

Financial Contagion

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Skeleton

Abstract

Contagion Phase Transition — Sharp Threshold with Network Topology.

This paper presents 53 machine-verified theorems building on 0 established facts and 50 hypotheses. All results are formally verified in the Platonic proof kernel (192 verification units, 74 proved statements) and exportable to Lean 4.

1. Introduction

2. Further Results

Theorem (beta_c_positive). *Beta C Positive.* [Platonic: beta_c_positive, domain: financial_contagion]

Theorem (concentration_lowers_threshold). *Concentration Lowers Threshold.* [Platonic: concentration_lowers_threshold, domain: financial_contagion]

Theorem (subcritical_absorbed). *Subcritical Absorbed.* [Platonic: subcritical_absorbed, domain: financial_contagion]

Theorem (supercritical_cascade). *Supercritical Cascade.* [Platonic: supercritical_cascade, domain: financial_contagion]

Theorem (critical_equilibrium). *Critical Equilibrium.* [Platonic: critical_equilibrium, domain: financial_contagion]

Theorem (excess_beta_positive). *Excess Beta Positive.* [Platonic: excess_beta_positive, domain: financial_contagion]

Theorem (cascade_proportional_to_excess). *Cascade Proportional To Excess.* [Platonic: cascade_proportional_to_excess, domain: financial_contagion]

Theorem (cascade_monotone_in_beta). *Cascade Monotone In Beta.* [Platonic: cascade_monotone_in_beta, domain: financial_contagion]

Theorem (cascade_accelerates_with_defaults). *Cascade Accelerates With Defaults.* [Platonic: cascade_accelerates_with_defaults, domain: financial_contagion]

Theorem (hubs_lower_threshold). *Hubs Lower Threshold.* [Platonic: hubs_lower_threshold, domain: financial_contagion]

Theorem (hub_removal_raises_threshold). *Hub Removal Raises Threshold.* [Platonic: hub_removal_raises_threshold, domain: financial_contagion]

Theorem (propagation_rate_positive). *Propagation Rate Positive.* [Platonic: propagation_rate_positive, domain: financial_contagion]

Theorem (larger_gap_faster_propagation). *Larger Gap Faster Propagation.* [Platonic: larger_gap_faster_propagation, domain: financial_contagion]

Theorem (crisis_faster_with_larger_gap). *Crisis Faster With Larger Gap.* [Platonic: crisis_faster_with_larger_gap, domain: financial_contagion]

Theorem (required_buffer_positive). *Required Buffer Positive.* [Platonic: required_buffer_positive, domain: financial_contagion]

Theorem (buffer_increases_with_concentration). *Buffer Increases With Concentration.* [Platonic: buffer_increases_with_concentration, domain: financial_contagion]

Theorem (safety_margin_positive). *Safety Margin Positive.* [Platonic: safety_margin_positive, domain: financial_contagion]

Theorem (deep_growth_rate_positive). *Deep Growth Rate Positive.* [Platonic: deep_growth_rate_positive, domain: financial_contagion]

Theorem (deep_time_to_half_positive). *Deep Time To Half Positive.* [Platonic: deep_time_to_half_positive, domain: financial_contagion]

Theorem (deep_firesale_multiplier_gt1). *Deep Firesale Multiplier Gt1.* [Platonic: deep_firesale_multiplier_gt1, domain: financial_contagion]

Theorem (deep_firesale_lowers_threshold). *Deep Firesale Lowers Threshold.* [Platonic: deep_firesale_lowers_threshold, domain: financial_contagion]

Theorem (deep_combined_gt_direct). *Deep Combined Gt Direct.* [Platonic: deep_combined_gt_direct, domain: financial_contagion]

Theorem (deep_shortfall_nonneg). *Deep Shortfall Nonneg.* [Platonic: deep_shortfall_nonneg, domain: financial_contagion]

Theorem (deep_solvent_pays_full). *Deep Solvent Pays Full.* [Platonic: deep_solvent_pays_full, domain: financial_contagion]

Theorem (deep_covar_ge_var). *Deep Covar Ge Var.* [Platonic: deep_covar_ge_var, domain: financial_contagion]

Theorem (deep_delta_covar_nonneg). *Deep Delta Covar Nonneg.* [Platonic: deep_delta_covar_nonneg, domain: financial_contagion]

Theorem (deep_hubs_more_systemic). *Deep Hubs More Systemic.* [Platonic: deep_hubs_more_systemic, domain: financial_contagion]

Theorem (deep_dominant_mode_concentration). *Deep Dominant Mode Concentration.* [Platonic: deep_dominant_mode_concentration, domain: financial_contagion]

Theorem (higher_lambda_lower_threshold). *Higher Lambda Lower Threshold.* [Platonic: higher_lambda_lower_threshold, domain: financial_contagion]

Theorem (latent_concentration). *Latent Concentration*. [Platonic: latent_concentration, domain: financial_contagion]

Theorem (latent_parameterized_threshold). *Latent Parameterized Threshold*. [Platonic: latent_parameterized_threshold, domain: financial_contagion]

Theorem (threshold_inverse_rho). *Threshold Inverse Rho*. [Platonic: threshold_inverse_rho, domain: financial_contagion]

Theorem (cascade_rate_scales_with_rho). *Cascade Rate Scales With Rho*. [Platonic: cascade_rate_scales_with_rho, domain: financial_contagion]

Theorem (systemic_variance_amplification). *Systemic Variance Amplification*. [Platonic: systemic_variance_amplification, domain: financial_contagion]

Theorem (sdf_contagion_amplification). *Sdf Contagion Amplification*. [Platonic: sdf_contagion_amplification, domain: financial_contagion]

Theorem (contagion_premium_component). *Contagion Premium Component*. [Platonic: contagion_premium_component, domain: financial_contagion]

Theorem (contagion_sharpe_amplification). *Contagion Sharpe Amplification*. [Platonic: contagion_sharpe_amplification, domain: financial_contagion]

Theorem (deconcentration_raises_threshold). *Deconcentration Raises Threshold*. [Platonic: deconcentration_raises_threshold, domain: financial_contagion]

Theorem (crisis_amplification_rho8). *Crisis Amplification Rho8*. [Platonic: crisis_amplification_rho8, domain: financial_contagion]

Theorem (crisis_premium_numerical). *Crisis Premium Numerical*. [Platonic: crisis_premium_numerical, domain: financial_contagion]

Theorem (dodd_frank_reform_effect). *Dodd Frank Reform Effect*. [Platonic: dodd_frank_reform_effect, domain: financial_contagion]

Theorem (critical_rho_for_premium). *Critical Rho For Premium*. [Platonic: critical_rho_for_premium, domain: financial_contagion]

3. Cross-Domain Bridges

Theorem (connectivity_lowers_threshold). *Connectivity Lowers Threshold*. [Platonic: connectivity_lowers_threshold, domain: financial_contagion]

Theorem (buffer_increases_with_connectivity). *Buffer Increases With Connectivity*. [Platonic: buffer_increases_with_connectivity, domain: financial_contagion]

Theorem (stress_test_double_connectivity). *Stress Test Double Connectivity*. [Platonic: stress_test_double_connectivity, domain: financial_contagion]

Theorem (deep_connectivity_amplifies_growth). *Deep Connectivity Amplifies Growth*. [Platonic: deep_connectivity_amplifies_growth, domain: financial_contagion]

4. Spectral Theory

Theorem (deep_spectral_gap_positive). *Deep Spectral Gap Positive*. [Platonic: deep_spectral_gap_positive, domain: financial_contagion]

Theorem (deep_spectral_early_warning). *Deep Spectral Early Warning*. [Platonic: deep_spectral_early_warning, domain: financial_contagion]

Theorem (spectral_threshold). *Spectral Threshold*. [Platonic: spectral_threshold, domain: financial_contagion]

Theorem (spectral_capital_requirement). *Spectral Capital Requirement*. [Platonic: spectral_capital_requirement, domain: financial_contagion]

5. Bounds and Estimates

Theorem (deep_payment_bounded_by_liab). *Deep Payment Bounded By Liab*. [Platonic: deep_payment_bounded_by_liab, domain: financial_contagion]

Theorem (deep_payment_bounded_by_assets). *Deep Payment Bounded By Assets*. [Platonic: deep_payment_bounded_by_assets, domain: financial_contagion]

6. Stability Results

Theorem (buffer_ensures_stability). *Buffer Ensures Stability*. [Platonic: buffer_ensures_stability, domain: financial_contagion]

7. Formal Framework

Hypotheses

- H_alpha_pos: Alpha Pos
- H_beta_pos: Beta Pos
- H_k_pos: K Pos
- H_sigma2_pos: Sigma2 Pos
- H_D_pos: D Pos
- H_D_lt1: D Lt1
- H_k1_pos: K1 Pos
- H_k12: K12
- H_s1_pos: S1 Pos
- H_s12: S12
- H_subcritical: Subcritical
- H_beta_super_pos: Beta Super Pos
- H_supercritical: Supercritical
- H_D_above_Dc: D Above Dc
- H_Dc_eq: Dc Eq
- H_b1_pos: B1 Pos
- H_b12: B12
- H_D1_pos: D1 Pos

- H_D12: D12
- H_keff_pos: Keff Pos
- H_kavg_pos: Kavg Pos
- H_hubs_amplify: Hubs Amplify
- H_kpost_pos: Kpost Pos
- H_hub_removed: Hub Removed
- H_gap_pos: Gap Pos
- H_lam1_pos: Lam1 Pos
- H_lam12: Lam12
- H_Dmax_pos: Dmax Pos
- H_D_le_Dmax: D Le Dmax
- H_buffer_sufficient: Buffer Sufficient
- H_excess_pos: Excess Pos
- H_fs_pos: Fs Pos
- H_ad_pos: Ad Pos
- H_fs_amplifies: Fs Amplifies
- H_ai_pos: Ai Pos
- H_li_pos: Li Pos
- H_pay_nn: Pay Nn
- H_pay_le_liab: Pay Le Liab
- H_pay_le_assets: Pay Le Assets
- H_solvent: Solvent
- H_cv_pos: Cv Pos
- H_vs_pos: Vs Pos
- H_covar_ge: Covar Ge
- H_dch_pos: Dch Pos
- H_dcp_pos: Dcp Pos
- H_hub_more_systemic: Hub More Systemic
- H_te_pos: Te Pos
- H_se_pos: Se Pos
- H_te_gt_se: Te Gt Se
- H_eval_crosses: Eval Crosses

8. Proof Architecture

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

File	Role
contagion_phase_transition_proof.py	
contagion_latent_bridge_proof.py	

9. Discussion

References