Practices, challenges and implementation options - Lessons learned from economic capital modelling
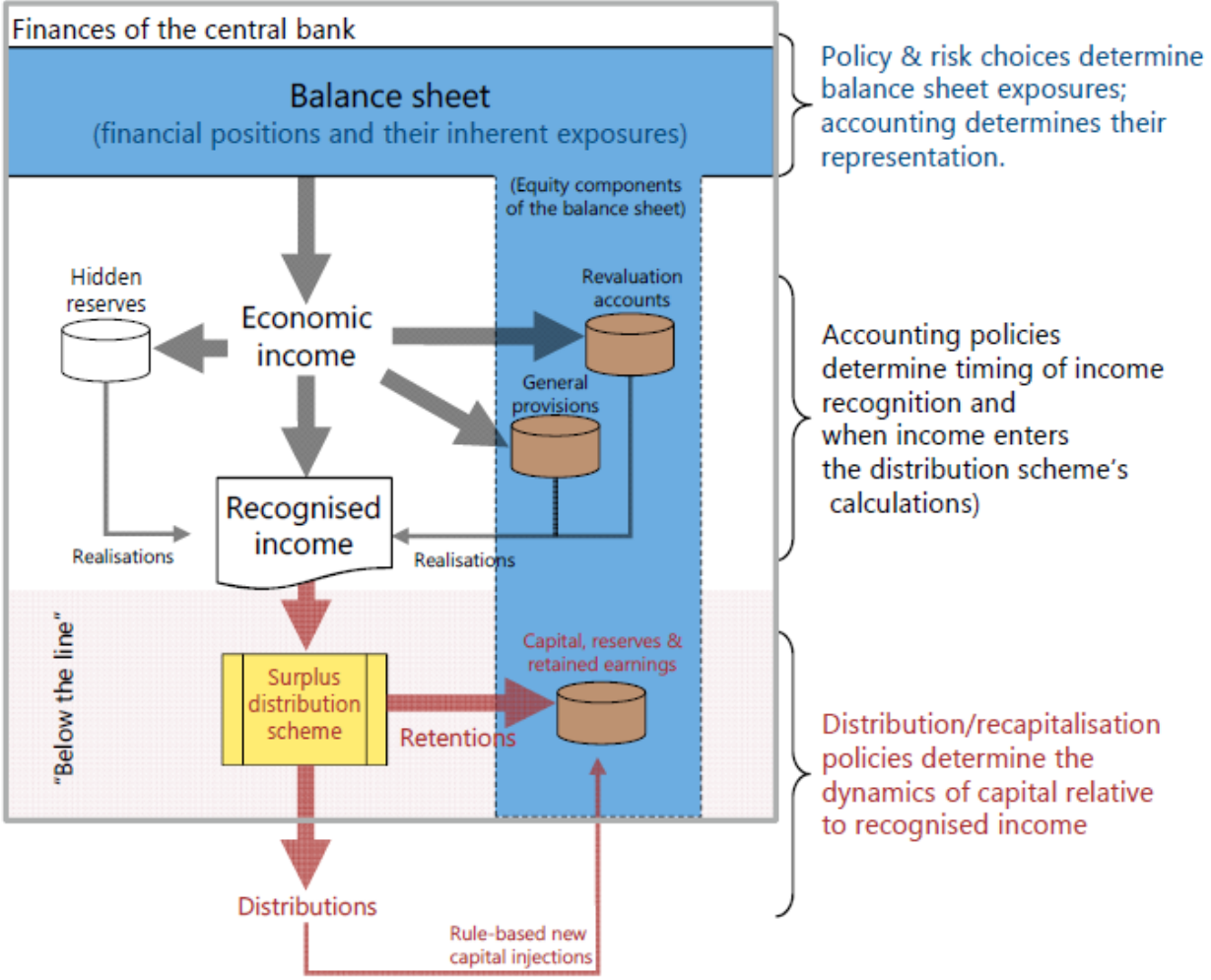
Rafael Schmidt, BIS Risk Control

12th Central Bank Risk Managers' Conference

Mumbai, 17-18 November 2016

Components interacting to influence the evolution of financial buffers (or economic capital of a commercial bank)

BIS Papers, No 71, Central bank finances, D Archer and P Moser-Boehm, 2013, Exhibit 1

Why might a CB quantify a (required) financial buffer?

- **Build up a sufficient financial buffer to withstand potential future losses**
- **Understanding, reporting and taking actions on potential risks**
- **Asset allocation** (Benchmark construction) **under risk-return considerations**, incorporating trade-offs between different risk types (credit, market, operational, liquidity, reputational etc.)
- High-level input into the overall **limit setting** framework
- **Structuring of discussion on surplus distribution (scheme)**

- Modelling of financial buffers / economic capital frameworks for reasons unrelated to a CB's investments, notably in their capacity as bank supervisors or for market surveillance

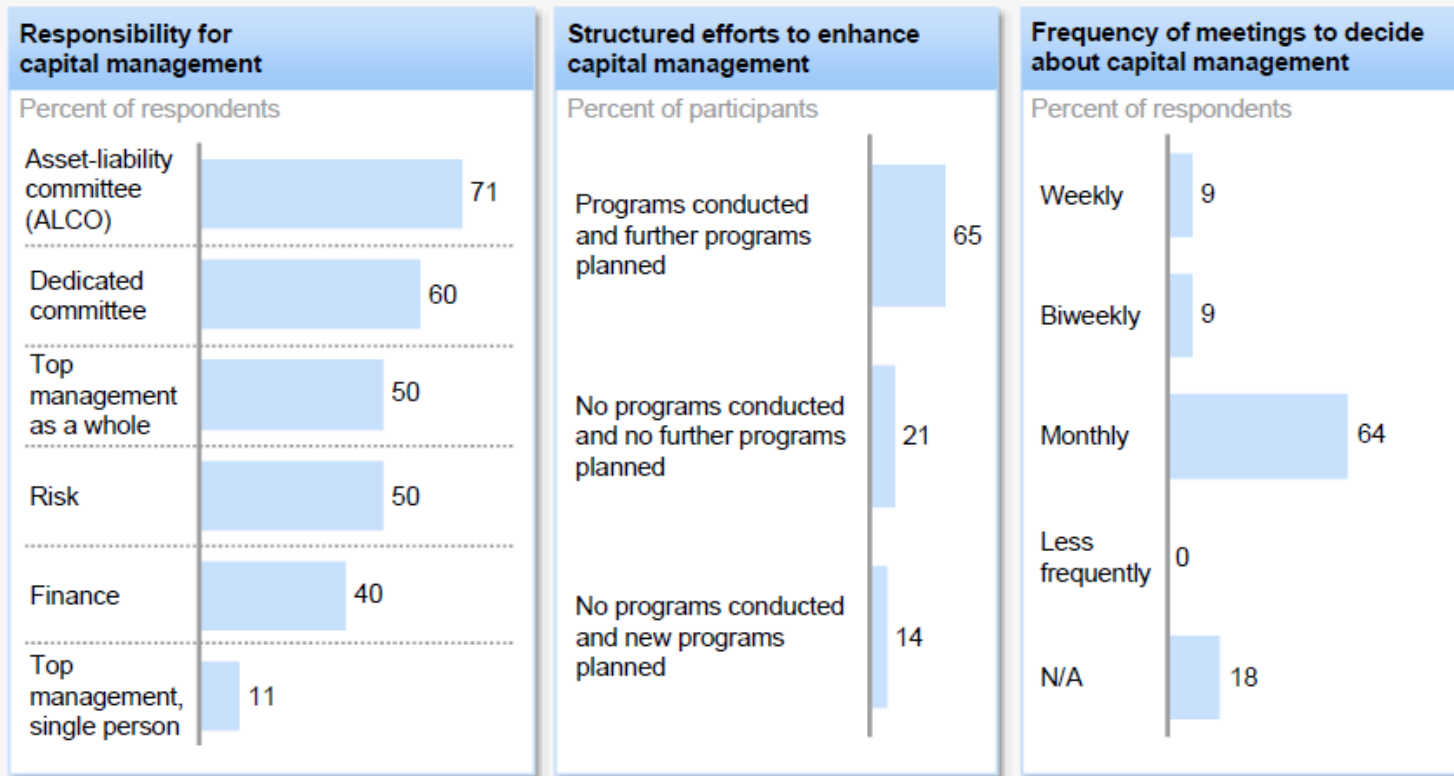# BIS economic capital allocation framework
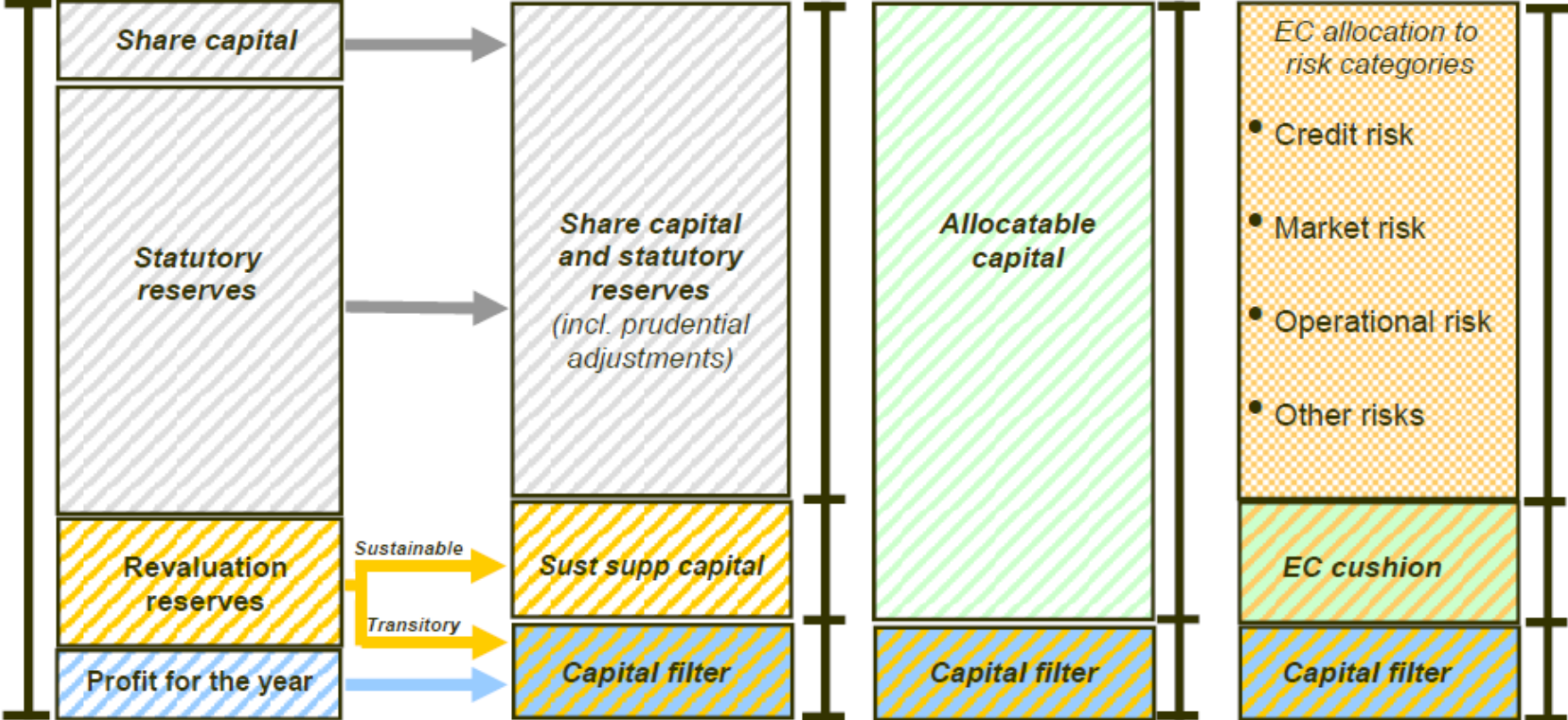
Evolving practices in the financial industry – Some considerations

- **Risk IT / data is getting more critical** (data quality, coverage, availability)
- **Established risk models** are typically **sophisticated enough**
- Banks enhance ECF with **stress testing and scenario analyses.**
- FI use **"dashboards" comprising critical metrics** (including financial buffer metrics). Helps to translate risk appetite into risk limits.
- **Different confidence levels** for the risk measure calculation are used for the calculation of risk buffers, risk-return analysis, or asset allocation.
- With the new regulatory frameworks, **many banks are constrained by a shortage of regulatory capital** rather than a lack of economic capital.
- Banks are **adjusting their organizational structures**: Closer involvement of senior management (e.g. for formulation of risk strategies and risk-related governance); move away from siloed characteristics to holistic views.

Banks have adjusted organizational structures and processes

How banks are organizing for capital management

Responsibility for capital management
Percent of respondents

Asset-liability committee (ALCO)	71
Dedicated committee	60
Top management as a whole	50
Risk	50
Finance	40
Top management, single person	11

Structured efforts to enhance capital management
Percent of participants

Programs conducted and further programs planned	65
No programs conducted and no further programs planned	21
No programs conducted and new programs planned	14

Frequency of meetings to decide about capital management
Percent of respondents

Weekly	9
Biweekly	9
Monthly	64
Less frequently	0
N/A	18

McKinsey Capital Management Survey 2015, survey across 15 German banks

Some modelling questions and challenges

- **Which quantification horizon and confidence level should I choose?**
  - Horizon should be longer than the time between the individual surplus distribution (decisions)
  - Confidence level should match the internal credit quality target
- **Which risk aggregation** (see Annex) **and attribution to choose?**
  - *Stay simple* in case of challenging dependence modelling
  - *Standalone risk attribution measures* are not capturing diversification but are intuitive and easy to interpret; use pro-rata scaling to ensure that the standalone figures sum up to total capital
- **Risk measure selection** (see Annex) **and model complexity**
  - Model selection – Simplicity should be the driving factor for model selection
  - For CB portfolios, containing standard instruments, VaR is usually a sufficiently good risk measure – Intuitive and easy to understand
- **Calculation performance**
  - Banks experiment with GPU (graphical processing unit) to boost computation performance

Example: Challenge of PD estimation in low default portfolios

- **Sparse or no default history is available for portfolios comprised of sovereigns or large financial institutions**

- Most of the existing statistical estimation methods need at least some defaults and are not applicable to no-default portfolios.

- Model outputs can only to a limited extend be statistically contested, validated or back-tested

→ **Certain degree of expert judgment is required.**

Alternative PD calibrations for low-default portfolios

- PD estimates calculated from **credit default swap (CDS) spread data**.

- **Rating transition models based on** a Markov Chain model,

- **Vendor models**, e.g. Moody's KMV, Kamakura (KRIS) PD estimates based on market and economic time series.

- PD estimates inferred from statistical analysis using **Binomial default models or Bayesian models** are the most promising models, see e.g.

  - Dwyer D.W. (2007), The distribution of defaults and Bayesian model validation, Journal of Risk Model Validation, Vol. 1, Iss. 1, pp. 23-53

  - Tasche D. (2013), Bayesian estimation of probabilities of default for low default portfolios, Journal of Risk Management in Financial Institutions, Vol. 6, Iss. 3, pp. 302-326

  - Chang YP and CT Yu (2014), Bayesian confidence intervals for probability of default and asset correlation of portfolio credit risk, Computational Statistics, Vol. 29, Iss. 1-2, pp. 331-361

Take aways

- Financial risk buffer modelling / forecasting helps in **structuring the discussion on surplus distribution**

- **Suitable organizational structure / governance is key** – Clear documentation of framework, policy, and processes (incl. scope, responsibilities, modelling, calibration, validation, etc.)

- **Modelling – Stay as simple as possible**

- Model parametrization – In case of scarce data, comparison of different models and **judgement is better than reliance on poor statistical methods**

- **Invest into good IT infrastructure and data**

ESSENTIALS OF RISK MANAGEMENT:

1. DON'T DO ANYTHING WRONG TODAY.
2. DON'T DO ANYTHING WRONG TOMORROW.
3. REPEAT.

Complex Discovery

GLASBERGEN

© Randy Glasbergen / glasbergen.com

Annex

Risk Measures

	Standard Deviation	VaR	Expected Shortfall	Spectral and Distorted Risk Measures
Intuitive	Sufficiently intuitive	Yes	Sufficiently intuitive	No (involves choice of spectrum or distortion function)
Stable	No, depends on assumptions about loss distribution	No, depends on assumptions about loss distribution	Depends on the loss distribution	Depends on the loss distribution
Easy to compute	Yes	Sufficiently easy (requires estimate of loss distribution)	Sufficiently easy (requires estimate of loss distribution)	Sufficiently easy (weighting of loss distribution by spectrum/distortion function)
Easy to understand	Yes	Yes	Sufficiently	Not immediately understandable
Coherent	Violates monotonicity	Violates subadditivity (for non-elliptical loss distributions)	Yes	Yes
Simple and meaningful risk decomposition	Simple, but not very meaningful	Not simple, might induce distorted choices	Relatively simple and meaningful	Relatively simple and meaningful

BCBS paper, No 71, Range of practices and issues in economic capital frameworks

BANK FOR INTERNATIONAL SETTLEMENTS

Comparison of risk aggregation methodologies

Aggregation methodology	Advantages	Disadvantages
Summation: Adds together individual capital components	Simplicity Typically considered to be conservative	It does not discriminate across risk types; imposes equal weighting assumption Does not capture non-linearities
Constant diversification: Similar to summation but subtracts fixed percentage from overall figure	Simplicity and recognition of diversification effects	The fixed diversification effect is not sensitive to underlying interactions between components. Does not capture non-linearities
Variance-Covariance: Weighted sum of components on basis of bilateral correlation between risks.	Better approximation of analytical method Relatively simple and intuitive	Estimates of inter-risk correlations difficult to obtain Does not capture non-linearities
Copulas: combine marginal distributions through copula functions	More flexible than covariance matrix Allows for nonlinearities and higher order dependencies	Parameterisation very difficult to validate Building a joint distribution very difficult
Full modelling/Simulation: Simulate the impact of common risk drivers on all risk components and construct the joint distribution of losses	Theoretically the most appealing method Potentially the most accurate method Intuitive	Practically the most demanding in terms of inputs Very high demands on IT Time consuming Can provide false sense of accuracy

BCBS paper, No 71, Range of practices and issues in economic capital frameworks

Different capital coverage is used for different circumstances
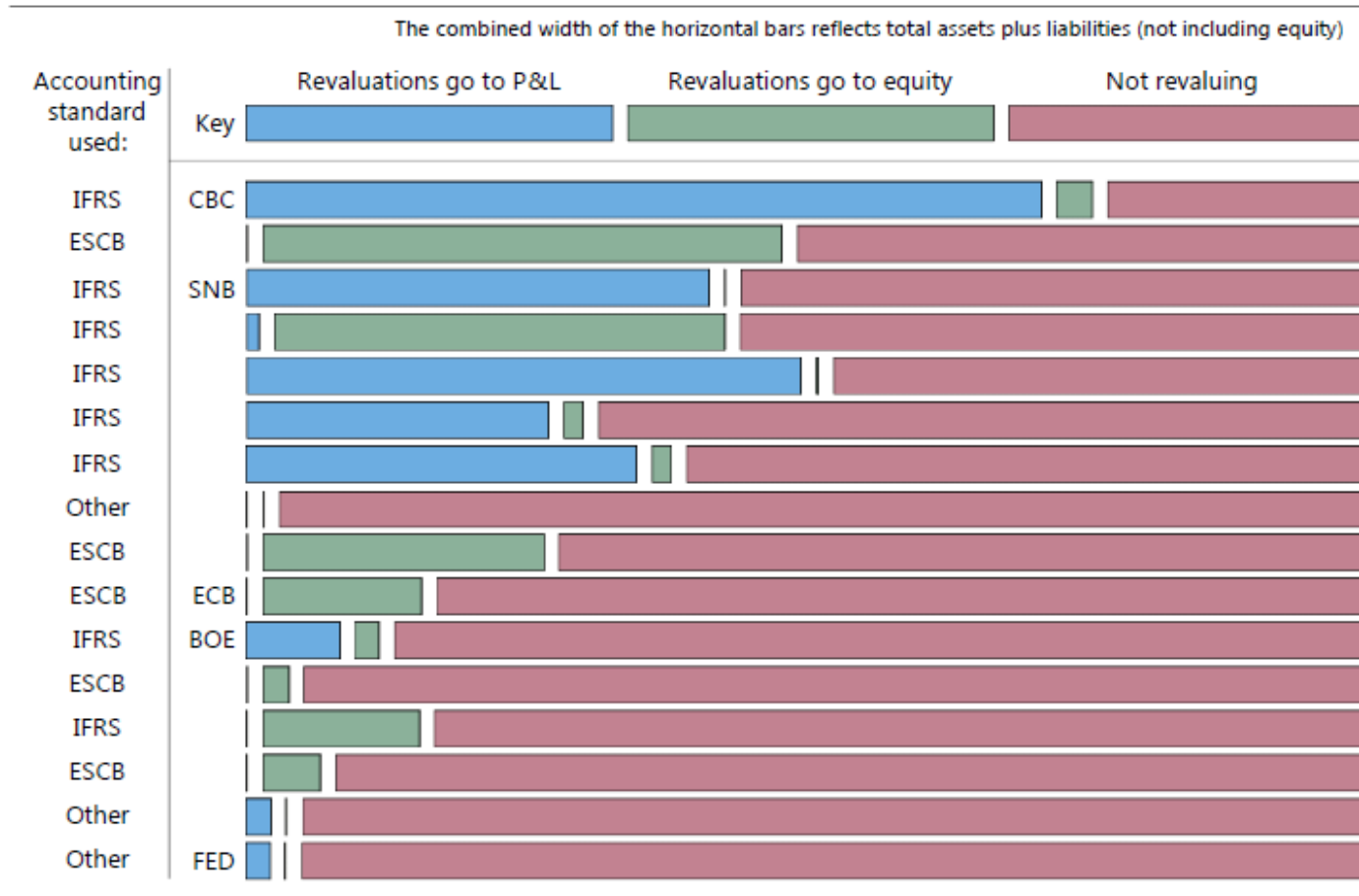
Going-concern and gone-concern scenarios

Scenario		Confidence interval[1] (time horizon)	Trigger	Typical economic-coverage capital
Going concern	**Early warning**	80% (30/250 days)	• Profit warning and negative publicity	• Budget results • Hidden reserves (eg, fair-value reserves, shortfall vs expected loss)
			• Net loss in current period, failure to pay dividends, deferred to preferred dividends and potential rating downgrade	• P&L of the current period • Accounting reserves (eg, deferred tax assets, goodwill and other intangibles, CFH[2] reserve)
	Severe stress	95% (30/250 days)	• Net balance-sheet loss and consumption of subscribed capital (eg, conversion of cumulative preferred shares)	• Retained earnings • Capital reserves and other reserves • Other Tier 1 capital components
			• Insolvency due to excess of debt over assets	• Subscribed capital and other paid-in capital • Other core Tier 1 capital components • Contingent convertibles[3]
Gone concern	**Liquidation**	99.98% (250 days)	• Failure to pay back debt (creditor protection)	• Hybrid capital and subordinated debt • Other Tier 2 capital components
		100% (250 days)	• –	• Debt

1 Probability that scenario does not occur within a time horizon of one year (250 business days); some risk types (especially market risk) are generally analyzed for shorter periods.
2 Cash-flow hedge.
3 Depending on trigger criteria.

McKinsey Working Papers on Risk, No 27, Mastering ICAAP

Balance sheet composition by accounting treatment for price changes

The combined width of the horizontal bars reflects total assets plus liabilities (not including equity)

BIS Papers, No 71, Central bank finances, D Archer and P Moser-Boehm, 2013, Figure A1