A New Framework for Managing Macro-Financial Risks in Trinidad and Tobago

An Application of Contingent Claims Analysis to the Banking System

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Introduction

- Global financial crisis demonstrates the vulnerability of economies to volatilities in the markets:
  - Credit
  - Commodities
  - Currencies

What Have We Been Missing?

"Study of financial fragility has not been well served by macroeconomic theory. Financial fragility is intimately related to probability of default. Default is hard to handle analytically being a discontinuous, nonlinear event so most macro models abstract from default and financial intermediaries such as banks."

Charles Goodhart

2005 Joint INS/MCM Conference

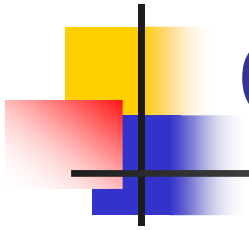
Need for New Frameworks

- Regulators need to find complementary approaches beyond traditional macro models to assess banking risk and sector exposure.

- Contingent Claims Analysis is a relatively new technique that incorporates economics, finance and risk management to assess macro-financial risk.

Contingent Claims Analysis

- Single Entity Risk
  - Firms, Banks, Sovereign
- Macrofinancial Risk
  - Interlinked, balance sheets



CCA Principles

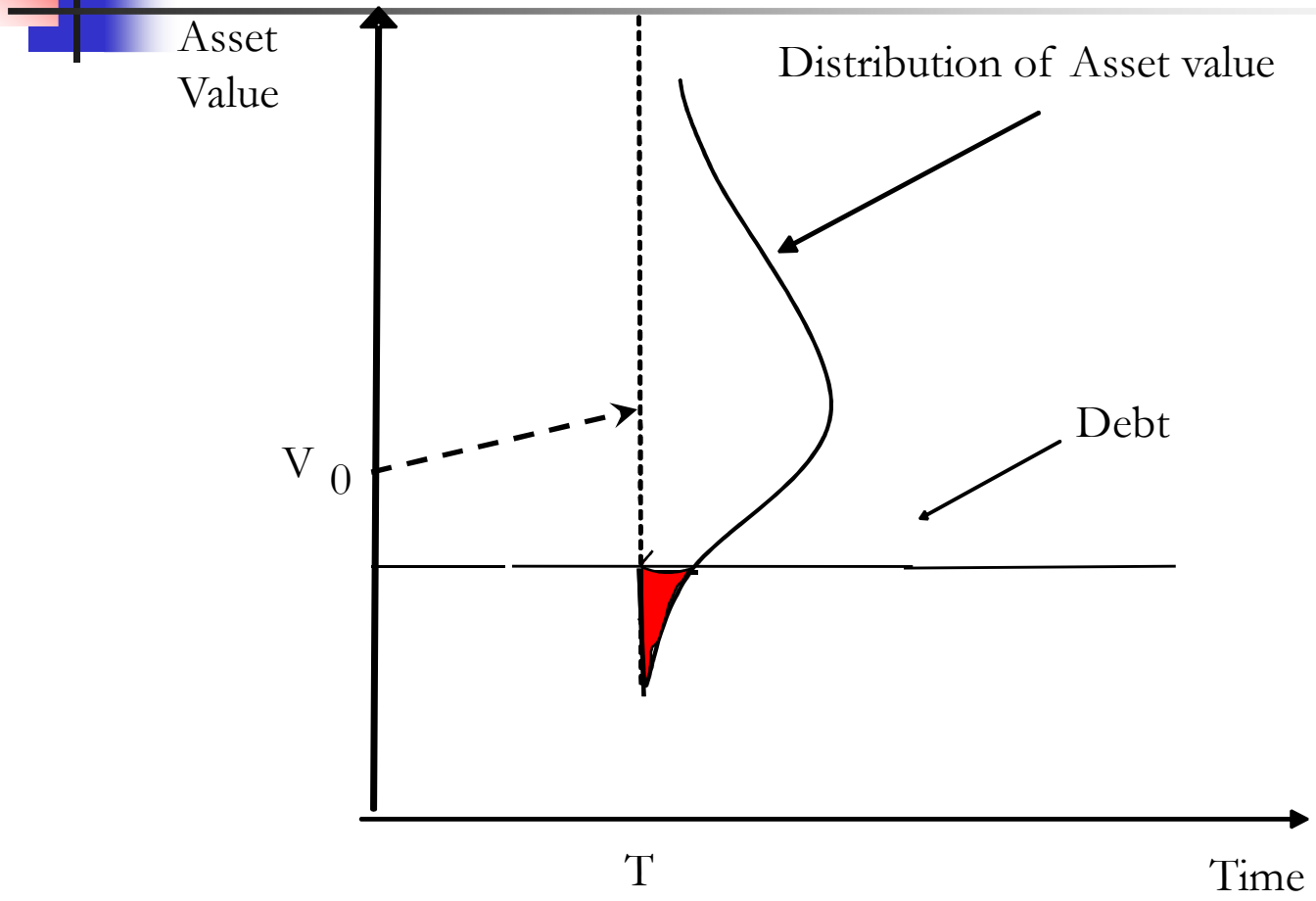
- The contingent claims approach is based on three principles:
  - (i) the values of liabilities are derived from assets
  - (ii) liabilities have different priority (i.e. senior, subordinated and junior claims)
  - (iii) assets follow a stochastic process.

Thinking About Default Risk

- Three main elements determine default probability:
  - Market value of assets
  - Uncertainty and risk in future asset value
  - Leverage: the extent of contractual liabilities

  - Note: emphasis on a marked-to-market balance sheet, where market value of assets is weighed against obligated payments

Key Relationships Concerning Default Risk



Thinking About Default Risk

- Problem: asset value and asset risk unobservable
- Solution: used an implied measure

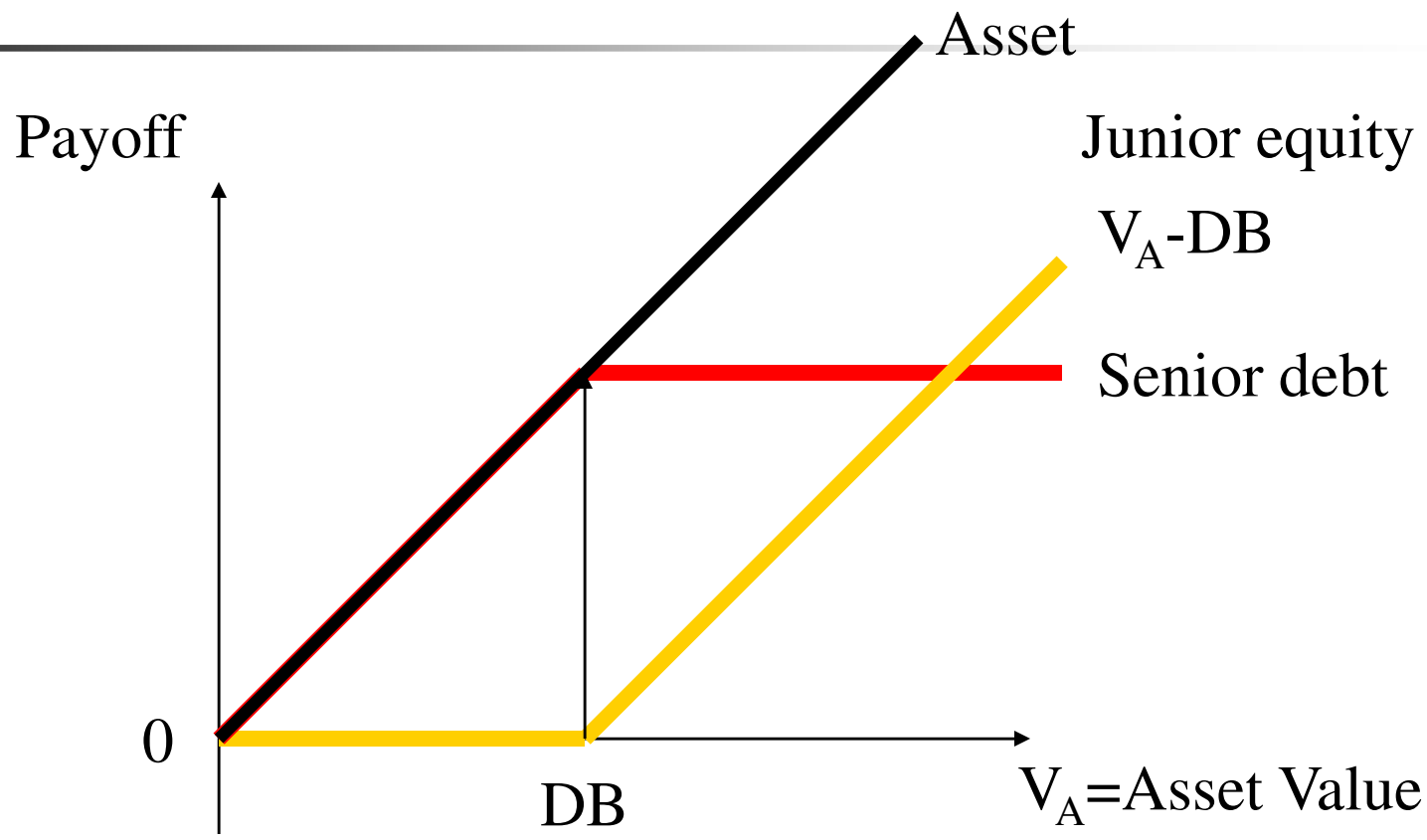
- We can't observe A and σ directly, but they influence the value of something we can observe—the value of the firm's equity

- Our understanding of options and capital structure will help us make the connection

Contingent Claims Analysis

- Debt holders have senior claim on firm assets
  - Paid first, limited upside, control assets if default
  - Payoff: **Min (DB, $V_A(T)$)**
- Equity has a junior claim on firm assets
  - Junior claim, paid after bonds, but unlimited upside
  - Payoff: **Max (0, $V_A(T)$ - DB)**
- Return on equity looks like a call option
  - The underlying = firm's assets
  - Strike price = value of liabilities (DB)

Payoff to Debt and Equity



Black-Scholes Option Pricing Model

- Equity as a call option on firm assets

$$V_E = V_A N(d_1) - DBe^{-rT} N(d_2)$$

$$d_1 = \frac{\ln\left(\frac{V_A}{DB}\right) + \left(r + \frac{\sigma_A^2}{2}\right)T}{\sigma_A\sqrt{T}}, \quad d_2 = d_1 - \sigma_A\sqrt{T}$$

- Also use the following relationship

$$\sigma_E V_E = \sigma_A V_A N(d_1)$$

- Solve the two equations for V_A and σ_A

Advantages of Contingent Claims Analysis

Uses a limited number of inputs

- Market value and volatility of traded equity
- Distress barrier (DB) from existing debt
- DB = ST debt + ßLT debt + interest
- Discount rate
- Time horizon (usually 1 year)

Market-Based Risk Indicators

- Distance to Distress
  - Number of standard deviations asset value is from distress barrier (one year)

$$d_2 = \frac{\ln(A/DB) + (r - \frac{\sigma_A^2}{2})}{\sigma_A}$$

- Probability of Default
  - Cumulative normal distribution $N(-d_2)$

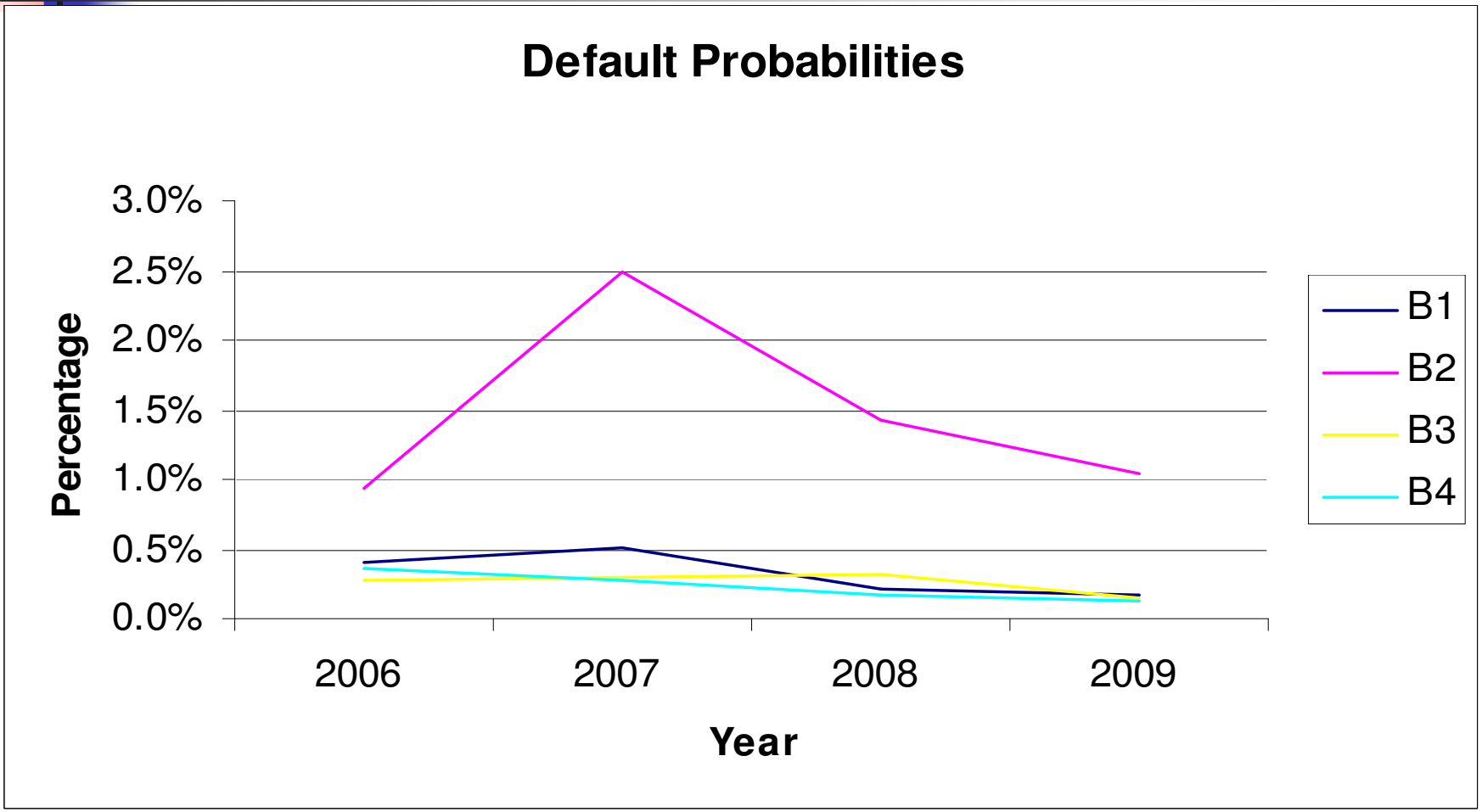
Application of CCA to TT Banks

- Research covers the four largest commercial banks in TT.

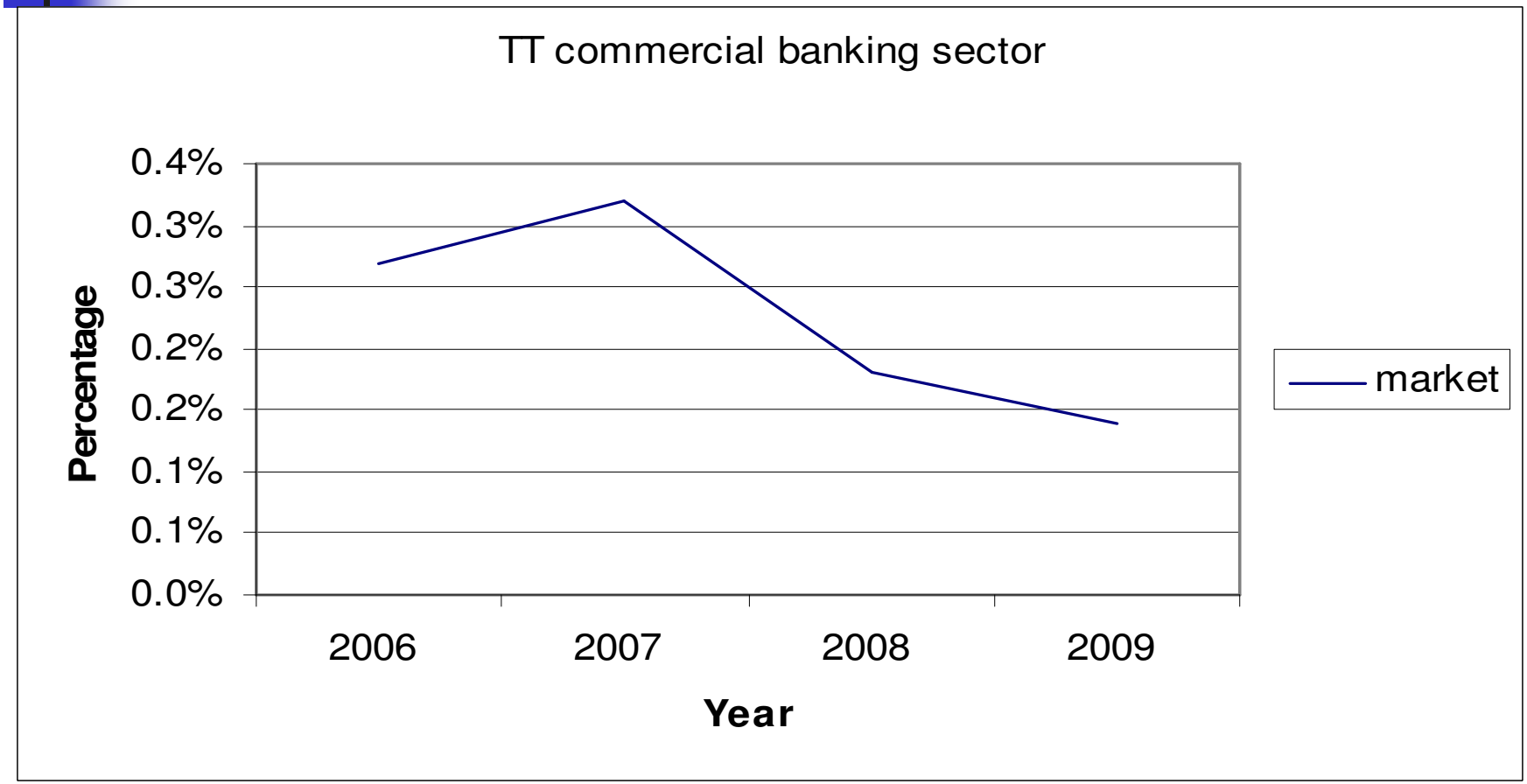
Distance to Distress for TT Banks

D2D	2006	2007	2008	2009
B1	2.65	2.56	2.85	2.95
B2	2.35	1.96	2.19	2.31
B3	2.78	2.76	2.78	2.97
B4	2.68	2.77	2.92	3.01

One Year Default Probabilities – TT Banks

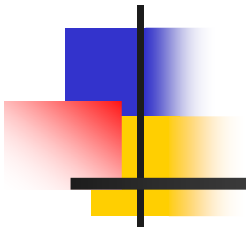


One Year Default Probability– TT Commercial Banking sector



Application of CCA to TT Banks

- Findings - TT banks show a very low probability of default. The highest for any bank over the past four years was 2.5%.
- As at 2009, the probability of default over the next year for the four banks was less than 1%.
- Commercial banking sector shows 0.2% probability of default over the next year



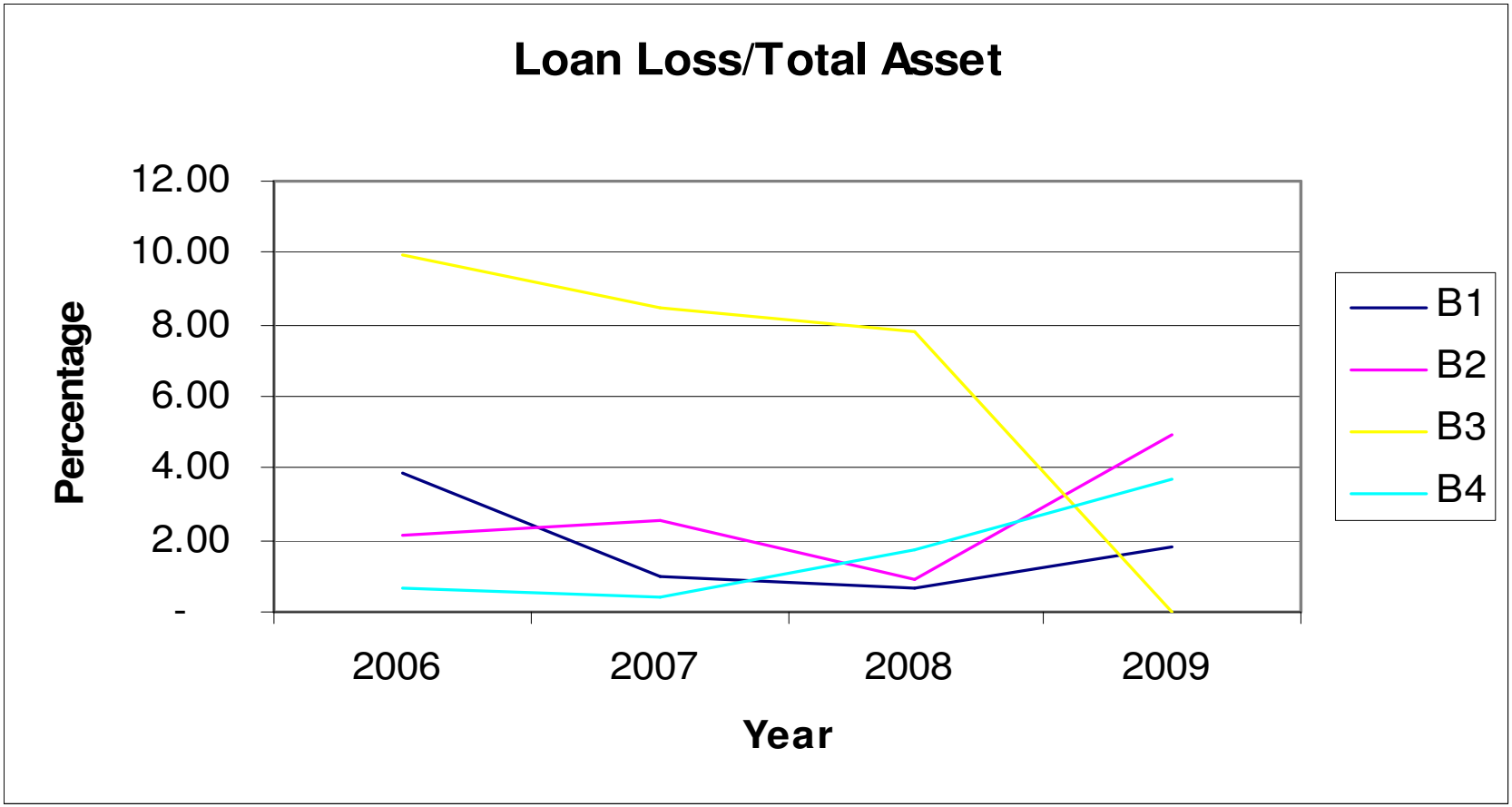
THANK YOU

Default and Provisioning

- The low default probabilities can be traced to the quality of the assets in the banks – specifically the loan portfolio.

- Loan loss (2009)under 6% of total assets
- Ratio of Loan loss /total loans is lower than asset volatility.
- Distance to default in 2009 – asset decline in excess of 20%.

Loan loss/Total assets



Conclusion

- CCA as a tool in managing macro-financial risk shows that the TT commercial banking sector is strong. Supports financial soundness indicators.
- Other areas for research – extend CCA to insurance companies and credit unions; incorporate into monetary policy models.
- Possibly the need for (additional) market based data in statutory reporting