Portfolio Theory without a Risk-Free Asset

Safety as a Fragmented and Endogenous Concept in a Multipolar World

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Outline

The Traditional Paradigm

Modern Portfolio Theory's Foundation

Portfolio theory relies on a universal risk-free asset
Traditional CAPM framework:

$$\mathbb{E}[R_i] = R_f + \beta_i(\mathbb{E}[R_M] - R_f) \tag{1}$$

Where R_f = universal risk-free rate, accessible to all investors

Key assumption: All investors agree on what constitutes "risk-free"

- Same asset is safe for all investor types
- Universal accessibility regardless of location/institution
- Homogeneous risk perceptions across markets

The Paradigm is Breaking Down

Contemporary Financial Reality

Empirical patterns traditional theory cannot explain:

- **Cross-Border Basis Spreads:** Currency-hedged returns differ by investor nationality
- **Portfolio Home Bias:** Varies systematically across investor types
- **Investment Flow Patterns:** Follow geographical and political proximity
- **Differential Asset Holdings:** Identical assets show different ownership patterns

The Problem

Rising geopolitical fragmentation, fiscal dominance, and multipolar reserve systems challenge the assumption of universal safety

Research Motivation

Why This Matters Now

Contemporary developments undermining universal safety:

1. **Geopolitical Fragmentation**
   - Strategic capital controls
   - Sanctions and counter-sanctions
   - Weaponization of financial systems
2. **Multipolar Reserve Systems**
   - Decline in dollar dominance
   - Central bank diversification
   - Alternative payment systems
3. **Institutional Constraints**
   - Regulatory fragmentation
   - Information asymmetries
   - Enforcement uncertainties

Our Theoretical Contribution

Key Innovations

We develop portfolio theory where safety is investor-specific

1. **Microfounded Safety Preferences**
   - Based on information asymmetries
   - Institutional monitoring capabilities
   - Enforcement reliability
2. **Marginal Investor Pricing**
   - Asset-specific marginal investors
   - Pricing based on comparative advantage
   - Avoids market average problems
3. **Limited Arbitrage Framework**
   - Institutional constraint analysis
   - Persistent pricing differences
   - Cross-sectional implications

Information Asymmetries Drive Safety Perceptions

Why Safety is Investor-Specific

Investors have superior information about assets that are:

1. **Institutionally Familiar**
   - Legal frameworks similar to home jurisdiction
   - Accumulated expertise and infrastructure
   - Regulatory familiarity
2. **Informationally Accessible**
   - Language and cultural understanding
   - Professional networks
   - Reporting requirement access
3. **Enforcement Reliable**
   - Historical experience with legal systems
   - Institutional relationships
   - Bilateral treaty coverage

Safety Valuation Function

Formalizing Investor-Specific Safety

Safety valuation reflects information and monitoring advantages:

$$\begin{aligned} V_i(A_j) = &\alpha_i \cdot \text{InformationQuality}_i(A_j) \\ &+ \beta_i \cdot \text{MonitoringEfficiency}_i(A_j) \\ &+ \gamma_i \cdot \text{EnforcementReliability}_i(A_j) + \varepsilon_{ij} \end{aligned} \tag{2}$$

Where:

- $\alpha_i, \beta_i, \gamma_i > 0$ are investor-specific parameters
- Information quality captures access and understanding
- Monitoring efficiency reflects cost-effective oversight
- Enforcement reliability measures legal confidence

Safety-Augmented Utility

Incorporating Safety into Portfolio Choice

Investors maximize utility including information advantages:

$$U_i(w) = \mathbb{E}[w^\top R] - \frac{\gamma_i}{2} w^\top \Sigma w + \delta_i \sum_{j=1}^{n} w_j V_i(A_j) \tag{3}$$

Three components:

- Expected return: $\mathbb{E}[w^\top R]$
- Risk penalty: $-\frac{\gamma_i}{2} w^\top \Sigma w$
- **Safety premium:** $\delta_i \sum_{j=1}^{n} w_j V_i(A_j)$

Key Insight

$\delta_i > 0$ represents value of reduced monitoring costs and enhanced information quality

First-Order Conditions

Solving the Optimization Problem

Optimal portfolio solution:

$$w_i^* = \frac{1}{\gamma_i}\Sigma^{-1}[\mu + \delta_i V_i - \lambda_i 1] \tag{4}$$

where:

$$\lambda_i = \frac{1^\top \Sigma^{-1}(\mu + \delta_i V_i) - \gamma_i}{1^\top \Sigma^{-1} 1} \tag{5}$$

Key difference from traditional portfolio theory:

- Safety valuation V_i is investor-specific
- No universal risk-free asset
- Portfolios differ even with identical risk preferences

Portfolio Implications

How Safety Shapes Asset Allocation

Optimal weights depend on three factors:

1. **Traditional Risk-Return:** μ and Σ
2. **Individual Safety Valuation:** $\delta_i V_i$
3. **Risk Aversion:** γ_i

Cross-sectional predictions:

- Investors overweight assets they can monitor better
- Home bias emerges from information advantages
- Portfolio heterogeneity reflects institutional capabilities
- Similar investors hold similar portfolios

Asset-Specific Marginal Investors

Who Sets Prices?

Theorem (Marginal Investor Definition)

For asset j, the marginal investor $i^*(j)$ has the highest effective valuation:

$$i^*(j) = \arg\max_{i \in \mathcal{I}} \left\{ \frac{\delta_i V_i(A_j)}{\gamma_i} \right\} \tag{6}$$

Economic intuition:

- Assets are priced by those with greatest comparative advantage
- Information and monitoring capabilities determine pricing power
- Different assets have different marginal investors
- Avoids meaningless "market average" concepts

Marginal Investor Pricing Framework

Equilibrium Asset Pricing

Theorem (Marginal Investor Pricing)

Asset j's expected return is determined by its marginal investor:

$$\mathbb{E}[R_j] = \frac{Cov(R_j, M_{i^*(j)})}{\mathbb{E}[M_{i^*(j)}]} + \frac{\delta_{i^*(j)} V_{i^*(j)}(A_j)}{\gamma_{i^*(j)}} \quad (7)$$

where $M_{i^*(j)}$ is the marginal investor's pricing kernel.

Two components:

- **Risk premium:** $\frac{\mathrm{Cov}(R_j, M_{i^*(j)})}{\mathbb{E}[M_{i^*(j)}]}$
- **Safety premium:** $\frac{\delta_{i^*(j)} V_{i^*(j)}(A_j)}{\gamma_{i^*(j)}}$

Cross-Asset Pricing Differences

Why Similar Assets Trade at Different Prices

Assets with different marginal investors exhibit pricing differences:

For assets A_i and A_k with different marginal investors:

$$\text{Safety Premium Difference} = \frac{\delta_{i^*(i)} V_{i^*(i)}(A_i)}{\gamma_{i^*(i)}} - \frac{\delta_{i^*(k)} V_{i^*(k)}(A_k)}{\gamma_{i^*(k)}} \tag{8}$$

Examples:

- U.S. Treasuries vs. German Bunds
- Domestic vs. foreign corporate bonds
- Local vs. international equity markets
- Currency-hedged vs. unhedged returns

Key Insight

Persistent pricing differences reflect fundamental information asymmetries, not market inefficiencies

Institutional Arbitrage Constraints

Why Pricing Differences Persist

Arbitrage is limited by institutional constraints:
For investor i arbitraging between assets j and k:

$$IC_{i,j,k} = \max\{0, \text{CapitalRequirement}_{i,j,k} - \text{AvailableCapital}_i\} \tag{9}$$

Sources of constraints:

- Regulatory capital requirements
- Risk management limits
- Institutional mandates
- Liquidity requirements
- Currency exposure limits

Theorem (Limited Arbitrage Condition)

For similar assets A_j and A_k, the return difference satisfies:

$$|\mathbb{E}[R_j] - \mathbb{E}[R_k]| \leq \min_{i \in \mathcal{I}} \left\{ \frac{IC_{i,j,k}}{TradingCapacity_i} + \left| \frac{\delta_i V_i(A_j)}{\gamma_i} - \frac{\delta_i V_i(A_k)}{\gamma_i} \right| \right\} \tag{10}$$

Implications:

- Similar assets can trade at different prices
- Bounds depend on institutional constraints
- Most constrained arbitrageurs determine bounds
- Safety valuations create permanent wedges

Information-Based Home Bias

Non-Circular Explanation

Theorem (Information-Driven Home Bias)

Optimal portfolios exhibit home bias when:

$$\delta_i[\alpha_i \Delta InfoQuality_i + \beta_i \Delta MonitoringEff_i] > \gamma_i \frac{DiversificationBenefit_i}{2} \quad (11)$$

Trade-off between:

- **Information advantages** of domestic assets
- **Diversification benefits** of international assets

Key Insight

Home bias emerges rationally from information asymmetries, not behavioral biases

Cross-Sectional Investment Patterns

Testable Predictions

Portfolio weights in asset j are positively correlated with:

1. **Information Quality**
   - Language similarity
   - Shared legal systems
   - Analyst coverage overlap
2. **Monitoring Efficiency**
   - Physical proximity
   - Time zone overlap
   - Cultural similarity
3. **Enforcement Reliability**
   - Bilateral investment treaties
   - Historical dispute resolution
   - Judicial system quality

Empirical Implementation

Measurable Proxies

Parameter estimation using cross-sectional portfolio data:

$$(\alpha_i, \beta_i, \gamma_i, \delta_i) = \arg\min \sum_{j=1}^{n} (w_{ij}^{observed} - w_{ij}^{model})^2 \tag{12}$$

Proxies for safety components:

- **Information:** Language, accounting standards, legal systems
- **Monitoring:** Distance, time zones, cultural indices
- **Enforcement:** Treaty coverage, judicial quality, dispute history

Data sources:

- Central bank portfolio holdings
- Institutional investor surveys
- Cross-border investment flows
- Basis spread data

Policies to reduce information asymmetries:

1. **Information Standardization**
   - Harmonize accounting standards
   - Standardize disclosure requirements
   - Improve data quality and accessibility
2. **Regulatory Coordination**
   - Mutual recognition agreements
   - Reduce monitoring costs
   - Streamline cross-border compliance
3. **Legal Framework Development**
   - Bilateral investment treaties
   - Dispute resolution mechanisms
   - Enforcement coordination

Crisis Resilience

Market Stability Implications

Markets with lower information asymmetries are more resilient:

- Investors maintain confidence across broader asset range
- Less flight-to-familiarity during stress
- Reduced market fragmentation
- Better risk sharing across investor types

Policy implications:

- Prioritize information infrastructure
- Develop early warning systems
- Strengthen international cooperation
- Monitor cross-border investment patterns

Warning

Increasing information asymmetries can destabilize global financial markets

Key Contributions

Theoretical Advances

1. **Microfounded Safety Preferences**
    - Information asymmetries and monitoring capabilities
    - Investor-specific valuations
    - Non-arbitrary safety concepts
2. **Marginal Investor Pricing**
    - Asset-specific price determination
    - Comparative advantage approach
    - Avoids market average problems
3. **Limited Arbitrage Framework**
    - Institutional constraint analysis
    - Persistent pricing differences
    - Cross-sectional implications
4. **Empirical Tractability**
    - Measurable proxies
    - Testable predictions
    - Policy applications

Broader Implications

Rethinking Portfolio Theory

Traditional portfolio theory must evolve:

- Move beyond universal risk-free asset assumption
- Incorporate heterogeneous safety perceptions
- Account for institutional constraints
- Recognize information asymmetries

Our framework shows:

- Portfolio theory can be rigorous without universal safety
- Cross-sectional patterns have fundamental explanations
- Information structure drives investment patterns
- Policy can influence market integration

Bottom Line

Safety is not universal—it's investor-specific and shaped by information asymmetries

Future Research Directions

Extensions and Applications

1. **Empirical Calibration**
   - International portfolio data analysis
   - Information quality measurement
   - Parameter estimation across investor types
2. **Dynamic Extensions**
   - Learning about information quality
   - Time-varying safety perceptions
   - Crisis and normal period dynamics
3. **Policy Applications**
   - Financial integration initiatives
   - Regulatory harmonization effects
   - Crisis intervention strategies
4. **Information Production**
   - Endogenous information acquisition
   - Rating agency roles
   - Technology and information costs

Thank You

Questions & Discussion

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Key Takeaway

In a multipolar world, portfolio theory must abandon the fiction of universal safety and embrace the reality of heterogeneous information structures that shape investor-specific risk perceptions.