Firm-wide Risk Appetite and Risk Aggregation

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Leland-Rubinstein Retirement Conference
17 November 2012

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Agenda

- Definitions and Rationale

- Notions of Capacity, Exposure, and Appetite

- Earnings- vs. Capital- based criteria

- Standardizing and aggregating multiple risk types

- Importance of multiple views: statistical vs. scenario metrics

- Linkage between 'top-of-the-house' and more granular metrics and limits

What is this "Risk Appetite" Stuff?

Ensure that a bank's level of risk taking is aligned with its (financial) resources

- **Definitions of Risk Appetite**

   "The level and type of risk a firm is able and willing to assume in its exposures and business activities, given its business objectives and obligations to stakeholders."

   "Risk appetite is generally expressed through both quantitative and qualitative means and should consider extreme conditions, events, and outcomes. In addition, risk appetite should reflect potential impact on earnings, capital, and funding/liquidity."
   (Senior Supervisors Group, "Observations on Developments in Risk Appetite Frameworks and IT Infrastructure", December 23, 2010)

- **Context**

   – Risk appetite emerges from a combination of both pre-crisis and post-crisis regulatory requirements/ expectations and industry best practice assessments

   – Basel II, Pillar 2:

   "The bank's board of directors has responsibility for setting the bank's tolerance for risks. It should also ensure that management establishes a framework for assessing the various risks, develops a system to relate risk to the bank's capital level…"

   – Several papers issued by the Senior Supervisors Group (SSG) and Institute for International Finance (IIF) established that a **comprehensive firm-wide risk appetite framework covering all types of risks is now considered essential and not just best practice**

      – Regulatory and industry best practice expectations have been set out for each of management, BoD, risk control, and regulatory supervisors

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Risk Appetite: Key Elements

Regulatory Expectations and Industry Best Practices

✓ Comprehensive approach – integrating credit, market, operational, liquidity, and reputational risks across the firm

- Both quantitative and qualitative elements

✓ Use of multiple methodologies (taking into account technical limitations of risk metrics, models, and techniques such as VaR) – incorporating, in particular, stress/scenario testing and consideration of risk concentrations

- Calibration of risk metrics to risk appetite horizons

✓ Linkage between appetite for risk, business strategy and planning, and financial resources & constraints (capital, earnings, liquidity, etc.)

✓ Translate risk appetite at the top of the house to risk appetite (limits) for individual risk types and at lower levels of the organization (business units and below)

✓ Role of risk culture, 'tone from the top', and communication amongst functions (notably risk, finance, and treasury)

Risk appetite as a continuous, evolutionary, learning process – not just a one-time exercise

Defining, Challenging and Monitoring Risk Appetite

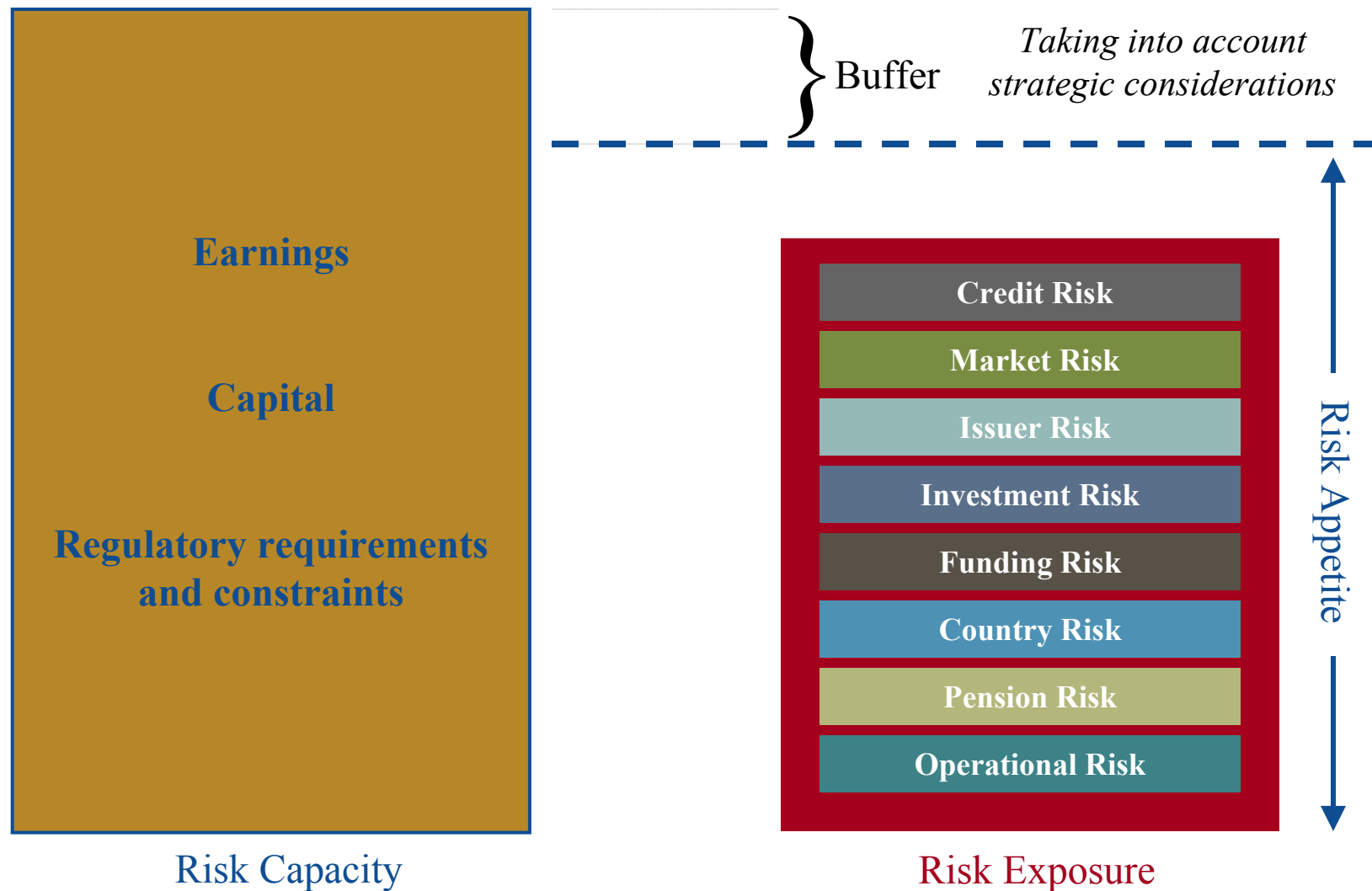**Firms' management, boards, risk management departments, and supervisors all have roles**

- Management should articulate the firm's appetite for risk in the context of business strategy
  - They own the risk and are expected to fully understand the firm's risk position at all times

- Boards should
  - set basic goals for the firm's risk appetite and strategy,
  - review and affirm management's articulation of risk appetite, and
  - ensure that risks are comprehensively considered and managed

- CROs should (and should be empowered to):
  - assess and control the firm-wide risk level
  - provide an integrated view of the overall risks the firm faces, and
  - ascertain that the firm's risk level is consistent with its risk appetite

- Supervisors have a role in assessing and challenging Boards' and Managements' achievement of these goals, risk awareness and understanding, and conformance to (evolving) best practice

What is Risk Appetite? Key Definitions and Questions

- Further defining Risk Appetite

  – Other than making clear that risk appetite is a conscious, intentional, management choice in a strategic context, the original statement leaves open almost all definitional elements:

    – What types of risk?

    – Quantitative or Qualitative? How measured? Over what time horizon(s)? Confidence levels?

    – At what level(s) of the firm? How to aggregate/disaggregate?

- Associated (but distinct) concepts

  – *Risk capacity* is the set of resources (e.g. capital, earnings) available to absorb losses

    – "maximum amount of risk a firm is technically able to assume given its capital base, liquidity, borrowing capacity, and regulatory constraints"…

    – based on current/actual levels (i.e. Tier 1 capital), forecasts (earnings, RWA, etc.), and strategic considerations

  – *Risk exposure (profile/position)* is the amount of risk, by whatever metric, actually being taken at a point in time or expected/forecast to be taken

    – Firmwide: loss from all sources, across all businesses, from e.g.:

      – a specified confidence level of a statistical model, or

      – a defined macro-economic/market stress scenario

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Risk Appetite Objectives: Risk Capacity vs. Risk Exposure

}Buffer *Taking into account strategic considerations*

Earnings

Capital

Regulatory requirements and constraints

| Credit Risk |
| Market Risk |
| Issuer Risk |
| Investment Risk |
| Funding Risk |
| Country Risk |
| Pension Risk |
| Operational Risk |

Risk Appetite

Risk Capacity

Risk Exposure

maximum amount of risk a firm is technically able to assume given its capital base, liquidity, borrowing capacity, and regulatory constraints

the amount of risk, by whatever metric, actually being taken at a point in time, or expected/forecast to be taken

Risk Categories

	Risk Category	Description
Position Risks	**Market Risk**	Risk of loss resulting from adverse movements in market variables including observable variables such as interest rates, foreign exchange rates, equity prices, credit spreads and commodity prices, and variables which may be only indirectly observable or unobservable such as volatilities or correlations. Positions mainly arise from firm-wide trading activities but also include interest rate and FX risk from non-trading activities. Also includes the risk of changes in Credit Valuation Adjustments (CVA).
	Issuer Risk	Potential total loss that would occur on a tradable position or group of tradable positions if an issuer/issuer group to which the firm is exposed were subject to a credit-related event. The potential loss arises not only from the value of securities issued by the name but also any other obligations in tradable form which are referenced to the name (including derivatives and basket securities).
	Credit Risk	i) The default risk of loans to financial institutions or customers, institutional, corporate and retail, as well as of traded products, i.e. the counterparty credit risk of securities financing and derivatives transactions for the firm-wide portfolio. ii) Risk of losses in the loan underwriting portfolio measured on a fair-value basis.
	Country Risk	The risk of losses resulting from the default of entities risk domiciled in a country (including the sovereign) and the firm's claims towards these entities due to imposition of restrictions and controls on payments. This includes risks not captured in other categories.
	Investment Risk	Risk arising from book or fair-value changes of long-term equity and debt investments.
Consequential Risks	**Operational Risk**	The risk of loss from inadequate or failed internal processes, people and systems or from external causes (deliberate, accidental or natural).
	Funding Risk	The risk of higher funding costs due to increase in the firm's credit spreads when existing funding positions mature and need to be rolled over.
	Business Risk	Represents the potential shortfall in earnings compared to expectations due to decrease in the volumes of business and / or margins earned. The decrease could be due to deterioration in the economy or changes in the competitive situation.

Evolution of Risk Appetite & Experience during the Crisis

Shift to ensuring going concern under stress

Traditionally, focus on:

- Solvency perspective
  - Consideration of Economic Capital vs. total (or Tier 1) capital

- Earnings protection (or dividend paying ability) in most years, also in adverse economic situation

Experience during the crisis:

- Focus on going-concern capital metrics (e.g., Tier 1 ratio)
  - Loss-absorbing capital is what matters

- Unreliability of some metrics in extreme tails of the loss distribution
  - Consider (scenario) stress metrics in addition to statistical metrics
  - Look beyond historical experience

- Ensure stable funding sources and ample liquid assets

Earnings/Capital Waterfall Continuum – at Least in Principle

Capital Criteria **Earnings Criteria**

View

Solvency

Regulatory Constraints

Rating Change

Positive Earnings, Payment of Dividends

Risk

Risk Exposure:
Deviation from Mean Earnings at:

Mean Earnings

Probability

99.9+%

95%

0

Earnings

Capacity / Cushion

Capital

Dividend

Earnings Power/Capacity

Event

Capital Depletion

Earnings/Dividend reduction
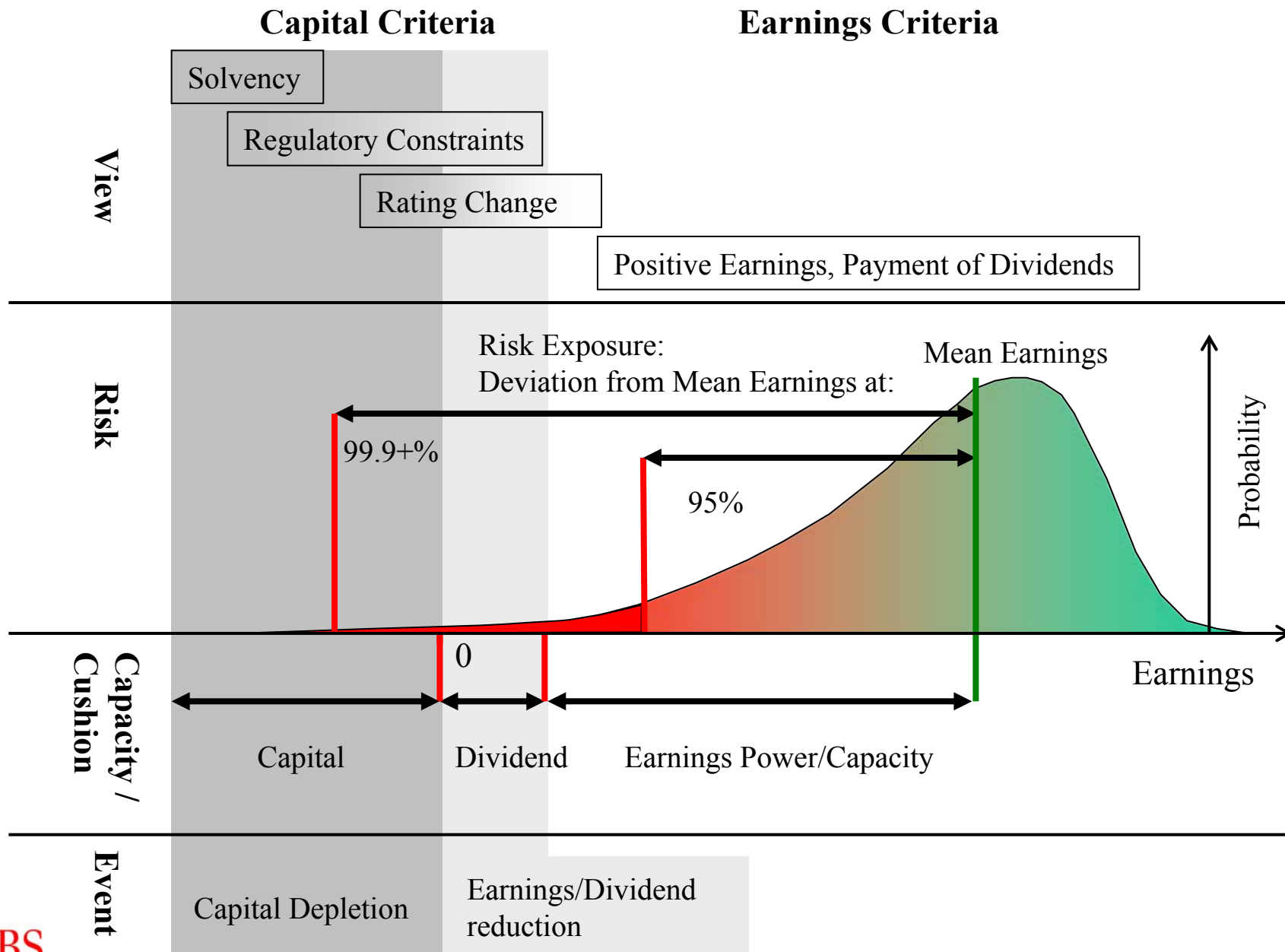
Implications for Risk Appetite

- Need for multiple, complementary criteria (with different time horizons and confidence/severity levels), representing different points in the financial structure/stakeholder waterfall. E.g.:

  - Traditional EC view at a high (99.9+%) confidence level over 1 year and/or multiple years
    - Ensure sufficient total capital, based on high confidence level loss metric
    - Regulatory expectation and input into Equity attribution
    - May be more appropriate for 'gone' concern or wind-down (bondholder) perspective
    - Still valuable, but a step removed from management/board view

  - Tier 1 ratio or similar view at a lower confidence level over ranges from 1 quarter to multiple years
    - Ensure that loss-absorbing capital will be sufficient to meet regulatory requirements even if a severe loss event were to occur
    - Need to evolve along with regulatory standards (i.e. Basel 2 → Basel 2.5 → Basel 3)

  - Earnings view at a lower (one in 5-25 year) confidence level over 1 quarter to 1 year time horizon
    - Business earnings should cover the risk of losses in most years
    - Top of the house, business units, or legal entities?
    - To what level of confidence and does it depend on top of the house / business unit?

  - Leverage ratio and liquidity views?

- Focus on high-quality equity capital (convergence to Basel III or similar view)

Multiple severity levels, metrics, and risk horizons

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Overview of Firm-wide Risk Appetite Framework

The framework encompasses all material risk categories, and plays a key role in the decision-making processes in the Bank
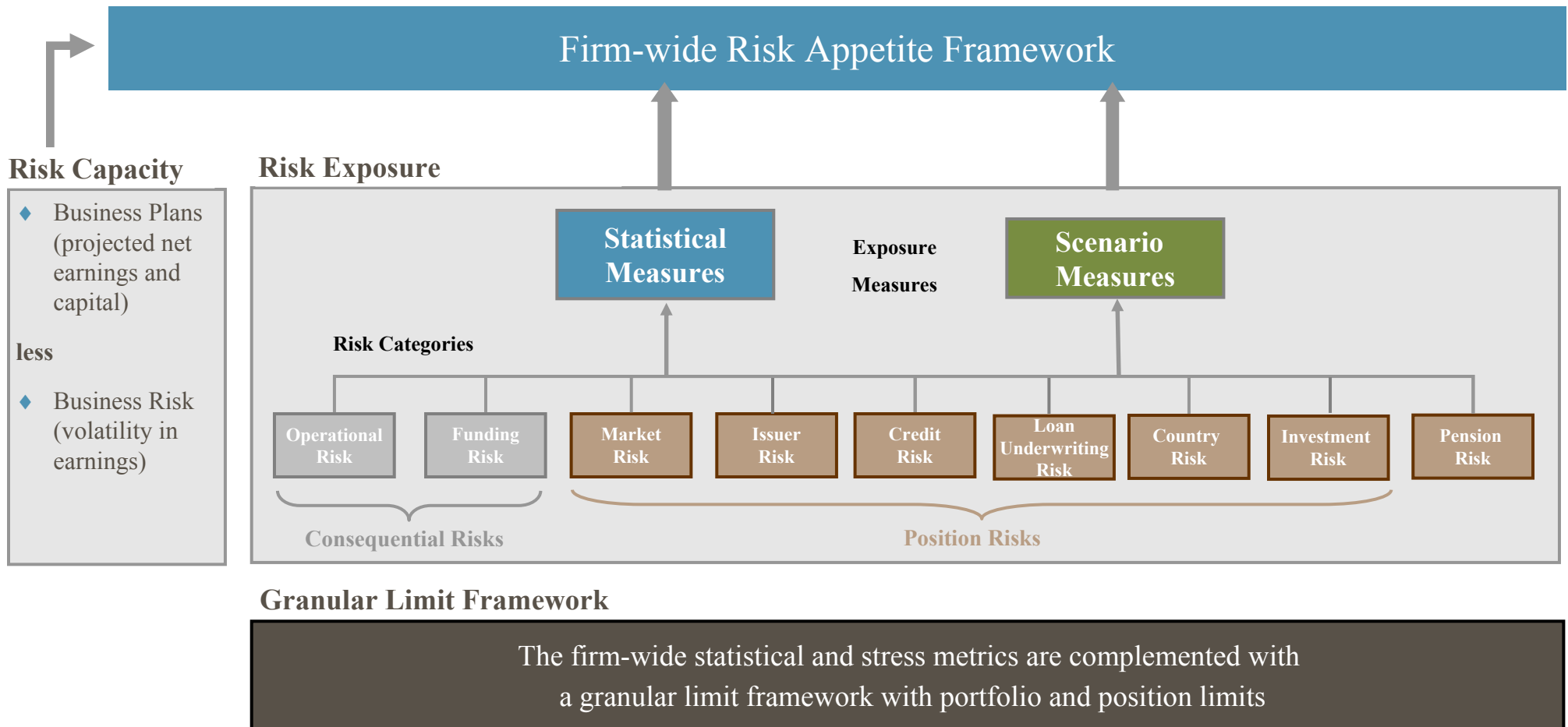
Of the various scenarios in the stress-testing framework, the most relevant / severe one is used as the 'binding' scenario in the Risk Appetite Framework

Risk Exposure: Firm-wide measures

Two complementary approaches – one statistical and one scenario based

Statistical Approach	Allows the aggregation of firm-wide risks using statistical techniques which can then be tied to probabilities / confidence levels *A large number of potential outcomes and associated losses is simulated, rooted in historically observed market changes*
Scenario-based Approach	More intuitive stress measure which calculates the impact of a scenario on the firm-wide portfolio including the causality chain by which losses would arise if the scenario were to unfold *Scenarios enable incorporation of forward-looking views*

Under both firm-wide measurement approaches, we model the first order P&L and capital impacts as well as the consequential capital impacts of downgrades in the Firm's portfolio and resulting adjustments to RWA

Statistical Risk framework

Comprehensive assessment of risks
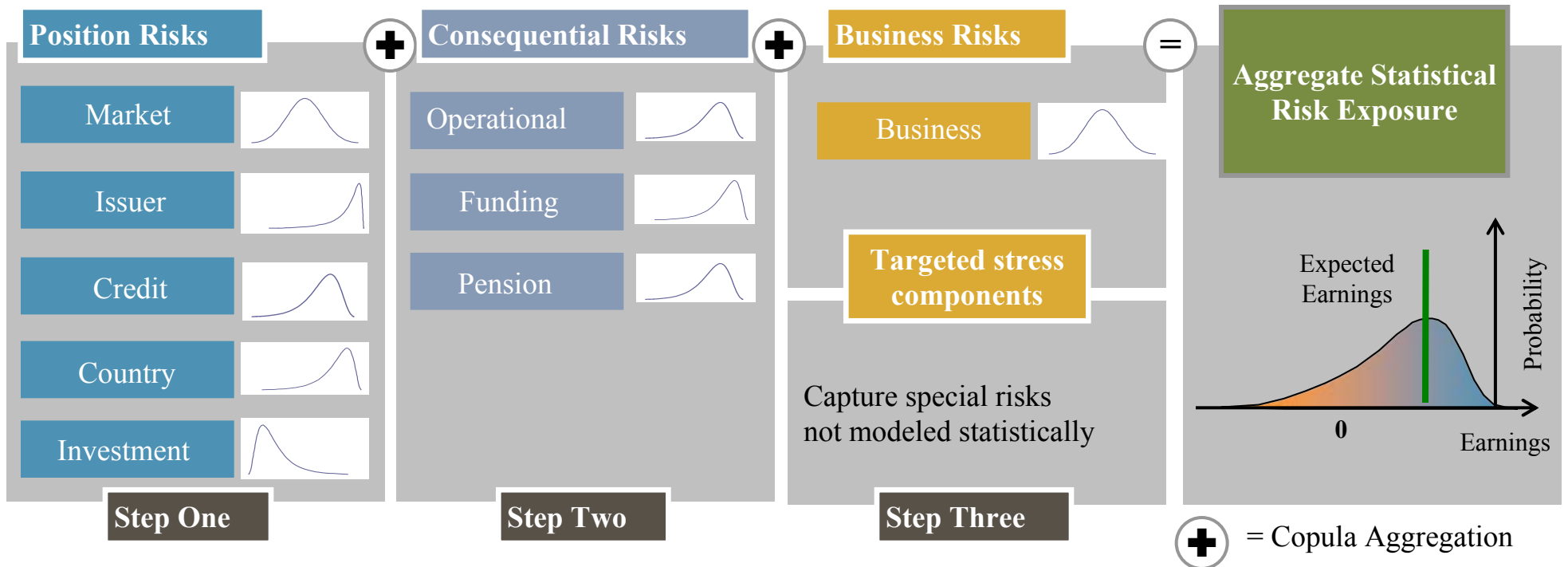
- Aggregate Group Risk Exposure derived from probability distribution of potential earnings shortfalls, supplemented by targeted stress components.

- Diversification between risk types is included at each aggregation step

On the Relative Importance of Risks

- The Basel committee traditionally approached regulation from a perspective deeply rooted in solvency with respect to credit risk

  – Market risk (based on VaR) appeared as an amendment to Basel I

  – Operational risk is an additional element of Basel II (through Pillar I)

  – Although 'other risks' (including 'strategic' and 'reputational') are mentioned in Pillar II, no examples were specifically defined other than liquidity risk

- This is how one bank viewed its distribution of risks (before aggregation across risk types):

Risk Category
- Credit
- Market & Issuer
- Investment
- Business
- Operational
- Funding & Liquidity
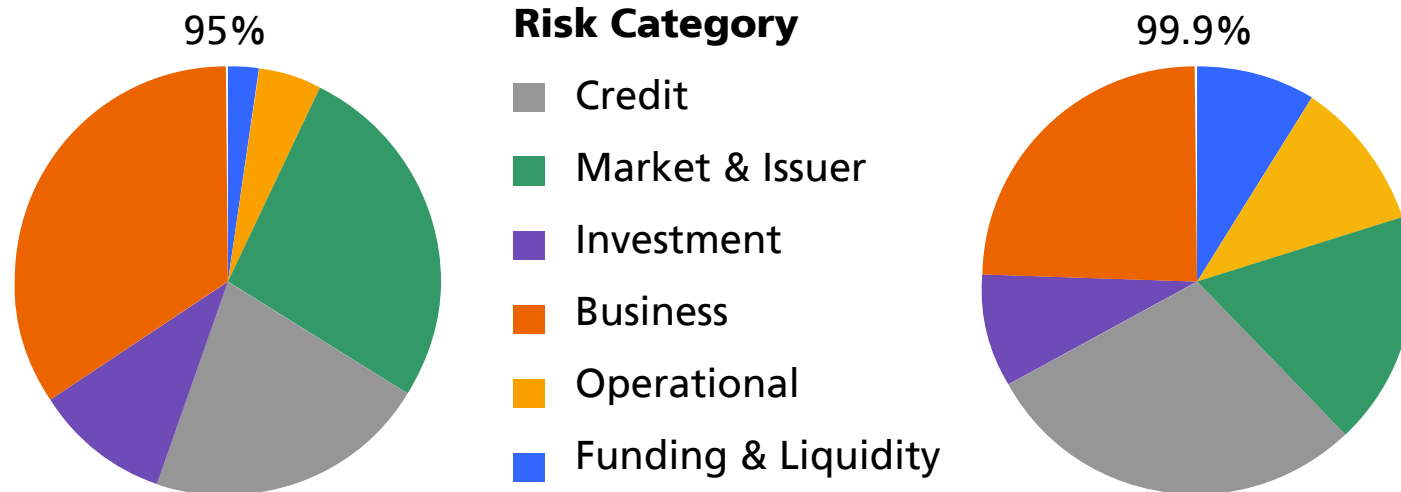
  – Particularly at a lower confidence level, the mixture of risks looks a little different to what one might imagine given regulatory capital rules…

On Choice (and Standardization) of Risk Measures

- Easier to discuss in a statistical framework

- Aggregation of risks is not simplified by the fact that risk measures are typically calibrated to time horizons and confidence levels that are appropriate for controlling the underlying collection of risks, i.e.:
  - Market Risk (VaR): 1 or 10 days, 95% or 99% confidence
  - Credit Risk (CVaR): 1 year, 99+% confidence

- Common practice is typically to scale from the available risk measure to the desired horizon and confidence level using, e.g., factors based on normal distributions

- It seems more robust (and general) to work with full loss distributions throughout and perform extrapolation using explicit assumptions about the returns process
  - At least at moderate confidence levels, simple scaling works quite well
  - At higher confidence levels, scaling will miss tail events in the short-term loss distribution that could (and should) appear in the longer horizon distribution
  - In principle, extrapolation can incorporate auto-correlation effects

On Aggregation of Disparate Risks

- The question is how to 'add up' market, credit, business, funding, operational, and other risks

    – In an ideal world, we would have a single risk system taking all its data from the balance sheet and applying a common set of economic, market, and behavioral risk drivers

    – In the real world, these are usually measured using completely different methodologies, systems, and data

    – The world to which we aspire is somewhere in between: measure and identify dependencies as much as possible from common models, and use as much evidence as is available to infer common drivers (and weightings thereof) between different models.

    – Some risks will remain intrinsically difficult to relate to others…

- Common practice until recently has been aggregation using simple normal-based approaches with single numbers for each risk category

    – This embodies at least a 'local' normality assumption for the underlying risks

    – It also agrees surprisingly well with other models at moderate confidence levels

- Alternative approach is use of Gaussian (or other) copula

    – Represents tail events in the individual, marginal loss distributions of the underlying risk factors

    – Dependency assumptions are still homogeneous and 'normal'

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Local Normal Approximation vs. Gaussian Copula
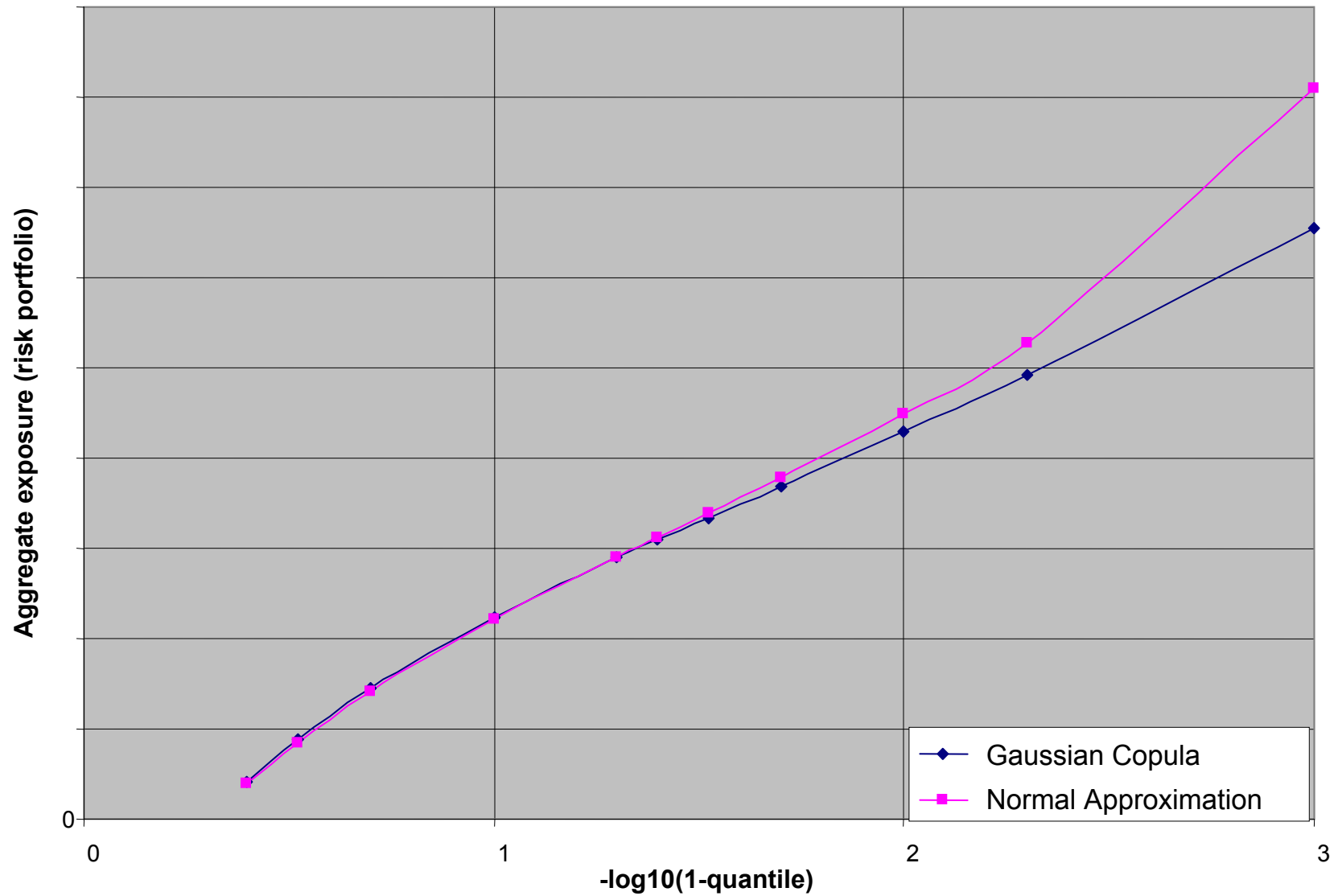
On Aggregation of Disparate Risks (2)

- In practice, we find that the Gaussian copula fits dependencies – for those risks where we are able to calibrate to a consistent set of measurements – remarkably well as long as we are working with portfolios that are reasonably well diversified and we are not reaching too fair into the tails of the distributions

- Accuracy is not as good for very granular, concentrated, or 'two-way' portfolios, but is still reasonable

- There are a number of deep, difficult conceptual issues regarding tail dependency and more generic questions about the definition of risk measures at extreme confidence levels
  - Incorporation of stressed / co-dependent correlations

Multiple views: Statistical vs. Stress/Scenario metrics

- Traditionally, stress models have been developed to focus on individual portfolios / risk types
  - Bespoke, inconsistent assumptions about model drivers and time horizons
  - Inconsistency limits ability to aggregate across risks, forcing aggregation models into a statistical setting

- Ironically, the financial crisis illuminated a solution to this problem
  - Scenario development can begin with identification and prioritization of an area of concern through dialogue amongst risk managers, economists, and management
  - Identify a consistent set of scenario assumptions that span risk types and the corresponding spectrum of time horizons, e.g.:
    - A market disruption (specified by a set of short-term shocks to market risk factors), leading to
    - Longer-term economic consequences (described by macro and high-level market factors)
    - Calibrate scenarios on a "how bad could it plausibly get" basis
  - Impacts on portfolio and business risks can then be estimated by identifying sensitivity relationships between macro/market drivers and the constituents of the 'book'/business mix
    - Dependencies through the driver sensitivities
    - In many cases, historical data can be mined; in others, judgment is required
    - Need to ensure that liquidity of the underlying portfolios is represented

- Advantages of transparency, simplicity of implementation (linearity) and avoidance of (some) blind spots relative to statistical frameworks

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Approach for Firm-wide Stress Testing

Scenario-based stress tests

| Macro-economic scenario | Risk Factor Sensitivities and/or Revaluation methodologies | P&L impacts OCI impacts RWA impacts | Aggregation |

Various global downturn, regionally-focussed, and topical scenarios

Quantitative and qualitative analysis of historical data about defaults, impairments, write-downs etc.

Credit Risk

Market Risk

Issuer Risk

Investment Risk

Funding Risk

Operational Risk

Pension Risk

Country Risk

Business Risk

Quarterly time profile of
• P&L (losses, earnings)
• OCI impacts
• Risk Weighted Assets
and ultimately **Tier 1 capital ratio**

Tier 1 Capital Ratio

Critical threshold

Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8

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EMU Sovereign Defaults: Outline of Potential Stress Scenarios

Basic Policy Options | **Potential Scenarios** | **Key Features & Impact** | **Second-Round Features** | **Final Outcome / Broader Implications**

Basic Policy Options:
- Austerity/Reform (Internal Deflation)
- Monetization
- Growth
- Opting-Out
- Default

(Or some combination of those, whereby Monetization or Stimulation of Growth via Devaluation are not an option for individual EMU member states.)

Potential Scenarios:
- Muddling-Through
- Opting-Out
- Greek Default
- Within EMU
- Outside EMU

Key Features & Impact:

Muddling-Through:
- Austerity/Reform
- Market Stabilization
- External EMU/IMF Support

Opting-Out:
- Devaluation
- Orderly Restructuring
- EU/IMF Support Package
- Argentina-Style Default

Within EMU:
- Orderly Process
- EMU/IMF Intervention
- Market/EUR turmoil
- Snowball Effect
- Lack of Competitiveness
- Sharp Euro Devaluation

Outside EMU:
- Disorderly Process
- Market Collapse
- Broader Contagion
- Massive EUR Devaluation
- Banking & Systemic Crisis

Second-Round Features:

- Weak Growth
- Political/Social Tensions
- Fiscal Consolidation

- Austerity/High Inflation
- Political/Social Tensions
- Lower Imbalances

- No further Sovereign Defaults
- Portugal & Spain Defaults follow
- No further Sovereign Defaults & EMU Exits
- Portugal & Spain Defaults follow
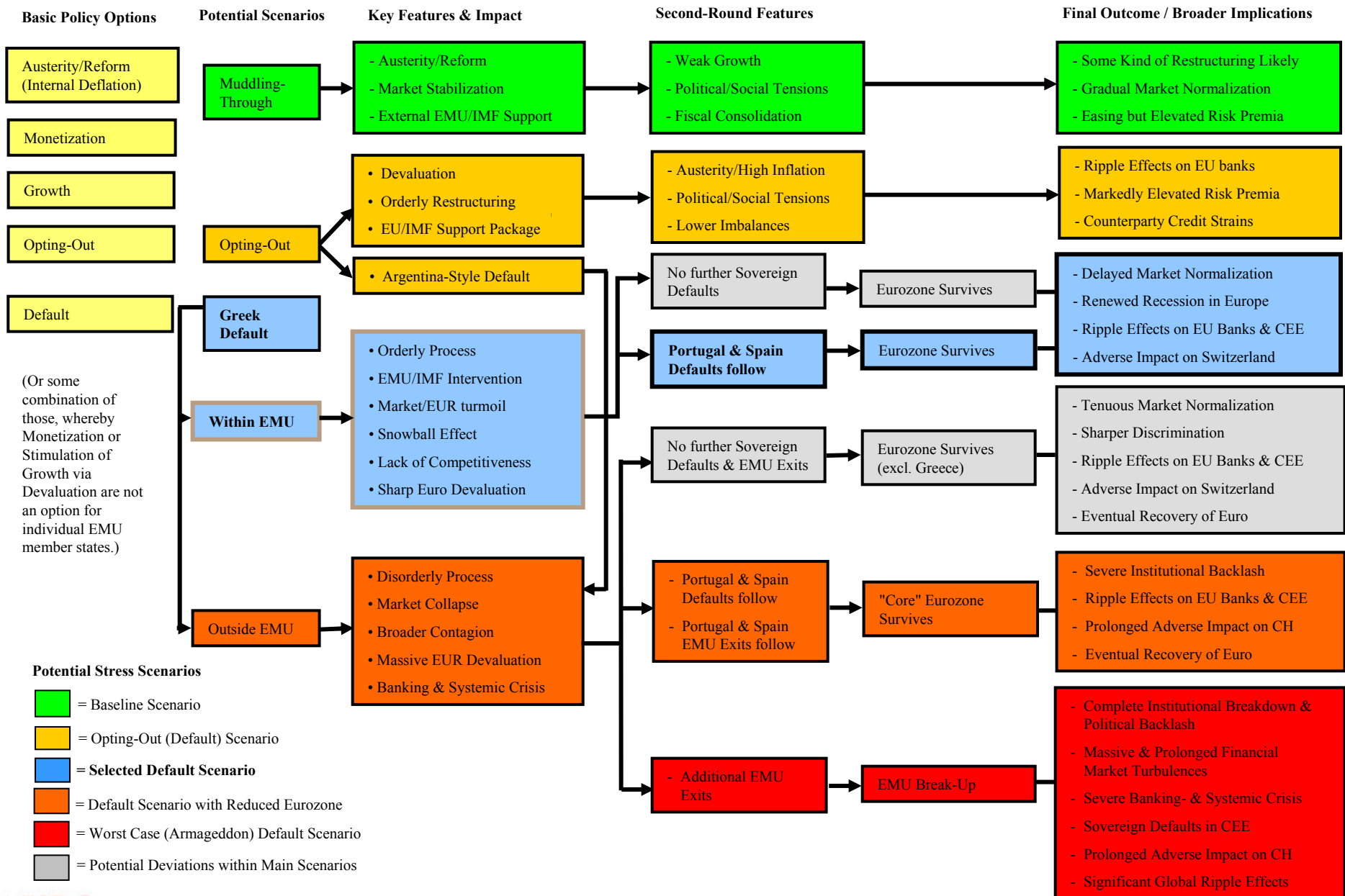- Portugal & Spain EMU Exits follow
- Additional EMU Exits

Eurozone Survives
Eurozone Survives
Eurozone Survives (excl. Greece)
"Core" Eurozone Survives
EMU Break-Up

Final Outcome / Broader Implications:

- Some Kind of Restructuring Likely
- Gradual Market Normalization
- Easing but Elevated Risk Premia

- Ripple Effects on EU banks
- Markedly Elevated Risk Premia
- Counterparty Credit Strains

- Delayed Market Normalization
- Renewed Recession in Europe
- Ripple Effects on EU Banks & CEE
- Adverse Impact on Switzerland

- Tenuous Market Normalization
- Sharper Discrimination
- Ripple Effects on EU Banks & CEE
- Adverse Impact on Switzerland
- Eventual Recovery of Euro

- Severe Institutional Backlash
- Ripple Effects on EU Banks & CEE
- Prolonged Adverse Impact on CH
- Eventual Recovery of Euro

- Complete Institutional Breakdown & Political Backlash
- Massive & Prolonged Financial Market Turbulences
- Severe Banking- & Systemic Crisis
- Sovereign Defaults in CEE
- Prolonged Adverse Impact on CH
- Significant Global Ripple Effects

Potential Stress Scenarios
- = Baseline Scenario (green)
- = Opting-Out (Default) Scenario (yellow)
- = Selected Default Scenario (blue)
- = Default Scenario with Reduced Eurozone (orange)
- = Worst Case (Armageddon) Default Scenario (red)
- = Potential Deviations within Main Scenarios (grey)

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Linkage between Firm-wide / More Granular Metrics & Limits

- Feeder relationship between firm-wide framework and individual risk types / view at lower organizational levels implies reverse relationship:
  - Risk appetite for specific risks must be consistent with / calibrated to overall risk appetite
  - Similarly, risk appetite for business units must be consistent with firm-wide appetite
    - Cross-subsidy relationships should be understood and made explicit

- Calibration could / should happen most naturally during the business planning process
  - Inherently an iterative process
  - Imperfect match between portfolio & firm-wide metrics implies that calibration will sometimes be approximate
    - Need for monitoring to ensure that calibration remains reliable

- Expression of appetite at more granular levels should not be restricted to firm-wide terms/metrics
  - Individual business units will necessarily have their own strategic drivers
    - While consistent with firm-wide strategy, these may be expressed in different terms

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On Completeness

- Almost by definition, we know how to measure the risks we are accustomed to managing

- The hard part is measuring (and incorporating) those risks we are less familiar with

- Many of these risks bear strong accounting flavors…

- Some examples:
  - Own-share and option risks
  - Defined-benefit pension risks
  - Tax (and deferred tax asset/liability) risks
  - Goodwill risks

- Yet, the 'economic' effects of these risks can be very real!

Conclusions

- Aggregation of firm-wide risks to identify an institution's overall risk profile / exposure is far from a completely settled question

- Open issues remain at all levels, and very little seems obvious anymore after one has worked on these problems for a long time

- Although one can try very hard to turn a blind eye to the underlying accounting questions, it becomes more-and-more difficult to do so as these tools become more deeply embedded in an organization.

  – And, actually, the accounting questions are very, very interesting!

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Key Challenges as Perceived by Financial Institutions

IIF Survey results

Appendices

Economic Capital

- Financial institutions are required to develop methods for quantifying and aggregating all material risks at confidence level[s] corresponding to those which test solvency over an appropriate time horizon

  - This is usually understood to mean 99.9+% at a one-year time horizon

  - This aggregate risk measurement is to be compared with a bank's available capital resources as an independent solvency test

  - Hence, the notion of an institution's 'economic capital'

- Other comparisons and applications are possible:

  - Shorter (or longer time horizons)

  - Other confidence levels (about which more later)

  - Comparisons to regulatory capital requirements by risk category as well as in aggregate

  - Tests of sufficiency of excess capital (buffer) above regulatory minimums

  - As a measure of required capital resource in performance measurement (RoRAC)

- Beyond what is required for Basel II compliance (which can vary between jurisdictions), it makes sense – at least conceptually – for banks to do many, if not most, of these things for their own purposes

  - Squaring the circle: this has the added benefit of satisfying Basel II's "use test"

Definitional Questions (1)

- How are we to define the 'economic capital' of an organization?
  - Risk measure (content, quantile, time horizon, etc.)
  - Centering of the distribution (expected/unexpected losses, earnings, capital definition)

- Common practice states more-or-less the following:
  - EC is defined as the unexpected potential change in economic value (explicitly rejecting the notion of accounting measurement) of an institution's holdings at a specified confidence level over a one year horizon
  - This is the aggregate measure of risk that is to be compared to the institution's available capital resources as a test of solvency

Definitional Questions (2)

This definition raises the following questions (among many)

- How is 'economic value' to be measured, as many of a bank's holdings are not valued on an economic basis?
  - E.g., most loan portfolios, but to a certain extent all valuation measures depart from the ideal of 'economic value'
  - Certain risks (to be mentioned later) are almost purely consequences of accounting treatments
  - And, for that matter, capital (by the way, which measure of capital?) is itself not an economic concept but rather one that is intrinsically linking to accounting

- How are expected losses accounted for?
  - Remember that, with the exception of credit portfolios, banks are not required to – and under some accounting regimes are currently precluded from – establishing general provisions for non-specific losses

- Is capital the only means of absorbing losses?
  - What ever happened to earnings? When can we use them?

- Is a solvency-based measure really the appropriate basis for steering an organization?
  - This will likely keep the bondholders happy, but what happened to shareholder value?

- What should happen if actual capital (however measured) departs from economic capital?

- What about coherent properties of the risk measure?
  - Do we care about sub-additivity?
  - Alternatively, if we adopt a coherent risk measure, how do we link it to a solvency criterion?

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Definitional Questions (3)

- In principle, there is only a loose connection between purist notions of economic value and the accounting, regulatory, and liquidity measures that govern a financial institution

- An outcome based on economic value might be completely benign, yet an institution could still find itself in default…