Harvestability Derivation

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Skeleton

Abstract

Harvestability Derivation — clean ProofEnv proof.

This paper presents 54 machine-verified theorems building on 0 established facts and 12 hypotheses. All results are formally verified in the Platonic proof kernel (64 verification units, 54 proved statements) and exportable to Lean 4.

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1. Introduction

2. Further Results

Theorem (bellman_contraction_forces_zero). *Bellman Contraction Forces Zero.* [Platonic: bellman_contraction_forces_zero, domain: harvestability_derivation]

Theorem (merton_denom_positive). *Merton Denom Positive.* [Platonic: merton_denom_positive, domain: harvestability_derivation]

Theorem (samuelson_error_nonneg). *Samuelson Error Nonneg.* [Platonic: samuelson_error_nonneg, domain: harvestability_derivation]

Theorem (error_decreasing_means_h_increasing). *Error Decreasing Means H Increasing.* [Platonic: error_decreasing_means_h_increasing, domain: harvestability_derivation]

Theorem (mode_risk_nonneg). *Mode Risk Nonneg.* [Platonic: mode_risk_nonneg, domain: harvestability_derivation]

Theorem (zero_weight_zero_return). *Zero Weight Zero Return.* [Platonic: zero_weight_zero_return, domain: harvestability_derivation]

Theorem (zero_weight_zero_risk). *Zero Weight Zero Risk.* [Platonic: zero_weight_zero_risk, domain: harvestability_derivation]

Theorem (merton_weight_positive). *Merton Weight Positive.* [Platonic: merton_weight_positive, domain: harvestability_derivation]

Theorem (hedging_vanishes_at_full_harvest). *Hedging Vanishes At Full Harvest.* [Platonic: hedging_vanishes_at_full_harvest, domain: harvestability_derivation]

Theorem (bellman_gap_nonneg). *Bellman Gap Nonneg.* [Platonic: bellman_gap_nonneg, domain: harvestability_derivation]

Theorem (bellman_contraction_shrinks_gap). *Bellman Contraction Shrinks Gap.* [Platonic: bellman_contraction_shrinks_gap, domain: harvestability_derivation]

Theorem (hd_w4_sq_nonneg). *Hd W4 Sq Nonneg.* [Platonic: hd_w4_sq_nonneg, domain: harvestability_derivation]

Theorem (hd_w4_finset_sum_nonneg). *Hd W4 Finset Sum Nonneg.* [Platonic: hd_w4_finset_sum_nonneg, domain: harvestability_derivation]

Theorem (hd_w4_finset_sum_pos). *Hd W4 Finset Sum Pos.* [Platonic: hd_w4_finset_sum_pos, domain: harvestability_derivation]

Theorem (hd_w4_finset_sum_le_sum). *Hd W4 Finset Sum Le Sum.* [Platonic: hd_w4_finset_sum_le_sum, domain: harvestability_derivation]

Theorem (hd_w4_finset_sum_mul). *Hd W4 Finset Sum Mul.* [Platonic: hd_w4_finset_sum_mul, domain: harvestability_derivation]

Theorem (hd_w4_finset_mul_sum). *Hd W4 Finset Mul Sum.* [Platonic: hd_w4_finset_mul_sum, domain: harvestability_derivation]

Theorem (hd_w4_finset_prod_nonneg). *Hd W4 Finset Prod Nonneg.* [Platonic: hd_w4_finset_prod_nonneg, domain: harvestability_derivation]

Theorem (hd_w4_finset_prod_le_prod). *Hd W4 Finset Prod Le Prod.* [Platonic: hd_w4_finset_prod_le_prod, domain: harvestability_derivation]

Theorem (hd_w4_vec_norm_sq_nonneg). *Hd W4 Vec Norm Sq Nonneg.* [Platonic: hd_w4_vec_norm_sq_nonneg, domain: harvestability_derivation]

Theorem (hd_w4_vec_dot_comm). *Hd W4 Vec Dot Comm.* [Platonic: hd_w4_vec_dot_comm, domain: harvestability_derivation]

Theorem (hd_w4_vec_norm_sq_def). *Hd W4 Vec Norm Sq Def.* [Platonic: hd_w4_vec_norm_sq_def, domain: harvestability_derivation]

Theorem (hd_w4_exp_pos). *Hd W4 Exp Pos.* [Platonic: hd_w4_exp_pos, domain: harvestability_derivation]

Theorem (hd_w4_exp_le_exp_replay). *Hd W4 Exp Le Exp Replay.* [Platonic: hd_w4_exp_le_exp_replay, domain: harvestability_derivation]

Theorem (hd_w4_sqrt_nonneg). *Hd W4 Sqrt Nonneg.* [Platonic: hd_w4_sqrt_nonneg, domain: harvestability_derivation]

Theorem (hd_w4_sqrt_mul). *Hd W4 Sqrt Mul.* [Platonic: hd_w4_sqrt_mul, domain: harvestability_derivation]

Theorem (hd_w4_sqrt_le_sqrt). *Hd W4 Sqrt Le Sqrt.* [Platonic: hd_w4_sqrt_le_sqrt, domain: harvestability_derivation]

Theorem (hd_w4_gamma_sq_lt_one). *Hd W4 Gamma Sq Lt One.* [Platonic: hd_w4_gamma_sq_lt_one, domain: harvestability_derivation]

Theorem (hd_w4_one_plus_rate_nonneg). *Hd W4 One Plus Rate Nonneg.* [Platonic: hd_w4_one_plus_rate_nonneg, domain: harvestability_derivation]

Theorem (hd_w4_mul_nonneg). *Hd W4 Mul Nonneg.* [Platonic: hd_w4_mul_nonneg, domain: harvestability_derivation]

Theorem (hd_w4_sub_le_self). *Hd W4 Sub Le Self.* [Platonic: hd_w4_sub_le_self, domain: harvestability_derivation]

Theorem (hd_w4_mul_le_mul_nonneg_left). *Hd W4 Mul Le Mul Nonneg Left.* [Platonic: hd_w4_mul_le_mul_nonneg_left, domain: harvestability_derivation]

Theorem (hd_w4_matrix_det_id). *Hd W4 Matrix Det Id.* [Platonic: hd_w4_matrix_det_id, domain: harvestability_derivation]

Theorem (hd_w4_exp_sum_pos). *Hd W4 Exp Sum Pos.* [Platonic: hd_w4_exp_sum_pos, domain: harvestability_derivation]

Theorem (hd_w11_hedgingCoeff_log). *Hd W11 Hedgingcoeff Log.* [Platonic: hd_w11_hedgingCoeff_log, domain: harvestability_derivation]

Theorem (hd_w11_log_utility_zero_hedging). *Hd W11 Log Utility Zero Hedging.* [Platonic: hd_w11_log_utility_zero_hedging, domain: harvestability_derivation]

Theorem (hd_w11_hedging_vanishes_at_T). *Hd W11 Hedging Vanishes At T.* [Platonic: hd_w11_hedging_vanishes_at_T, domain: harvestability_derivation]

Theorem (hd_w11_fullAllocation_at_T). *Hd W11 Fullallocation At T.* [Platonic: hd_w11_fullAllocation_at_T domain: harvestability_derivation]

Theorem (hd_w11_allocation_decomposition). *Hd W11 Allocation Decomposition.* [Platonic: hd_w11_allocation_decomposition, domain: harvestability_derivation]

Theorem (hd_w11_derivation_agrees_with_assumption). *Hd W11 Derivation Agrees With Assumption.* [Platonic: hd_w11_derivation_agrees_with_assumption, domain: harvestability_derivation]

Theorem (hd_w11_samuelson_error_exponential). *Hd W11 Samuelson Error Exponential.* [Platonic: hd_w11_samuelson_error_exponential, domain: harvestability_derivation]

Theorem (hd_w11_riccati_terminal_condition). *Hd W11 Riccati Terminal Condition.* [Platonic: hd_w11_riccati_terminal_condition, domain: harvestability_derivation]

Theorem (hd_w11_riccati_initial_value). *Hd W11 Riccati Initial Value.* [Platonic: hd_w11_riccati_initial_value, domain: harvestability_derivation]

Theorem (hd_w11_samuelsonError_eq_residual). *Hd W11 Samuelsonerror Eq Residual.* [Platonic: hd_w11_samuelsonError_eq_residual, domain: harvestability_derivation]

Theorem (hd_w11_samuelsonError_at_zero). *Hd W11 Samuelsonerror At Zero.* [Platonic: hd_w11_samuelsonError_at_zero, domain: harvestability_derivation]

Theorem (hd_w11_separation_linear_g). *Hd W11 Separation Linear G.* [Platonic: hd_w11_separation_linear_g, domain: harvestability_derivation]

Theorem (hd_w11_separation_multiplicative). *Hd W11 Separation Multiplicative.* [Platonic: hd_w11_separation_multiplicative, domain: harvestability_derivation]

3. Stability Results

Theorem (harvestability_scales_weight). *Harvestability Scales Weight.* [Platonic: harvestability_scales_weight, domain: harvestability_derivation]

Theorem (harvestability_plus_error_is_one). *Harvestability Plus Error Is One.* [Platonic: harvestability_plus_error_is_one, domain: harvestability_derivation]

Theorem (hd_w11_riccati_factor_is_harvestability). *Hd W11 Riccati Factor Is Harvestability.* [Platonic: hd_w11_riccati_factor_is_harvestability, domain: harvestability_derivation]

Theorem (hd_w11_riccati_solution_is_harvestability). *Hd W11 Riccati Solution Is Harvestability.* [Platonic: hd_w11_riccati_solution_is_harvestability, domain: harvestability_derivation]

Theorem (hd_w11_harvestability_plus_error). *Hd W11 Harvestability Plus Error.* [Platonic: hd_w11_harvestability_plus_error, domain: harvestability_derivation]

4. Bounds and Estimates

Theorem (error_bounded_01). *Error Bounded 01.* [Platonic: error_bounded_01, domain: harvestability_derivation]

5. Cross-Domain Bridges

Theorem (riccati_merton_connection). *Riccati Merton Connection.* [Platonic: riccati_merton_connection, domain: harvestability_derivation]

6. Formal Framework

Hypotheses

- diff : Diff
- gamma_c: Gamma C
- premium: Premium
- gamma_ra: Gamma Ra
- variance: Variance
- h_val: H Val
- error: Error
- mode_var: Mode Var
- mode_prem: Mode Prem
- weight: Weight
- V_star: V Star
- V_approx: V Approx

7. Proof Architecture

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

File	Role
harvestability_derivation_proof.py	

8. Discussion

References