.977314**	**409.106601**	**412.683042**	**415.200758**	**427.695047**	**434.365918**	**417.331027**	**412.308021**
Effect of Reconciliation	34123	12.7386144	0.49558342	11.4303782	**0.79902328**	**-10.37817**	**-11.864298**	**-14.330868**	**-22.90021**	**-30.901855**	**-17.679607**	**-9.2683759**
Reconciled Forecast	10516	408.913592	387.061445	391.75287	**393.776337**	**398.728432**	**400.818744**	**400.869891**	**404.794837**	**403.464062**	**399.65142**	**403.039645**
Overrides												
Override Locks												
Effect of Overrides	.	.	.	.	**2.0896013**	**3.62176373**	**-4.4535403**	**0**	**0**	**0**	**0**	**0**
Final Forecast	.	.	.	.	**395.865939**	**402.350195**	**396.365203**	**400.869891**	**404.794837**	**403.464062**	**399.65142**	**403.039645**

Optimize lease offers

- Optimizing lease offers
  - What is the value of different customer options?
  - What is the propensity of customer to take any options?
  - How does one develop an optimization logic for which product to present in which order?

- Design of Experiment question to answer:
  - What is the propensity to accept an offer at the end of the lease end process, conditioned upon the specifics of an offer?

**Cost of each option can be calculated given a residual value

**Optimization of the profit equation given acceptance rates and alternatives

Optimize lease offers – Design of Experiment

Segments
- Region (5)
- Brand (2)
- Type (8)

Initial Value to Institution
- Positive (residual value is less than market value)
- Negative (residual value is more than market value) – Loss position

Loss Position
- High
- Average
- Low

Experimental unit* is a combination of these values

Example 1 unit:
Northeast
Honda
Civic
Negative
High loss position

Factor
- Turn in offer
- Extend offer
- Purchase offer
- Buy new car offer

Treatment is the factor (i.e. form of offer) and level of factor (i.e. 2% vs. 3%) combination applied to the experimental unit

Factor Levels
- Turn In
- Extend
  - 1 year – same terms
  - 2 years - same terms

Factor Levels
- Purchase
  - Give 50% off underwater amount
  - Give 75% off underwater amount
- Buy new car
  - Give rebate equal to 50% underwater amount
  - Give rebate equal to 75% underwater amount

Example treatment:
- Purchase
  - 50% of underwater amount
  - 75% of underwater amount
- Buy new car
  - Rebate 50% of underwater amount
  - Rebate 75% of underwater amount

Effects	Power	Tweaking
• Capture • Measure	• Probability • Testing of Hypothesis	• Model tweaking • Feedback loop

* Channel is one of the key dimension for experimental unit which was left out for simplicity.

Design of Experiment Framework

System 1

System 2

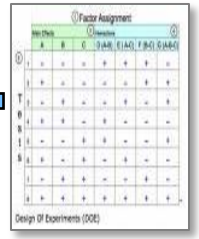
Others

Finance

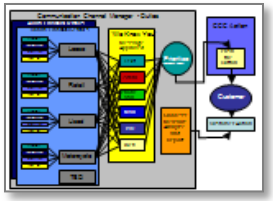
SAS Data Management and Transformation

Managed Analytical Mart for Analytics Projects

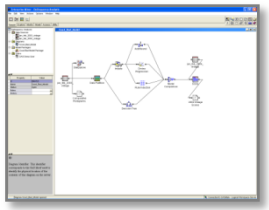
Method:
Segmentation/Blocking
Tool:
SAS E-Miner
Data:
Historical



Method:
Design of Experiments
Tool:
Base SAS or JMP
Data:
New



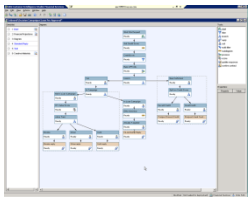
Decisioning engine
Apply Scenarios
Collect Response Data

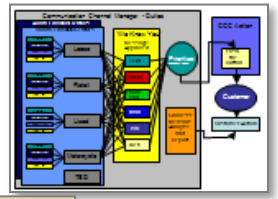


Analyze Response data
Tool:
E-Miner / JMP
Formulate Messaging Strategy

Analytical Layer

Operational Layer





Record Responses to Finance

Operationalize the Messaging Strategy in Decision engine

Collection Optimization

- Collection Optimization requirements:
  - Segments of customers based on PD and LGD calculation
    - » Behavioral score cards
  - Historical collection response rates for PD/LGD buckets
  - Historical success rates /channel (channel sequence)
  - Formulate collection strategies
- Benefits
  - Optimize collection actions to maximize $ collected per $ spent
  - Prioritize strategies (channel & agent) based on customer's Expected Loss Amount (PD*LGD*EAD)
  - Minimize $ spent on collection effort
    - » Prioritizing high cost contact strategy with high risk accounts
    - » Minimize collection contacts for self-cure accounts.

** PD- probability of default

** LGD- loss given default (% of exposure at default)

** EAD- $ exposure at default

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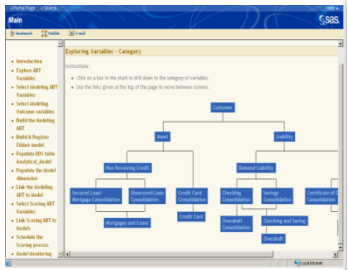
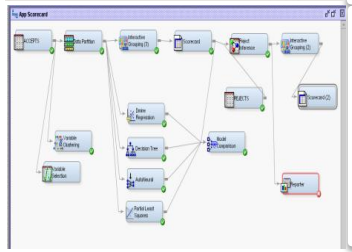
Collections Auto Finance - Case Study

- **In House Credit Scoring Management**



GUI Framework for:
- Navigate Data Model
- Dataset creation (select variables and target, create variables)
- Create Basel II pools
- Map pools to Master Scale
- Schedule model scoring



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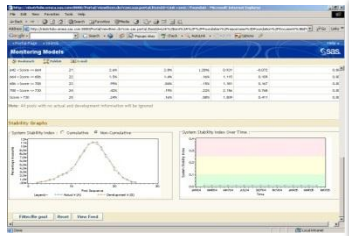
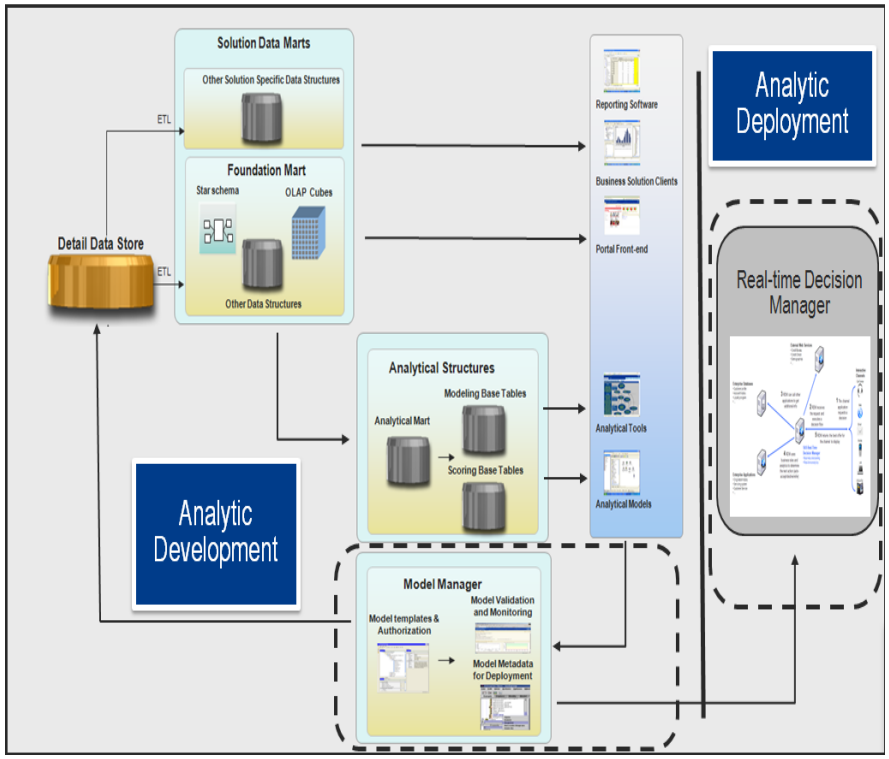


GUI Framework for:
- Model Monitoring
- Model Input monitoring
- Model Output monitoring
- Basel compliant
- Configurable statistical measures

- **Problem:**
  - No ability to extract data for analysis in a timely fashion
  - Required ability to create models for delinquency and collections very quickly as credit crisis spread.
  - Ability to support multiple modelers and feed results to collections team to operationalize model feedback on collection priorities
- **Solution: SAS CSFB Solution**
  - Ability to generate modeling dataset via web interface for over 5000+ variables
  - Ability to use state of the art modeling capability in creating models in less than 1/3 of the time it used to take
  - Collections team performance and staffing improved drastically enabling firm to generate an ROI at more than 10 x the solution price.

Decisioning Auto Finance - Case Study

- **Real Time Model Deployment**



- **Problem:**
  - No ability to deploy model without recoding and re-testing
  - Need to reduce time to update model in strategy management very quickly
  - Ability to support multiple strategies but production and on an ad hoc basis on large scale dataset for batch and real time decision
- **Solution: SAS Model Manager and Real Time Decision Solution**
  - Ability to store all models in a single repository for promotion to production
  - Promotion to production decision engine required no re-coding
  - Ability to implement strategy change often and very quickly to react to changing market conditions
  - Run large scale decision project under tie constraints allotted

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