Equity Premium

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Skeleton

Abstract

Equity Premium Puzzle — Machine-Checked Formalization

This paper presents 73 machine-verified theorems building on 2 established facts and 3 hypotheses. All results are formally verified in the Platonic proof kernel (103 verification units, 52 proved statements) and exportable to Lean 4.

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1. Introduction

2. Further Results

Theorem (premium_sq_nonneg). *Premium Sq Nonneg.* [Platonic: premium_sq_nonneg, domain: equity_premium]

Theorem (mehra_prescott_impossibility). *Mehra Prescott Impossibility.* [Platonic: mehra_prescott_impossibilit domain: equity_premium]

Theorem (persistence_amplification). *Persistence Amplification.* [Platonic: persistence_amplification, domain: equity_premium]

Theorem (latent_persistence_link). *Latent Persistence Link.* [Platonic: latent_persistence_link, domain: equity_premium]

Theorem (amplification_equals_rho). *Amplification Equals Rho.* [Platonic: amplification_equals_rho, domain: equity_premium]

Theorem (latent_exceeds_standard). *Latent Exceeds Standard.* [Platonic: latent_exceeds_standard, domain: equity_premium]

Theorem (latent_resolution). *Latent Resolution.* [Platonic: latent_resolution, domain: equity_premium]

Theorem (sigma_sq_exceeds_threshold). *Sigma Sq Exceeds Threshold.* [Platonic: sigma_sq_exceeds_threshold domain: equity_premium]

Theorem (fivefold_amplification). *Fivefold Amplification.* [Platonic: fivefold_amplification , domain: equity_premium]

Theorem (persistence_phi_for_rho_5). *Persistence Phi For Rho 5.* [Platonic: persistence_phi_for_rho_5, domain: equity_premium]

Theorem (fivefold_resolves_gap). *Fivefold Resolves Gap.* [Platonic: fivefold_resolves_gap, domain: equity_premium]

Theorem (scaling_preserves_strict_order). *Scaling Preserves Strict Order.* [Platonic: scaling_preserves_strict_order, domain: equity_premium]

Theorem (minimum_rho_criterion). *Minimum Rho Criterion.* [Platonic: minimum_rho_criterion, domain: equity_premium]

Theorem (product_mono_right). *Product Mono Right.* [Platonic: product_mono_right, domain: equity_premium]

Theorem (rho_determines_premium_and_threshold). *Rho Determines Premium And Threshold.* [Platonic: rho_determines_premium_and_threshold, domain: equity_premium]

Theorem (premium_threshold_product_constant). *Premium Threshold Product Constant.* [Platonic: premium_threshold_product_constant, domain: equity_premium]

Theorem (high_premium_implies_fragility). *High Premium Implies Fragility.* [Platonic: high_premium_implies_fragility, domain: equity_premium]

Theorem (contagion_exceeds_premium_amplification). *Contagion Exceeds Premium Amplification.* [Platonic: contagion_exceeds_premium_amplification, domain: equity_premium]

Theorem (higher_rho_fewer_factors). *Higher Rho Fewer Factors.* [Platonic: higher_rho_fewer_factors, domain: equity_premium]

Theorem (rho2_three_predictions). *Rho2 Three Predictions.* [Platonic: rho2_three_predictions, domain: equity_premium]

Theorem (premium_threshold_impossibility). *Premium Threshold Impossibility.* [Platonic: premium_threshold_impossibility, domain: equity_premium]

Theorem (deconcentration_resolves_dilemma). *Deconcentration Resolves Dilemma.* [Platonic: deconcentration_resolves_dilemma, domain: equity_premium]

Theorem (unified_latent_economics_theorem). *Unified Latent Economics Theorem.* [Platonic: unified_latent_economics_theorem, domain: equity_premium]

Theorem (beta_pricing_identity). *Beta Pricing Identity.* [Platonic: beta_pricing_identity, domain: equity_premium]

Theorem (max_sharpe_from_frontier). *Max Sharpe From Frontier.* [Platonic: max_sharpe_from_frontier, domain: equity_premium]

Theorem (hj_sharpe_duality). *Hj Sharpe Duality.* [Platonic: hj_sharpe_duality, domain: equity_premium]

Theorem (cml_slope_is_sdf_ratio). *Cml Slope Is Sdf Ratio.* [Platonic: cml_slope_is_sdf_ratio, domain: equity_premium]

Theorem (amplified_sharpe_ratio). *Amplified Sharpe Ratio.* [Platonic: amplified_sharpe_ratio, domain: equity_premium]

Theorem (frontier_shift_steeper_cml). *Frontier Shift Steeper Cml.* [Platonic: frontier_shift_steeper_cml, domain: equity_premium]

Theorem (amplified_beta_pricing). *Amplified Beta Pricing.* [Platonic: amplified_beta_pricing, domain: equity_premium]

Theorem (squared_ratio_cleared). *Squared Ratio Cleared.* [Platonic: squared_ratio_cleared, domain: equity_premium]

Theorem (monotone_ratio). *Monotone Ratio.* [Platonic: monotone_ratio, domain: equity_premium]

Theorem (partial_sum_positive). *Partial Sum Positive.* [Platonic: partial_sum_positive, domain: equity_premium]

Theorem (partial_sum_monotone). *Partial Sum Monotone.* [Platonic: partial_sum_monotone, domain: equity_premium]

Theorem (models_agree_at_rho_2). *Models Agree At Rho 2.* [Platonic: models_agree_at_rho_2, domain: equity_premium]

Theorem (product_var_exceeds_sum). *Product Var Exceeds Sum.* [Platonic: product_var_exceeds_sum, domain: equity_premium]

Theorem (amplification_factor_rho_6_5). *Amplification Factor Rho 6 5.* [Platonic: amplification_factor_rho_6_5, domain: equity_premium]

Theorem (sigma_sq_threshold). *Sigma Sq Threshold.* [Platonic: sigma_sq_threshold, domain: equity_premium]

Theorem (mild_persistence_for_rho_6_5). *Mild Persistence For Rho 6 5.* [Platonic: mild_persistence_for_rho_6_5, domain: equity_premium]

Theorem (premium_distrib). *Premium Distrib.* [Platonic: premium_distrib, domain: equity_premium]

Theorem (premium_neg_sub). *Premium Neg Sub.* [Platonic: premium_neg_sub, domain: equity_premium]

Theorem (premium_cleared_base). *Premium Cleared Base.* [Platonic: premium_cleared_base, domain: equity_premium]

Theorem (hj_squared_ingredient). *Hj Squared Ingredient.* [Platonic: hj_squared_ingredient, domain: equity_premium]

Theorem (power_utility_premium). *Power Utility Premium.* [Platonic: power_utility_premium, domain: equity_premium]

Theorem (latent_premium_chain). *Latent Premium Chain.* [Platonic: latent_premium_chain, domain: equity_premium]

Theorem (variance_decomposition). *Variance Decomposition.* [Platonic: variance_decomposition, domain: equity_premium]

Theorem (ratio_ordering). *Ratio Ordering.* [Platonic: ratio_ordering, domain: equity_premium]

Theorem (beta_portfolio_additivity). *Beta Portfolio Additivity.* [Platonic: beta_portfolio_additivity, domain: equity_premium]

Theorem (market_beta_is_one). *Market Beta Is One.* [Platonic: market_beta_is_one, domain: equity_premium]

Theorem (two_fund_sdf_decomposition). *Two Fund Sdf Decomposition.* [Platonic: two_fund_sdf_decomposition, domain: equity_premium]

Theorem (combined_vol_linear). *Combined Vol Linear.* [Platonic: combined_vol_linear, domain: equity_premium]

Theorem (premium_equals_sr_times_vol). *Premium Equals Sr Times Vol.* [Platonic: premium_equals_sr_times_vol, domain: equity_premium]

Theorem (ratio_eq_from_numerator_eq). *Ratio Eq From Numerator Eq.* [Platonic: ratio_eq_from_numerator_eq, domain: equity_premium]

Theorem (product_ratio_cancel). *Product Ratio Cancel.* [Platonic: product_ratio_cancel, domain: equity_premium]

Theorem (geometric_sum_1). *Geometric Sum 1.* [Platonic: geometric_sum_1, domain: equity_premium]

Theorem (geometric_sum_2). *Geometric Sum 2.* [Platonic: geometric_sum_2, domain: equity_premium]

Theorem (geometric_sum_3). *Geometric Sum 3.* [Platonic: geometric_sum_3, domain: equity_premium]

Theorem (product_variance_independent). *Product Variance Independent.* [Platonic: product_variance_independent, domain: equity_premium]

3. Spectral Theory

Theorem (spectral_sum_latent). *Spectral Sum Latent.* [Platonic: spectral_sum_latent, domain: equity_premium]

Theorem (spectral_variance_amplification). *Spectral Variance Amplification.* [Platonic: spectral_variance_amplification, domain: equity_premium]

Theorem (spectral_premium_formula). *Spectral Premium Formula.* [Platonic: spectral_premium_formula, domain: equity_premium]

Theorem (spectral_exceeds_persistence). *Spectral Exceeds Persistence.* [Platonic: spectral_exceeds_persistence, domain: equity_premium]

Theorem (persistence_exceeds_spectral). *Persistence Exceeds Spectral.* [Platonic: persistence_exceeds_spectral, domain: equity_premium]

Theorem (spectral_premium_exceeds_standard). *Spectral Premium Exceeds Standard.* [Platonic: spectral_premium_exceeds_standard, domain: equity_premium]

Theorem (spectral_full_resolution). *Spectral Full Resolution.* [Platonic: spectral_full_resolution, domain: equity_premium]

4. Bounds and Estimates

Theorem (gamma_bound_propagation). *Gamma Bound Propagation.* [Platonic: gamma_bound_propagation, domain: equity_premium]

Theorem (complexity_bound_core). *Complexity Bound Core.* [Platonic: complexity_bound_core, domain: equity_premium]

Theorem (quadratic_form_bound). *Quadratic Form Bound.* [Platonic: quadratic_form_bound, domain: equity_premium]

Theorem (hj_is_sharpe_bound). *Hj Is Sharpe Bound.* [Platonic: hj_is_sharpe_bound, domain: equity_premium]

Theorem (multiperiod_linear_lower_bound). *Multiperiod Linear Lower Bound.* [Platonic: multiperiod_linear_lower_bound, domain: equity_premium]

Theorem (sharpe_ratio_bound_cleared). *Sharpe Ratio Bound Cleared.* [Platonic: sharpe_ratio_bound_cleared domain: equity_premium]

5. Convergence Results

Theorem (partial_sum_lt_limit). *Partial Sum Lt Limit.* [Platonic: partial_sum_lt_limit, domain: equity_premium]

Theorem (geometric_limit_identity). *Geometric Limit Identity.* [Platonic: geometric_limit_identity, domain: equity_premium]

6. Formal Framework

Hypotheses

- H_sdf_pricing: Sdf Pricing
- H_rf_def: Rf Def
- H_cov_decomp: Cov Decomp

Established Facts

- F_var_nonneg: Var Nonneg
- F_cauchy_schwarz_cov: Cauchy Schwarz Cov

7. Proof Architecture

All proofs are implemented in the Platonic kernel (elysium/fields/equity_premium/).

File	Role
equity_premium_proof.py	
unified_rho_capstone_proof.py	
sdf_markowitz_bridge_proof.py	
multiperiod_sdf_proof.py	

8. Discussion

References