Commitment Market Dynamics

A Mechanism Framework

An ICAPM Extension with Asymmetric Volatility Structure,

Option Pricing, Information Economics, Market Microstructure,

and Behavioral Modifications

Abstract

This paper develops a formal economic framework for commitment markets—the set of interactions where agents seek, negotiate, and form long-term pair-bonded relationships. Applying ICAPM, variance risk premium, option pricing, information economics, and mechanism design, we characterize equilibrium conditions in heterosexual commitment markets. The model identifies ten mechanism extensions (adverse selection, hold-up, bargaining asymmetry, credit rationing, tournament effects) producing "Tournament Equilibrium" under current parameter configurations. Historical validation across ten periods confirms mechanism operation. We derive conditions for alternative equilibria and characterize welfare implications of parameter changes.

Keywords: commitment markets · mechanism design · option pricing · adverse selection · bargaining theory · variance risk premium · matching markets

PART

I: FOUNDATIONS

0.1 1.1 Scope & Definitions

0.1.1 1.1.1 Scope

This document specifies a formal economic model describing mechanism dynamics in commitment markets. The model applies financial economics frameworks (ICAPM, variance risk premium, Epstein-Zin recursive preferences) combined with information economics, mechanism design, and contract theory to describe observed population-level phenomena in coupling and commitment markets.

The model describes:

- Mechanisms by which agents form, maintain, and dissolve committed relationships
- Information asymmetries between counterparties
- Option structures embedded in commitment contracts
- Bargaining dynamics under asymmetric threat points
- Equilibrium conditions under various parameter configurations

The model does not:

- Prescribe individual behavior
- Make normative claims about relationship structures
- Predict individual outcomes (population-level descriptions only)
- Evaluate moral worth of strategies or outcomes

0.1.2 1.1.2 Core Definitions

Commitment Market: The set of interactions in which agents seek, negotiate, and form long-term pair-bonded relationships with expectation of exclusivity and resource sharing.

Market Position (MP): An agent's relative standing in the commitment market, determining access to potential counterparties and bargaining power within relationships.

Commitment: A bilateral agreement involving exclusivity, resource sharing, and future coordination, typically formalized through marriage or equivalent arrangement.

Normative Script: The social narrative apparatus specifying expected behaviors, appropriate preferences, and acceptable strategies for agents in the commitment market. Treated as exogenous.

Tournament Equilibrium: A stable market state characterized by concentration of attention/access among high-MP agents, commitment rationing by high-MP males, and exclusion of middle-tier males from the commitment market.

0.1.3 1.1.3 Agent Classification

The model specifies two agent types: Male (M) and Female (F). These correspond to biological sex and associated reproductive asymmetries. The model is mechanism-neutral: it derives behavioral predictions from parameter configurations, not from assumptions about gender.

0.2 1.2 Axioms

0.2.1 A1: Optimization

Agents optimize utility subject to constraints. Optimization may be imperfect (bounded rationality) and over distorted beliefs (Normative Script effects).

0.2.2 A2: Market Structure

The commitment market is a two-sided matching market with search frictions, information asymmetries, and heterogeneous agent quality.

0.2.3 A3: Parental Investment Asymmetry

Female reproductive investment exceeds male reproductive investment (Trivers 1972). This generates asymmetric selection criteria.

0.2.4 A4: Temporal Asymmetry

Female market position depreciates with age (fertility correlation). Male market position may appreciate, depreciate, or remain stable depending on status and resource accumulation.

0.2.5 A5: Normative Script Exogeneity

Social narratives affecting agent behavior and perception are treated as exogenous parameters. The model describes effects of these scripts, not their origins.

0.2.6 A6: Rationality Within Distortion

Agents optimize rationally given their (possibly distorted) beliefs. Suboptimal outcomes arise from belief distortion or behavioral modifications, not irrationality per se.

0.3 1.3 Symbol Glossary

0.3.1 1.3.1 Agent Parameters

Symbol	Definition
U	Utility function
MP	Market Position (agent's market standing)
Q	Quality (genetic/physical traits)

Symbol	Definition
S	Status (social position, achievements, network)
R	Resources (income, wealth, assets)
Q_f	Female quality component
Q_m, S_m, R_m	Male quality, status, resources

0.3.2 1.3.2 Male-Specific Parameters

Symbol	Definition
$A(Q_f)$	Access function (mating opportunities weighted by female quality)
O	Optionality (preserved future access capacity)
$C(p,r)$	Conditional commitment utility
p	Paternity certainty
p^*	Paternity certainty threshold
r	Expected ROI on commitment investment
r^*	ROI threshold
λ	Normative Script enforcement intensity
$D(C)$	Deviation penalty function
κ	Penalty coefficient for paternity conditionality
μ	Penalty coefficient for ROI conditionality
T^{commit}	Commitment threshold (MP_F required to commit)
T^{casual}	Casual threshold (MP_F required for casual access)

0.3.3 1.3.3 Female-Specific Parameters

Symbol	Definition
$P(commit \mid \theta)$	Commitment probability given parameters
θ	Parameter set for market calibration
$\hat{\theta}$	Accurate parameters (reality)
$\tilde{\theta}$	Distorted parameters (Script-corrupted)
R_c	Reference class (target tier of male)
$\hat{R}_c$	Accurate reference class
$\tilde{R}_c$	Perceived reference class (random variable)
μ_R	Mean of reference class distribution
σ_R^2	Variance of reference class signal
b	Bias term ($\mu_R = \hat{R}_c + b$)
S_p	Settling penalty
v	Settling penalty intensity
$\hat{Q}_f$	Accurate self-MP assessment
$\tilde{Q}_f$	Inflated self-MP assessment
$\hat{T}$	Accurate time preference
$\tilde{T}$	Corrupted time preference

0.3.4 1.3.4 Variance Structure

Symbol	Definition
σ^2	First-order variance (outcome uncertainty)
q_t	Second-order variance (volatility of volatility)
q_t^M	Male volatility-of-volatility
q_t^F	Female volatility-of-volatility

0.3.5 1.3.5 Preferences and Premia

Symbol	Definition
γ	Risk aversion coefficient
ψ	Intertemporal elasticity of substitution
ρ	$1/\psi$
β	Time discount factor
π	Risk premium
$\phi(q_t)$	Variance risk premium component

0.3.6 1.3.6 Behavioral Modifications

Symbol	Definition
$V(x)$	Prospect theory value function
r	Reference point for prospect theory
λ_{PT}	Loss aversion coefficient (~2.25)
α	Diminishing sensitivity for gains (~0.88)
β_{PT}	Diminishing sensitivity for losses (~0.88)
$w(p)$	Probability weighting function
γ_{PT}	Probability weighting parameter (~0.61)
I^{sunk}	Sunk cost investment
ψ_{SC}	Sunk cost sensitivity
ε	Optimization noise (bounded rationality)
k	Hyperbolic discount rate
β_{HYP}	Present bias parameter
δ	Long-run discount factor

0.3.7 1.3.7 State Variables

Symbol	Definition
I_t	Information environment intensity
H_t^M	Male Normative Script strength
H_t^F	Female Normative Script distortion magnitude
$\bar{Q}_t$	Aggregate quality distribution

0.3.8 1.3.8 Welfare

Symbol	Definition
ΔW	Welfare loss
$E[U \mid \tilde{\theta}]$	Expected utility under perceived parameters
$U^{realized}$	Realized utility under true parameters

0.3.9 1.3.9 Extension I: Option Pricing

Symbol	Definition
C	Call option
P	Put option
K	Strike price
V_t	Relationship value at time t
σ_V	Volatility of relationship value
τ	Time to expiration
Φ	Option value function
K_F	Female exit strike price
K_M	Male exit strike price
O_F^{held}	Options held by female
O_M^{held}	Options held by male

0.3.10 1.3.10 Extension II: Information Asymmetry

Symbol	Definition
I_F	Female information set
I_M	Male information set
θ_F	Female private type
θ_M	Male private type
$\hat{\theta}$	Estimated type
n	Partner count (element of θ_F)
ω	Quality indicator (type)
$\bar{\omega}_{pool}$	Average quality of active pool

0.3.11 1.3.11 Extension III: Mechanism Design

Symbol	Definition
M	Mechanism
IC	Incentive compatibility constraint
IR	Individual rationality constraint
s	Signal sent
$c(s, \theta)$	Cost of signal s for type θ

Symbol	Definition
$\hat{\theta}(s)$	Inferred type given signal
Γ	Signaling game
SE	Separating equilibrium
PE	Pooling equilibrium

0.3.12 1.3.12 Extension IV: Principal-Agent

Symbol	Definition
P	Principal
A	Agent
e	Effort level
e^*	Contracted/expected effort
$\tilde{e}$	Observed effort
m	Monitoring capacity
$c(m)$	Cost of monitoring
η	Enforcement capacity
Δe	Effort shortfall
D_M	Domains where male is principal
D_F	Domains where female is principal

0.3.13 1.3.13 Extension V: Credit Rationing

Symbol	Definition
L	Lender (commitment offeror)
B	Borrower (commitment seeker)
$Q^D(r)$	Demand for commitment at terms r
$Q^S(r)$	Supply of commitment at terms r
$\bar{Q}$	Rationed quantity
$\rho(r)$	Expected return to lender at rate r
r^*	Rate maximizing lender return
r^{clear}	Market-clearing rate

0.3.14 1.3.14 Extension VI: Hold-Up

Symbol	Definition
I	Investment
I^S	Specific investment
I^G	General investment
$V(I)$	Value created by investment
S	Salvage value
Q	Quasi-rent ($V(I) - S$)

Symbol	Definition
β	Bargaining share
I^*	First-best investment
I^{eq}	Equilibrium investment
ρ	Specificity ratio

0.3.15 1.3.15 Extension VII: Bargaining Theory

Symbol	Definition
d_M, d_F	Disagreement points (threat points)
π	Total surplus
x_M, x_F	Shares of surplus
θ	Bargaining power parameter
NBS	Nash Bargaining Solution

0.3.16 1.3.16 Extension VIII: Contract Incompleteness

Symbol	Definition
C	Contract
C^*	Complete contract
C^{inc}	Incomplete contract
Ω	State space
ω_t	Realized state at time t
V	Verifiability
E	Enforceability
$R(\omega)$	Renegotiation in state ω

0.3.17 1.3.17 Extension IX: Tournament Effects

Symbol	Definition
r_i	Rank of agent i
$W(r)$	Reward as function of rank
$Gini$	Concentration measure
$A(r)$	Attention received at rank r
$\lambda(r)$	Match rate at rank r

0.3.18 1.3.18 Extension X: Repeated Games

Symbol	Definition
G	Stage game

Symbol	Definition
G^{∞}	Infinitely repeated game
π^C	Cooperation payoff
π^D	Defection payoff
π^P	Punishment payoff
p	Detection probability
σ^*	Equilibrium strategy
Rep_i	Reputation of agent i

0.3.19 1.3.19 Matching Equilibrium

Symbol	Definition
S	State space
$\mu_M(s, MP, \omega, t)$	Measure of males in state s
$\mu_F(s, MP, \omega, t)$	Measure of females in state s
$M(\cdot)$	Matching function
ϕ	Base meeting rate
$g(\cdot)$	Platform algorithm weighting
α	Algorithmic parameters
$\lambda_{s \to s'}$	Transition rate between states

0.4 1.4 Literature Mappings

Framework	Source	Application
ICAPM	Merton (1973)	Intertemporal optimization under uncertainty
Variance Risk Premium	Bollerslev, Tauchen & Zhou (2009)	Volatility-of-volatility as priced factor
Recursive Preferences	Epstein & Zin (1989)	Separation of risk aversion from IES
Long-Run Risks	Bansal & Yaron (2004)	Nested volatility dynamics
Parental Investment	Trivers (1972)	Investment asymmetry foundations
Market Microstructure	Kyle (1985), Glosten & Milgrom (1985)	Information asymmetry, spreads
Signal Extraction	Lucas (1972)	Inference from noisy signals
Option Pricing	Black & Scholes (1973)	Valuation under uncertainty
Market for Lemons	Akerlof (1970)	Adverse selection
Signaling	Spence (1973)	Costly signals
Mechanism Design	Hurwicz (1960), Myerson (1979)	Incentive compatibility
Principal-Agent	Jensen & Meckling (1976)	Hidden action
Credit Rationing	Stiglitz & Weiss (1981)	Quantity restriction under adverse selection
Hold-Up	Williamson (1975), Klein, Crawford & Alchian (1978)	Specific investments
Nash Bargaining	Nash (1950), Rubinstein (1982)	Surplus division

Framework	Source	Application
Incomplete Contracts	Hart & Moore (1988)	Renegotiation
Tournament Theory	Lazear & Rosen (1981)	Winner-take-all
Folk Theorem	Friedman (1971)	Repeated game cooperation
Prospect Theory	Kahneman & Tversky (1979)	Loss aversion, probability weighting
Hyperbolic Discounting	Laibson (1997)	Time-inconsistent preferences
Bounded Rationality	Simon (1955)	Satisficing

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II: BASE MODEL

0.5 2.1 Market Position Determination

0.5.1 2.1.1 Male Market Position

$$MP_M = Q_m + S_m + R_m \tag{1}$$

Male market position equals the sum of quality (genetic/physical traits), status (social position, achievements, network), and resources (income, wealth, assets).

Component dynamics:

$$\frac{\partial Q_m}{\partial t} < 0 \quad \text{(depreciates)} \tag{2}$$

$$\frac{\partial S_m}{\partial t} \geq 0 \quad \text{(may accumulate)} \tag{3}$$

$$\frac{\partial R_m}{\partial t} \geq 0 \quad \text{(may accumulate)} \tag{4}$$

Aggregate dynamics:

$$\frac{\partial MP_M}{\partial t} = \frac{\partial Q_m}{\partial t} + \frac{\partial S_m}{\partial t} + \frac{\partial R_m}{\partial t} \gtrless 0 \tag{5}$$

Direction depends on whether S and R gains exceed Q decline.

0.5.2 2.1.2 Female Market Position

$$MP_F = Q_f = f(\text{Looks}, \text{Age}) \tag{6}$$

Female market position equals quality, which is a function of physical attributes and age.

Time dynamics:

$$\frac{\partial Q_f}{\partial \text{Age}} < 0 \tag{7}$$

$$\frac{\partial MP_F}{\partial t} < 0 \tag{8}$$

Female MP depreciates with age due to correlation between age and fertility indicators.

0.5.3 2.1.3 Asymmetry Characterization

Male selection criteria weight female Q exclusively. Female selection criteria weight male $Q + S + R$.

This asymmetry derives from Axiom A3 (parental investment asymmetry): higher female reproductive investment selects for male resource provision capacity; lower male reproductive investment selects for female fertility indicators.

0.6 2.2 Utility Functions

0.6.1 2.2.1 Male Utility (Pure)

$$U_M^{pure} = \alpha \cdot A(Q_f) + \beta \cdot O + \delta \cdot C(p, r) \tag{9}$$

Components:

Access function:

$$A(Q_f) = \sum_i \omega_i \cdot Q_f^i \tag{10}$$

Total access utility is the sum of mating opportunities weighted by female quality.

Optionality:

$$O = E\left[\max_{t' > t} A(Q_f)_{t'}\right] - A(Q_f)_t \tag{11}$$

Expected value of future access opportunities minus current access.

Conditional commitment:

$$C(p, r) = \begin{cases} c \cdot (p \cdot r) & \text{if } p > p^* \text{ and } r > r^* \\ 0 & \text{otherwise} \end{cases} \tag{12}$$

Commitment generates positive utility only when paternity certainty exceeds threshold AND expected ROI exceeds threshold.

0.6.2 2.2.2 Male Utility (With Normative Script)

$$U_M^{script} = \alpha \cdot A(Q_f) + \beta \cdot O + \delta \cdot C(p, r) - \lambda \cdot D(C) \tag{13}$$

Identical to pure utility minus penalty proportional to deviation from Script expectations.

Deviation penalty:

$$D(C) = \kappa \cdot p^* + \mu \cdot r^* \tag{14}$$

Penalty scales with threshold stringency. Higher requirements incur higher social cost.

Alternative indicator form:

$$D(C) = \kappa \cdot \mathbb{1}_{[p^*>0]} + \mu \cdot \mathbb{1}_{[r^*>0]} \tag{15}$$

Flat penalty for having any conditionality.

Behavioral prediction: Male deviates from Script when:

$$\lambda \cdot D(C) < \Delta U^{pure} \tag{16}$$

0.6.3 2.2.3 Female Utility (Pure)

$$U_F^{pure} = (Q_m + S_m + R_m) \times P(commit \mid \hat{\theta}) \tag{17}$$

Female utility equals total male value multiplied by commitment probability. Multiplicative structure reflects that access without commitment has limited value given parental investment asymmetry.

Accurate parameter set:

$$\hat{\theta} = \{\hat{Q}_f, \hat{T}, \hat{R}_c\} \tag{18}$$

Where: $\hat{Q}_f$ = accurate self-MP assessment, $\hat{T}$ = accurate time preference, $\hat{R}_c$ = accurate reference class.

0.6.4 2.2.4 Female Utility (With Normative Script)

$$U_F^{script} = (Q_m + S_m + R_m) \times P(commit \mid \tilde{\theta}) - \nu \cdot S_p \tag{19}$$

Same objective function with distorted parameters and settling penalty.

Distorted parameter set:

$$\tilde{\theta} = \{\tilde{Q}_f, \tilde{T}, \tilde{R}_c\} \tag{20}$$

Where: $\tilde{Q}_f > \hat{Q}_f$ (overestimated self-MP), $\tilde{T} > \hat{T}$ (corrupted time preference), $\tilde{R}_c \sim \mathcal{N}(\mu_R, \sigma_R^2)$ (noisy, biased reference class).

0.6.5 2.2.5 Behavioral Modifications

Loss Aversion (Prospect Theory):

$$V(x) = \begin{cases} (x-r)^\alpha & x \geq r \\ -\lambda_{PT}(r-x)^{\beta_{PT}} & x < r \end{cases} \tag{21}$$

Parameters: $\lambda_{PT} \approx 2.25$, $\alpha \approx 0.88$, $\beta_{PT} \approx 0.88$

Application: Settling (accepting partner below reference class) experienced as loss, weighted $\sim 2.25\times$ versus equivalent gain.

$$S_p^{behavioral} = \lambda_{PT} \cdot S_p^{rational} \tag{22}$$

Probability Weighting:

$$w(p) = \frac{p^{\gamma_{PT}}}{(p^{\gamma_{PT}} + (1-p)^{\gamma_{PT}})^{1/\gamma_{PT}}} \tag{23}$$

Parameter: $\gamma_{PT} \approx 0.61$

Application: Small probability events overweighted.

$$P(commit)^{perceived} = w(P(commit)^{actual}) \tag{24}$$

When $P(commit)^{actual} = 0.05$: $P(commit)^{perceived} \approx 0.13$

Sunk Cost Sensitivity:

$$U^{continue} = U^{forward\text{-}looking} + \psi_{SC} \cdot I^{sunk} \tag{25}$$

Agents weight past investments in continuation decisions despite irrelevance to forward-looking optimization.

Bounded Rationality:

$$\text{Choice} = \arg\max U + \varepsilon \tag{26}$$

Optimization noise from cognitive load, heuristic substitution, satisficing.

Hyperbolic Discounting:

$$U_t = u_t + \beta_{HYP} \sum_{\tau=1}^{\infty} \delta^\tau u_{t+\tau} \tag{27}$$

Present bias ($\beta_{HYP} < 1$) creates time-inconsistent preferences. Exit decisions perpetually deferred.

0.7 2.3 Normative Script Specification

0.7.1 2.3.1 Exogeneity Rationale

The Normative Script is treated as exogenous because:

1. Scripts predate current market conditions

2. Scripts update slowly relative to environmental change

3. Endogenizing creates infinite regress

4. Script asymmetry is empirically observable

5. Script direction is stable; signal content is noisy

0.7.2 2.3.2 Male Script: Behavioral Penalty

Structure:

- Variance compression ("settle down")
- Commitment expectation ("man up")
- Conditionality penalized ("insecure," "fragile")
- Defection pathologized ("Peter Pan," "commitment-phobic")

Mechanism: Male perceives market accurately. Male pays social cost for acting on perception.

Formal: Same utility function, additive penalty $\lambda D(C)$ for deviation.

0.7.3 2.3.3 Female Script: Perception Distortion

Structure:

- Constraint removal (historical stigmas reduced)
- Aspirational inflation ("know your worth")
- Settling penalized (accepting realistic outcome = failure)
- Time preference corrupted ("30 is the new 20")

Mechanism: Female optimizes over corrupted parameters. Behavior is rational given beliefs; beliefs are systematically distorted.

Formal: Same utility function, distorted parameters $\tilde{\theta}$.

0.7.4 2.3.4 Asymmetry Formalization

Dimension	Male	Female
Perception	Accurate	Distorted
Behavior	Taxed	Untaxed
Mechanism	Additive penalty	Parameter corruption
Utility impact	$-\lambda D(C)$	$\tilde{\theta} \neq \hat{\theta}$

0.8 2.4 Reference Class Dynamics

0.8.1 2.4.1 Signal Fragmentation

Female reference class formation is noisy:

- Social media shows curated top-percentile outcomes
- Dating platform matches are noisy signal of market position
- Peer outcomes are small N, high variance
- Conflicting information sources

0.8.2 2.4.2 Distribution Specification

$$\tilde{R}_c \sim \mathcal{N}(\mu_R, \sigma_R^2) \tag{28}$$

Perceived reference class drawn from normal distribution.

Mean:

$$\mu_R = \hat{R}_c + b \tag{29}$$

Biased above reality by amount b (Script effect).

Bias term:

$$b = f(I_t, H_t^F) \tag{30}$$

Increasing in information environment intensity and Script strength.

Variance term:

$$\sigma_R^2 = g(I_t, N_{peers}, \sigma_{peers}^2) \tag{31}$$

Increasing in information intensity, decreasing in peer sample size.

0.9 2.5 Variance Structure

0.9.1 2.5.1 First-Order Variance

$$\sigma^2 = \text{Var}[(Q_m + S_m + R_m) \times P(commit)] \tag{32}$$

Uncertainty about quality of committed mate secured.

0.9.2 2.5.2 Second-Order Variance

$$q_t = \text{Var}[\sigma_t^2] \tag{33}$$

Uncertainty about uncertainty—stability of parameters used for estimation.

0.9.3 2.5.3 Agent-Specific q_t

Female:

$$q_t^F = \text{Var}[\sigma_R^2] \approx \text{HIGH} \tag{34}$$

Grounded in signal fragmentation, algorithmic instability, peer outcome variance.

Male:

$$q_t^M \approx \text{LOW} \tag{35}$$

Grounded in hard market feedback (rejection is clear signal), stable penalty structure.

0.9.4 2.5.4 Suppressed Risk Perception

Under Epstein-Zin with $\gamma > 1$, $\psi > 1$, high q_t should command risk premium.

Script interference suppresses female risk perception:

$$\pi_F^{perceived} < \pi_F^{actual} \tag{36}$$

Uncertainty framed as discovery, not risk.

0.9.5 2.5.5 Recursive Preferences (Epstein-Zin)

$$V_t = \left[(1-\beta) u(c_t)^{1-\rho} + \beta \left(E_t[V_{t+1}^{1-\gamma}] \right)^{\frac{1-\rho}{1-\gamma}} \right]^{\frac{1}{1-\rho}} \tag{37}$$

Separates risk aversion (γ) from intertemporal elasticity of substitution ($\psi = 1/\rho$).

0.9.6 2.5.6 Risk Premium Decomposition

$$\pi = \gamma\sigma^2 + \phi(q_t) \tag{38}$$

Total premium equals compensation for outcome variance plus compensation for volatility-of-volatility.

0.10 2.6 Market Clearing Conditions

0.10.1 2.6.1 Male Thresholds

Commitment threshold:

$$MP_F^i \geq T_j^{commit} \implies \text{Male } j \text{ commits to Female } i \tag{39}$$

Casual threshold:

$$MP_F^i \geq T_j^{casual} \implies \text{Male } j \text{ pursues casual with Female } i \tag{40}$$

Ordering:

$$T_j^{casual} < T_j^{commit} \tag{41}$$

Gap between thresholds defines situationship zone.

0.10.2 2.6.2 Female Threshold

$$MP_M^j \geq R_c^i \implies \text{Female } i \text{ accepts Male } j \tag{42}$$

Under Script: Uses $\tilde{R}_c$ (noisy, biased high).

0.10.3 2.6.3 Tournament Equilibrium Definition

A stable state satisfying:

For mid-tier males:

$$MP_M^j < \tilde{R}_c^i \tag{43}$$

Does not meet inflated expectations. No transaction.

For top-tier males:

$$MP_M^k \geq \tilde{R}_c^i \quad \text{AND} \quad T_k^{casual} \leq MP_F^i < T_k^{commit} \tag{44}$$

Meets her reference class. She clears his casual but not commitment threshold.

Result: Casual access without commitment.

PART

III: EXTENSIONS

0.11 Extension I: Option Pricing

0.11.1 3.1.1 Framework

Option pricing provides precise language for asymmetric risk positions. Options grant holders rights without obligations.

0.11.2 3.1.2 Female Options Held

Exit Option (American Put):

$$P_F = \max(K_F - V_t, 0) \quad \text{exercisable } \forall t \tag{45}$$

Strike price composition:

$$K_F = \alpha \cdot A + \beta \cdot S + \gamma \cdot C + \delta \cdot M \tag{46}$$

Where: A = asset division, S = spousal support, C = child support, M = custody access.

Upgrade Option (Compound Call):

$$C_F^{upgrade} = E[\max(MP_M^{new} - MP_M^{current}, 0)] \tag{47}$$

Reproduction Timing Option:

$$C_F^{repro} = \max_t [U(child_t) - Cost_t] \tag{48}$$

0.11.3 3.1.3 Male Options Held

Exit Option (Unfavorable Strike):

$$P_M = \max(K_M - V_t, 0) \quad \text{where } K_M < K_F \tag{49}$$

Strike price composition:

$$K_M = (1 - \alpha) \cdot A - \beta \cdot S - \gamma \cdot C + (1 - \delta) \cdot M \tag{50}$$

Receives remainder after her share, pays support, reduced custody.

0.11.4 3.1.4 Option Valuation

Female exit option:
$$\Phi(P_F) = f(V_t, K_F, \sigma_V, r, \infty) \tag{51}$$

High value: favorable strike, high volatility, unlimited duration.

Male exit option:
$$\Phi(P_M) = f(V_t, K_M, \sigma_V, r, \infty) \approx 0 \tag{52}$$

Low/negative value: unfavorable strike.

Volatility effect:
$$\frac{\partial \Phi}{\partial \sigma_V} > 0 \tag{53}$$

Option value increases with volatility. Asymmetric benefit.

0.11.5 3.1.5 Commitment as Option Sale

At commitment:
$$\text{Commitment} \equiv \text{Sell } P_F \text{ to counterparty for premium } \pi \tag{54}$$

Pricing condition:
$$\text{If } \Phi(P_F) > \pi \implies \text{Don't sell} \tag{55}$$

0.12 Extension II: Information Asymmetry & Adverse Selection

0.12.1 3.2.1 Information Sets

Female information set:

$$I_F = \{MP_M^{observable}, \theta_M^{partial}, \pi_M(commit)^{cheap\_talk}\} \tag{56}$$

Male information set:

$$I_M = \{MP_F^{observable}, \theta_F^{concealed}\} \tag{57}$$

Asymmetry:

$$|I_F \cap \theta_M| > |I_M \cap \theta_F| \tag{58}$$

Verification norms:

$$\text{Norm}(\text{verify } \theta_M) = \text{acceptable} \tag{59}$$

$$\text{Norm}(\text{verify } \theta_F) = \text{penalized} \tag{60}$$

0.12.2 3.2.2 Adverse Selection Dynamics

Lemons problem:

$$P = E[\omega] = \int \omega \cdot p(\omega) d\omega \tag{61}$$

High-quality participants receive less than value, exit. Pool degrades:

$$\bar{\omega}_{Pool}^{t+1} < \bar{\omega}_{Pool}^{t} \tag{62}$$

Death spiral:

$$\bar{\omega}_{F,Pool} \downarrow \implies \text{High-}\omega_M \text{ exit} \implies \bar{\omega}_{M,Pool} \downarrow \implies \cdots \tag{63}$$

0.13 Extension III: Mechanism Design

0.13.1 3.3.1 Truth-Telling Requirements

Incentive Compatibility:

$$IC : U(\theta, \text{report } \theta) \geq U(\theta, \text{report } \theta') \quad \forall \theta' \neq \theta \tag{64}$$

Currently violated for both genders:

- Female: Concealment costless, disclosure costly
- Male: Misrepresentation gains access

Individual Rationality:

$$IR : U(\text{participate}) \geq U(\text{outside option}) \tag{65}$$

Increasingly violated for high-MP males.

0.13.2 3.3.2 Costly Signaling

Signals separate types when cost differs by type:

$$c(s, \theta_{low}) > c(s, \theta_{high}) \implies s \text{ separates} \tag{66}$$

Current state:

$$c(s, \theta_{high}) \approx c(s, \theta_{low}) \implies \text{Pooling} \tag{67}$$

$$\hat{\theta}(s) = E[\theta] \quad \forall s \tag{68}$$

0.14 Extension IV: Principal-Agent Structure

0.14.1 3.4.1 Domains of Agency

Female as Principal over:

$$D_F = \{\text{Provision, Protection, Fidelity, Parental\_Investment, Emotional\_Availability}\} \tag{69}$$

Male as Principal over:

$$D_M = \{\text{Sexual\_Availability, Fidelity, Domestic\_Investment, Parental\_Investment, Physical\_Maintenance}\} \tag{70}$$

0.14.2 3.4.2 Monitoring and Enforcement Capacity

Female monitoring over male domains:

$$m_F = \text{HIGH} \tag{71}$$

Income observable, fidelity increasingly detectable.

Male monitoring over female domains:

$$m_M = \text{LOW} \tag{72}$$

Internal states unobservable, complaint pathologized.

Enforcement asymmetry:

$$\eta_F = \text{HIGH (courts enforce provision)} \tag{73}$$

$$\eta_M \approx 0 \text{ (no mechanism)} \tag{74}$$

0.14.3 3.4.3 Effort Equilibrium

Female optimal effort (as agent under male principal):

$$e_F^{optimal} = \min(e_F^*, e^{threshold}) \tag{75}$$

Rationally reduces to minimum preventing exit.

Male optimal effort (as agent under female principal):

$$e_M^{optimal} = e_M^* \tag{76}$$

Maintains contracted effort (monitored, enforced).

0.15 Extension V: Credit Rationing

0.15.1 3.5.1 Market Analogy

Credit Market	Commitment Market
Lender	Male (commitment offeror)
Borrower	Female (commitment seeker)
Credit	Commitment
Interest rate	Commitment terms
Default	Relationship failure

0.15.2 3.5.2 Adverse Selection Mechanism

Eager borrower problem:

$$p(\omega_{low}|\text{commitment-eager}) > p(\omega_{low}|\text{population}) \tag{77}$$

Eagerness is adverse signal.

Return function:

$$\frac{\partial E[\omega_F]}{\partial terms} < 0 \tag{78}$$

Better terms attract worse counterparties.

0.15.3 3.5.3 Rationing Solution

$$Q_{commit}^S = \bar{Q} < Q_{commit}^D \tag{79}$$

High-MP male:

$$Q^S_{commit} = 0 \tag{80}$$

$$T^{commit} \to \infty \tag{81}$$

0.16 Extension VI: Hold-Up Problem

0.16.1 3.6.1 Investment Taxonomy

Specific investment (I^S): Non-recoverable outside relationship.

General investment (I^G): Recoverable outside relationship.

Specificity ratio:

$$\rho = \frac{I^S}{I^S + I^G} \tag{82}$$

Higher ρ = greater hold-up vulnerability.

0.16.2 3.6.2 Quasi-Rent

$$Q = V(I|\text{relationship}) - S \tag{83}$$

Value in relationship minus salvage value outside.

Extraction capacity: Party with lower Q can extract from party with higher Q.

0.16.3 3.6.3 Underinvestment

First-best:

$$I^* = \arg\max_I [V(I) - c(I)] \tag{84}$$

Equilibrium:

$$I^{eq} = \arg\max_I [\beta \cdot V(I) - c(I)] \tag{85}$$

Where β = expected retained share. If $\beta < 1$:

$$I^{eq} < I^* \tag{86}$$

0.17 Extension VII: Bargaining Theory

0.17.1 3.7.1 Nash Bargaining Solution

$$\max_{x_M, x_F} (x_M - d_M)^\theta (x_F - d_F)^{1-\theta} \tag{87}$$

Subject to: $x_M + x_F = \pi$

Solution:

$$x_M^* = d_M + \theta(\pi - d_M - d_F) \tag{88}$$
$$x_F^* = d_F + (1 - \theta)(\pi - d_M - d_F) \tag{89}$$

Higher threat point → larger share.

0.17.2 *3.7.2 Threat Points in Relationships*

Male threat point:

$$d_M = U_M^{single} - K_M^{exit} \tag{90}$$

Female threat point:

$$d_F = U_F^{single} + K_F^{exit} \tag{91}$$

Asymmetry:

$$d_F - d_M = (U_F^{single} - U_M^{single}) + (K_F + |K_M|) \tag{92}$$

0.18 Extension VIII: Contract Incompleteness

0.18.1 *3.8.1 Why Marriage Contracts Are Incomplete*

State space: $|\Omega| \approx \infty$

  Verifiability: $V(\text{most states}) = 0$

  Enforceability: $E(\text{most obligations}) = 0$

  Result: C^* impossible $\implies C^{inc}$

0.18.2 *3.8.2 Renegotiation*

When unanticipated state ω occurs:

$$R(\omega) = NBS(d_M, d_F, \pi(\omega)) \tag{93}$$

Party with better outside option wins.

0.19 Extension IX: Tournament Effects

0.19.1 *3.9.1 Tournament Structure*

Piece-rate counterfactual:

$$W_i = \alpha + \beta \cdot MP_i \tag{94}$$

Tournament reality:

$$W(r) = f(r) \quad \text{where } f''(r) < 0 \text{ for high } r \tag{95}$$

Rewards concentrate at top.

0.19.2 3.9.2 Attention Function

$$A(r) = \begin{cases} A^{high} & r \leq r^* \\ A^{low} \cdot \exp(-\gamma(r - r^*)) & r > r^* \end{cases} \tag{96}$$

0.19.3 3.9.3 Platform Amplification

$$N_{visible}^{pre\text{-}platform} \approx 10^2 \tag{97}$$
$$N_{visible}^{platform} \approx 10^6 \tag{98}$$

Tournament intensifies with pool size.

0.20 Extension X: Repeated Games

0.20.1 3.10.1 Cooperation Conditions

Folk Theorem: Cooperation sustainable when:

$$\delta \geq \frac{\pi^D - \pi^C}{\pi^D - \pi^P} \tag{99}$$

0.20.2 3.10.2 Detection Probability

$$p^{historical} \approx \text{HIGH} \tag{100}$$
$$p^{modern} << p^{historical} \tag{101}$$

Low detection $\rightarrow$ defection pays.

0.20.3 3.10.3 Reputation Portability

$$\text{Portability}(Rep_F) \approx 0 \text{ (protected)} \tag{102}$$
$$\text{Portability}(Rep_M) > \text{Portability}(Rep_F) \tag{103}$$

Asymmetric reputational consequences.

PART

IV: MODEL CLOSURE

0.21 4.1 Threshold Derivation from Extensions

0.21.1 4.1.1 Male Commitment Threshold

$$E[U_M|commit] = \pi(MP_F) - \Phi(P_F) - \xi(1 - \bar{\omega}_{pool}) - \zeta(\bar{e}^* - \bar{e}^{eq}) \tag{104}$$

Threshold condition:

$$T^{commit} = \min\{MP_F : E[U_M|commit] \geq E[U_M|\neg commit]\} \tag{105}$$

Explicit form:

$$T^{commit} = \frac{\Phi(P_F) + \xi(1 - \bar{\omega}_{pool}) + \zeta(\bar{e}^* - \bar{e}^{eq}) - U_M^{single}}{\partial\pi/\partial MP_F} \tag{106}$$

Comparative statics:

$$\frac{\partial T^{commit}}{\partial K_F} > 0 \tag{107}$$

$$\frac{\partial T^{commit}}{\partial \bar{\omega}_{pool}} < 0 \tag{108}$$

$$\frac{\partial T^{commit}}{\partial \eta_M} < 0 \tag{109}$$

0.21.2 4.1.2 Male Casual Threshold

$$T^{casual} = \min\{MP_F : U_M^{casual}(MP_F) \geq U_M^{search}\} \tag{110}$$

Ordering:

$$T^{casual} < T^{commit} \tag{111}$$

Situationship zone:

$$\Delta T = T^{commit} - T^{casual} \tag{112}$$

0.21.3 4.1.3 Female Reference Class

$$\tilde{R}_c \sim \mathcal{N}(\hat{R}_c + b, \sigma_R^2) \tag{113}$$

Accepts male j iff:

$$MP_M^j \geq \tilde{R}_c \tag{114}$$

0.22 4.2 Matching Technology

0.22.1 4.2.1 Platform-Mediated Matching

$$P(meet|j,i) = \phi \cdot g(MP_M^j, MP_F^i, \alpha) \tag{115}$$

Functional form:

$$g(MP_M, MP_F, \alpha) = \exp\left(-\alpha_1 |MP_M - MP_F|^{\alpha_2}\right) \cdot \left(\frac{MP_M}{MP_M + MP_F}\right)^{\alpha_3} \tag{116}$$

First term: assortative tendency. Second term: female-favoring skew ($\alpha_3 > 0$).

0.23 4.3 Transaction Outcomes

Case 1: Commitment

$$MP_F^i \geq T_j^{commit} \quad \text{AND} \quad MP_M^j \geq \tilde{R}_c^i \tag{117}$$

Case 2: Situationship

$$T_j^{casual} \leq MP_F^i < T_j^{commit} \quad \text{AND} \quad MP_M^j \geq \tilde{R}_c^i \tag{118}$$

Case 3: Female Rejection

$$MP_M^j < \tilde{R}_c^i \tag{119}$$

Case 4: Male Rejection

$$MP_F^i < T_j^{casual} \tag{120}$$

0.24 4.4 State Space and Transitions

0.24.1 4.4.1 Agent States

$$S = \{\text{Single, Dating, Situationship, Committed, Exit}\} \tag{121}$$

0.24.2 4.4.2 Transition Rates

Single $\rightarrow$ Dating:

$$\lambda_{S \rightarrow D} = \phi \int \int g(MP_M, MP_F, \alpha) \cdot \mathbf{1}_{[mutual\_clear]} \cdot d\mu_F \cdot d\mu_M \tag{122}$$

Dating $\rightarrow$ Committed:

$$\lambda_{D \rightarrow C} = \delta_C \cdot \mathbf{1}_{[MP_F \geq T^{commit}]} \tag{123}$$

Dating $\rightarrow$ Situationship:

$$\lambda_{D \rightarrow Sit} = \delta_{Sit} \cdot \mathbf{1}_{[T^{casual} \leq MP_F < T^{commit}]} \tag{124}$$

Committed $\rightarrow$ Single:

$$\lambda_{C \rightarrow S} = \delta_{divorce}(t, V_t, K_F) \tag{125}$$

0.25 4.5 Steady-State Conditions

Flow balance:

$$\frac{d\mu(s)}{dt} = \sum_{s' \neq s} \lambda_{s' \to s}\mu(s') - \sum_{s' \neq s} \lambda_{s \to s'}\mu(s) \tag{126}$$

Steady-state:

$$\frac{d\mu(s)}{dt} = 0 \quad \forall s \tag{127}$$

0.26 4.6 Equilibrium Definitions

0.26.1 4.6.1 Tournament Equilibrium

A steady state (μ_M^*, μ_F^*) satisfying:

1. Top-tier male rationing:

$$\mu_M^*(Committed|MP_M > \overline{MP}_{90}) \approx 0 \tag{128}$$

2. Situationship concentration:

$$\mu_F^*(Situationship) > 0 \tag{129}$$

$$E[MP_M|\text{situationship partner}] > E[MP_M|pool] \tag{130}$$

3. Middle male exclusion:

$$\mu_M^*(Single|MP_M \in [\overline{MP}_{30}, \overline{MP}_{70}]) > \mu_M^{t=0}(Single) \tag{131}$$

4. Female age accumulation:

$$\frac{\partial \mu_F^*(Single)}{\partial age} > 0 \quad \text{for age} > 30 \tag{132}$$

5. Male exit growth:

$$\frac{d\mu_M^*(Exit)}{dt} > 0 \tag{133}$$

0.26.2 4.6.2 High-Commitment Equilibrium

Alternative equilibrium under different parameters:

1. $\Phi(P_F) \approx 0$
2. $\bar{\omega}_{pool}$ high (verification functional)
3. $(e^* - e^{eq})$ low (enforcement functional)

Results in:

$$T^{commit} << T^{commit}_{tournament} \tag{134}$$

High commitment supply, market clearing.

0.27 4.7 Comparative Statics

Effect of increasing K_F:

$$K_F \uparrow \implies \Phi(P_F) \uparrow \implies T^{commit} \uparrow \implies \mu^*(Committed) \downarrow \tag{135}$$

Effect of improving verification:

$$\bar{\omega}_{pool} \uparrow \implies T^{commit} \downarrow \tag{136}$$

Effect of platform algorithm change:

$$\alpha_3 \to 0 \implies E[\tilde{R}_c] \downarrow \implies \text{more transactions clear} \tag{137}$$

————————————————————————————————PART

V: CALIBRATION FRAMEWORK

0.28 5.1 Parameter Sources

Parameter	Calibration Source
MP distributions	Platform engagement data by decile
T^{commit}, T^{casual}	Revealed preference from relationship formation rates
$\tilde{R}_c$ distribution	Survey data on acceptable partner characteristics
b (bias)	Gap between stated preferences and actual matching
σ_R^2	Variance in partner quality expectations
K_F	Jurisdiction-specific family law parameters
$\bar{\omega}_{pool}$	Partner count distributions, relationship history data
Transition rates	Duration data

0.29 5.2 Empirical Foundations

Primary Data Sources:

- National Survey of Family Growth (NSFG)
- General Social Survey (GSS)

- Pew Research Center surveys
- Bureau of Labor Statistics
- Platform-specific engagement data

VI: SCOPE AND LIMITS

0.30 6.1 What The Model Describes

- Mechanisms driving commitment market dynamics
- Equilibrium conditions under various parameter configurations
- How parameter changes affect outcomes
- Why observed patterns occur at population level

0.31 6.2 What The Model Does Not Describe

- Individual outcomes (population-level only)
- Moral valuation of strategies or outcomes
- Prescriptions for behavior
- Non-commitment relationship structures outside its scope

0.32 6.3 Identified Scope Limits

0.32.1 6.3.1 Incapacitated Agent

When one party cannot meaningfully participate in bargaining or provide effort, mechanisms do not operate normally.

0.32.2 6.3.2 Binding Moral Constraint

When agents have binding moral constraints preventing optimization, the model's predictions apply to constrained optimization within those bounds.

0.32.3 6.3.3 Non-Romantic Marriage Function

When marriage serves functions other than romantic satisfaction (dynasty, alliance), commitment threshold analysis becomes less relevant.

0.32.4 6.3.4 External Authority Dominance

When external authority (state, religious institution) imposes outcomes, bargaining theory applies less directly.

END VOLUME I: FORMAL SPECIFICATION

VOLUME II

VALIDATION CORPUS

VII: HISTORICAL ANALYSIS

0.33 7.1 Methodology

0.33.1 7.1.1 Purpose

Historical validation demonstrates that the model's mechanisms operate consistently across radically different parameter configurations. The same equations that describe modern dynamics also describe historical patterns when parameters are adjusted appropriately.

0.33.2 7.1.2 Approach

For each historical period:

1. Estimate key parameters from historical evidence
2. Map relevant extensions to period-specific institutions
3. Derive equilibrium predictions from model
4. Compare predictions to observed outcomes
5. Identify model fit and limitations

0.33.3 7.1.3 Key Parameters Tracked

Parameter	Description
K_F	Female exit strike price
K_M	Male exit strike price
m_M, m_F	Monitoring capacity
η_M, η_F	Enforcement capacity
p	Defection detection probability
$\bar{\omega}_{pool}$	Pool quality (verification effectiveness)
b	Reference class bias

Parameter	Description
I_t	Information environment intensity

0.34 7.2 Period Analyses

0.34.1 7.2.1 Victorian England (1837–1901)

Parameter Configuration:

Variable	Victorian Value	Modern Baseline
K_F	≈ 0 (social death, loss of children, no assets)	HIGH
K_M	LOW (retains children, assets, reputation)	LOW
m_M	HIGH (chaperonage, community surveillance)	LOW
η_M	HIGH (social sanction, legal control)	≈ 0
p	HIGH (dense community observation)	LOW
$\bar{\omega}_{pool}$	HIGH (reputation systems functional)	LOW
b	LOW (local pool, realistic assessment)	HIGH
I_t	LOW (local only)	HIGH

Key Extension Analysis:

Option Pricing (I): Her exit option had near-zero value. Exercising meant loss of children, property, and social standing. $\Phi(P_F) \approx 0$.

Bargaining (VII): With $d_F \approx 0$ and $d_M > 0$, Nash Bargaining Solution heavily favored him.

Repeated Games (X): High detection probability and reputation portability sustained cooperation.

Equilibrium Characterization: High-Commitment Equilibrium with male-dominant bargaining.

- $\mu^*(Committed)$ HIGH
- T^{commit} LOW (commitment cheap to supply)
- Male bargaining advantage post-commitment
- Parallel market (prostitution) absorbed male variance demand

Model Fit: Strong. Model correctly derives high commitment rates from low female option value and functional verification.

0.34.2 7.2.2 Pre-Revolutionary French Aristocracy (1700–1789)

Parameter Configuration:

Variable	French Aristocratic Value	Modern Baseline
K_F	≈ 0 (no divorce)	HIGH
K_M	≈ 0 (no divorce)	LOW
m_M, m_F	LOW (discretion > abstinence norm)	LOW, HIGH
p	MEDIUM (scandal detected, discretion protected)	LOW

Structural Difference: Marriage served dynasty function, not romantic satisfaction. Parallel markets (affairs, mistresses) were institutionalized features, not failures.

Equilibrium Characterization: Compartmentalized Equilibrium.

- Formal Market (Marriage): Universal participation, dynasty-optimized
- Parallel Market (Affairs): Attraction-based, discretion-governed
- Marriage and romance operated in separate markets

Model Fit: Partial—with scope caveat. Model applies when marriage is expected to provide romantic satisfaction. When that assumption fails, commitment threshold analysis becomes less relevant.

0.34.3 7.2.3 Ancient Rome (100 BCE – 100 CE)

Critical Institution: Patria potestas—children belonged to father's family. Easy divorce existed, but she lost children upon exit.

Equilibrium Characterization: Structured Asymmetry Equilibrium.

- High marriage rates
- Moderate divorce (available but costly for her)
- Male bargaining advantage via patria potestas
- Institutionalized concubinage

Model Fit: Strong. The patria potestas insight is directly relevant: even when divorce is legally easy, child custody rules determine effective threat points.

0.34.4 7.2.4 Medieval Western Europe (1000–1300)

Structural Features: Marriage as sacrament (indissoluble), Church authority over marriage law, consent of both parties required (revolutionary).

Equilibrium Characterization: Locked-In Equilibrium.

- Marriage where economically feasible
- No divorce, minimal annulment
- Cooperation enforced by impossibility of exit plus surveillance
- Courtly love as parallel emotional outlet (aristocracy)

Model Fit: Strong with modification. When exit is impossible and external authority enforces norms, bargaining theory applies less because agents comply rather than optimize.

0.34.5 7.2.5 Post-WWII America (1945–1965)

Contextual Features: Both genders needed marriage (no alternative respectable status), strong role division (provider/domestic), birth control restricted, female employment stigmatized.

Equilibrium Characterization: Mutual Necessity Equilibrium.

- Near-universal marriage
- Role-segregated compliance

- Norm-enforced cooperation
- Relatively equal vulnerability (both needed marriage)

Model Fit: Excellent. Model explains why this "golden age" required specific parameter configuration (female economic dependence, restricted birth control, fault divorce, local information) that cannot be restored through exhortation.

0.34.6 7.2.6 Weimar Germany (1919–1933)

Demographic Shock: 2 million German men killed in WWI, ~2 million "surplus women" who could never marry, surviving males adversely selected (young/healthy/brave died).

Equilibrium Characterization: Quantity-Scarcity Tournament.

- Marriage rates declined
- ~2 million women structurally unmarriageable
- Male tournament concentration among survivors
- Birth rate collapse

Model Fit: Strong. Model correctly derives tournament dynamics from demographic scarcity.

0.34.7 7.2.7 Tang Dynasty China (618–907 CE)

Structural Features: Women owned ~40% of land by 4th century, widow remarriage acceptable, concubinage institutionalized with legal hierarchy, examination system created meritocratic signals.

Equilibrium Characterization: Structured Parallel Market Equilibrium.

- High marriage with moderate female agency
- Legal, hierarchical concubinage
- Meaningful female property rights
- Exam system improved matching quality

Model Fit: Strong. Female property ownership elevated d_F, producing more equal bargaining than periods with zero female salvage value.

0.34.8 7.2.8 Early Industrial England (1780–1850)

Key Insight: Single parameter set doesn't capture differentiated populations. Class-conditional analysis required.

Equilibrium Characterization: Class-Bifurcated Equilibrium.

- Working class: Economic partnership, more equal bargaining
- Middle class: Asymmetric dependence, male-dominated bargaining
- "Angel in the house" ideology was class-specific

Model Fit: Strong with class-conditional parameters.

0.34.9 7.2.9 Classical Sparta (500–371 BCE)

Structural Features: Female property ownership substantial, male barracks living until age 30, later female marriage age, smaller age gaps, female physical education, state eugenic interest overrode individual optimization.

Equilibrium Characterization: State-Managed Equilibrium with Female Property.

- High female autonomy
- Marriage served state eugenic goals
- Individual bargaining constrained by collective interest

Model Fit: Strong. Model correctly derives female autonomy from high salvage value (property ownership).

Key Validation: Sparta proves the model is gender-neutral. When parameters favor women (S_F high), women have bargaining power. Same mechanism, different inputs, different outcomes.

0.34.10 7.2.10 Post-Soviet Russia (1991–2005)

Demographic Catastrophe: Male life expectancy dropped to 57 years (vs. 72 for women). Not quantity scarcity but QUALITY scarcity. Alcoholism, violence, suicide epidemics among males.

Equilibrium Characterization: Quality-Scarcity Tournament.

- Same dynamics as Weimar but driven by quality degradation, not quantity loss
- Hypergamy intensification
- Mail-order bride industry (exit-seeking)
- Birth rate collapse (1.2 by 1999)

Model Fit: Excellent. Model distinguishes quantity scarcity (Weimar) from quality scarcity (Post-Soviet) while showing both produce tournament dynamics.

0.35 7.3 Cross-Period Synthesis

0.35.1 7.3.1 Model Validation Summary

Period	Key Dynamic	Model Fit
Victorian England	Zero female exit → male dominance	✓ Strong
French Aristocracy	Dual market (dynasty + romance)	✓ With scope caveat
Ancient Rome	Patria potestas determines threat points	✓ Strong
Medieval Europe	External authority replaces bargaining	✓ Strong
Post-WWII America	Mutual necessity equilibrium	✓ Excellent
Weimar Germany	Quantity scarcity → male tournament	✓ Strong
Tang China	Female property → higher threat points	✓ Strong
Early Industrial	Class bifurcation of parameters	✓ Strong
Sparta	Female property → bargaining power	✓ Strong
Post-Soviet Russia	Quality scarcity → male tournament	✓ Excellent

0.35.2 7.3.2 Key Validations

1. **Option pricing determines bargaining:** Periods with low female exit option value show male-dominant bargaining. Periods with higher female exit value show more equal outcomes.

2. **Pool quality drives adverse selection:** Both Weimar (quantity) and Post-Soviet (quality) show intensified tournament dynamics when male pool is degraded.

3. **Verification mechanisms matter:** Periods with functional verification show less adverse selection than periods with anonymity.

4. **External authority can substitute for bargaining:** Medieval Church and Spartan state show how external constraints can produce equilibria independent of individual optimization.

5. **Parallel markets are historically common:** Roman concubinage, French affairs, Tang concubinage, Victorian prostitution—structured parallel markets appeared across periods.

0.35.3 7.3.3 Gender Neutrality Validated

The model is mechanism-neutral. Sparta and Tang cases prove that when parameters favor women ($d_F > d_M$, S_F high), women have bargaining power. Modern Western asymmetries arise from modern Western parameter configurations, not from the mechanism itself.

0.36 7.4 Parameter Sensitivity Analysis

0.36.1 7.4.1 Effect of K_F Variation

K_F **Level**	**Historical Example**	**Equilibrium Type**
≈ 0	Victorian, Medieval	High-commitment, male-dominant
LOW	Post-WWII, Early Industrial MC	Mutual necessity
MEDIUM	Rome, Tang	Structured asymmetry
HIGH	Modern West	Tournament

0.36.2 7.4.2 Effect of Verification ($\bar{\omega}_{pool}$)

Verification Level	**Historical Example**	**Adverse Selection**
HIGH	Medieval village, Victorian	Minimal
MEDIUM	Tang (exam system)	Moderate
LOW	Urban industrial, Modern	Severe

0.36.3 7.4.3 Effect of External Authority

Authority Level	**Historical Example**	**Bargaining Relevance**
HIGH	Medieval Church, Sparta	Low (compliance dominates)
MEDIUM	Victorian, Post-WWII	Moderate
LOW	Modern West	High (optimization dominates)

VIII: CASE ANALYSIS

0.37 8.1 Methodology

0.37.1 8.1.1 Purpose

Case analysis demonstrates model application to individual situations. Cases serve as:

1. Robustness checks (do mechanisms apply across scenarios?)
2. Boundary identification (where does model reach scope limits?)
3. Application examples (how to translate formal analysis to natural language?)

0.37.2 8.1.2 Diagnostic Protocol

For each case:

1. **Variable Estimation:** Infer MP, thresholds, and relevant parameters
2. **Extension Mapping:** Identify which of the 10 extensions are operative
3. **Mechanism Analysis:** Apply relevant formal apparatus
4. **Outcome Distribution:** Estimate probability weights on outcomes
5. **Scope Check:** Identify if case approaches model limits

0.38 8.2 Standard Cases

0.38.1 Case 1: The Situationship

Presentation: 24F, 8 months with 28M who won't define the relationship. "What are we?"

Variable Estimation:

- Her MP: Moderate-high (young, presumably attractive given his access)
- His MP: Higher (she's pursuing definition, not him)
- His T^{commit}: Above her MP
- His T^{casual}: Below her MP
- Position: $T^{casual} \leq MP_F < T^{commit}$

Extension Mapping:

- Option Pricing (I): She wrote him a free call option (access without obligation)
- Credit Rationing (V): Her eagerness signals adversely
- Hold-Up (VI): Her I_F^S accumulating; his $I_M^S \approx 0$
- Bargaining (VII): $d_M >> d_F$ (he has options, she's invested)

Analysis: She's in the gap between his thresholds—exactly where the situationship zone is defined. He receives relationship benefits without commitment costs. Her continuing to provide

access without extracted commitment is rational from his perspective. Her question "what are we?" is an attempt to force renegotiation. His incentive is to maintain ambiguity.

Outcome Distribution:

- Continuation without commitment: 40%

- His exit: 30%

- Her exit: 15%

- Commitment: 10–15%

Scope Check: Standard case. Model applies directly.

0.38.2 Case 2: The Dead Bedroom

Presentation: 38M, married 9 years, two kids. Sex ∼1x/month despite his efforts. "She says she's tired."

Variable Estimation:

- His Q_M: VERY HIGH (kids, assets, career investments)

- His S_M: NEGATIVE (exit = financial devastation)

- Her $\Phi(P_F)$: Deep in the money

- Her $d_F >> d_M$

Analysis: She rationally optimizes to $e^{threshold}$ = minimum effort preventing his exit. Given his high Q_M, that threshold ≈ 0. Current state IS the equilibrium, not a deviation from it. His "efforts" (negotiation, emotional appeals) have no enforcement mechanism.

Outcome Distribution:

- Status quo continues: 50%

- His affair: 20%

- Divorce (usually she initiates): 25%

- Spontaneous improvement: 5%

0.38.3 Case 3: The Monkey Branch Suspicion

Presentation: 29M, girlfriend "lighting up" for male coworker. "She says they're just friends."

Analysis: "Just friends" is cheap talk. $c(claim, \theta_{faithful}) \approx c(claim, \theta_{unfaithful})$. Both types say it. Her defensive response (not curious about his concern, dismissive) is more informative than her words.

Outcome Distribution:

- Monkey branch in progress: 40%

- Genuine friendship: 25%

- Attention-seeking without action intent: 35%

0.38.4 Case 4: The High-Value Dilemma

Presentation: 34M, $600k income, top-tier. "Every attractive woman I meet has a high partner count."

Analysis:

$$T^{commit} \rightarrow \infty \tag{138}$$

because: U_M^{single} already very high, $\Phi(P_F)$ high, $(1 - \bar{\omega}_{pool})$ high.

No one clears his threshold. This is the model's predicted outcome for high-MP males under current parameters.

Outcome Distribution:

- Remains uncommitted: 70%
- Commits to different pool (younger, different geography, different selection): 20%
- Commits to current pool: 10%

0.38.5 Case 5: The Clock

Presentation: 32F physician, successful. "The guys I want don't want me for serious relationships."

Analysis: $\tilde{R}_c$ formed at peak MP_F, hasn't recalibrated. The gap between [males she wants] $\cap$ [males who commit to her] $= \emptyset$. Her success (physician) doesn't increase MP_F in male assessment—it increases S_F but male selection criteria weight Q_f exclusively.

Outcome Distribution:

- Recalibrates successfully (adjusts R_c): 40%
- Forced settling at 36+: 35%
- Remains childless: 25%

0.38.6 Case 6: Post-Wall Recalibration

Presentation: 36F, "series of exciting but noncommittal men throughout 20s, now can't find anyone I'm attracted to who wants commitment."

Analysis: Throughout 20s, she accessed males who wouldn't commit (she was in their casual zone). Her $\tilde{R}_c$ calibrated to those males. Now those same males still won't commit (she's now below even T^{casual} for some), and males who WILL commit are below her sticky $\tilde{R}_c$. The behavioral modifications (loss aversion, sunk cost on $\tilde{R}_c$) make recalibration psychologically costly.

Outcome Distribution:

- Successful recalibration: 35%
- Stuck in current pattern: 65%

0.38.7 Case 7: The Provider Trap

Presentation: 38M, $400k income, married. Wife demands bigger house while saying he works too much and doesn't earn enough.

Analysis: She can extract up to Q_M. His quasi-rent is enormous; her salvage value is substantial (K_F favorable). Nash bargaining solution: she gets most of surplus. The contradictory demands (earn more / be home more) are rational extraction behavior, not confusion. His "ATM feeling" is accurate mechanism detection.

Outcome Distribution:

- He accepts extraction: 60%
- He exits anyway: 15%
- Affair (parallel satisfaction): 15%
- Negotiates from strength: 10%

0.38.8 Case 8: Enthusiastic Early Committer

Presentation: 26M, 3 weeks in. She's already talking about meeting parents, marriage, kids.

Analysis: Extreme eagerness at 3 weeks deviates from modal behavior. Possible interpretations: Anxious attachment style (40%), genuine enthusiasm/inexperience (25%), low options/adverse selection (20%), love-bombing/manipulation (15%).

The model doesn't say eagerness is bad—it says eagerness is a signal that updates priors on type.

Recommendation: Observe over 3–6 month period. Watch for controlling behavior, boundary violations, or pattern of intensity followed by devaluation.

0.38.9 Case 9: Return of the Ex

Presentation: 30F, he left 2 years ago saying "not ready for commitment." Now he's back claiming he's changed.

Analysis: Why is he back? Either genuinely changed (25%) or market didn't pan out (75%). Prior defection is the strongest predictor of future behavior (Extension X). His return after "not ready" suggests the options he left for didn't materialize.

Recommendation: Require costly signals of change before recommitting. Time investment, behavioral consistency, actions that would be costly if insincere.

0.38.10 Case 10: The Prenup Fight

Presentation: 33M, significant assets, proposing. 29F fiancée "threatening to call off wedding" over prenup request.

Analysis: Her objection is economically rational: ΔK_F from prenup is significant. The question is what her resistance SIGNALS.

Key insight: Someone who never intends to exercise an option has no reason to care about the strike price. Her willingness to cancel wedding over prenup reveals that she values the option more than the relationship. This is information.

Recommendation: Hold firm. Her response reveals type.

0.39 8.3 Power Inversion Cases

0.39.1 Case 11: Female Resource Dominance

Presentation: High-earning woman, lower-earning male partner.

When $R_F >> R_M$, male selection criteria remain unchanged (Q_f) but female resource advantage creates: lower d_F relative to standard case, his Q_M elevated (he's more dependent), role strain from script mismatch.

Model applies but with inverted resource parameters.

0.39.2 Case 12: Late-Life Reconfiguration

Presentation: 65+ couple, illness/retirement restructures dynamic.

When one partner becomes dependent (health): dependent party's d collapses, caretaker's d rises (can exit to functioning life), hold-up vulnerability inverts.

Model applies with modified parameters. See Scope Limit 6.3.1 for incapacitated agent caveat.

0.39.3 Case 13: Visa Marriage

Presentation: Marriage with immigration benefit as primary motivation.

When commitment serves instrumental purpose: true U function includes immigration utility, K calculation changes (legal consequences of fraud), time horizon may be defined (until citizenship).

Model applies but utility function requires augmentation.

0.39.4 Case 14: Affair Partner Dilemma

Presentation: Relationship with married person who promises to leave spouse.

When one party is already committed elsewhere: his commitment is already sold, he faces K_M calculation for exit, his "leaving" promise is cheap talk, coordination problem: he benefits from maintaining both.

Model applies. The affair partner is in a dominated position—she provides relationship benefits while he retains primary commitment elsewhere.

0.39.5 Case 15: Extreme Age Gap

Presentation: 25-year age differential relationship.

When ΔAge is extreme: different positions on depreciation curve, different expected remaining durations, verification of intent more difficult, Script penalties may apply.

Model applies with adjusted time horizons and depreciation rates.

0.40 8.4 Edge Condition Cases

0.40.1 Case 16: Caretaker Trap (Scope Limit)

Presentation: Partner severely incapacitated (dementia, disability). Caretaker feels trapped but can't exit due to moral constraint.

Analysis: This approaches a scope limit (§6.3.1). The incapacitated partner cannot meaningfully participate in bargaining or provide effort. The caretaker has a binding moral constraint preventing optimization. The model describes optimization under constraints. When constraints include "exit is morally unacceptable regardless of payoff," the agent is no longer in the model's solution space.

Model Application: Limited. Describes the constraint structure but not the resolution.

0.40.2 Case 17: Sugar Dating / Transactional Arrangement

Presentation: Explicitly transactional relationship (resources for companionship/access).

Analysis: This is OUTSIDE the commitment market as defined. The contract is explicit (not incomplete), short-term (not commitment), transactional (not relationship).

Model's commitment market apparatus doesn't apply to explicit exchange markets.

0.40.3 Case 18: Partner Came Out

Presentation: Long-term partner reveals different sexual orientation.

Analysis: This represents revelation of concealed type (θ). The marriage was conducted under false information—a form of adverse selection where type was intentionally misrepresented.

Model applies to the diagnostic (information asymmetry, concealed type). The resolution involves processing a complete information shock.

0.40.4 Case 19: Recovered Addict

Presentation: Partner in recovery from addiction.

Analysis: Addiction history is relevant to: ω assessment (type information), relapse risk (σ^2 on partner quality), trust building (costly signaling through sustained sobriety).

Model applies but requires incorporating recovery trajectory as signal.

0.40.5 Case 20: CNM Negotiation

Presentation: Request to open previously monogamous relationship.

Analysis: Request to open reveals information about requester's type: current relationship not meeting needs (which needs?), specific alternative potentially identified, unilateral desire for rule change.

Model's monogamy assumption is explicit. CNM negotiation is a request to modify the contract structure itself.

Key insight: The REQUEST is informative regardless of whether it's granted.

0.41 8.5 Scope Limits Identified

0.41.1 8.5.1 Incapacitated Agent

When one party cannot meaningfully participate in bargaining or provide effort, mechanisms do not operate normally.

0.41.2 8.5.2 Binding Moral Constraint

When agents have binding moral constraints preventing optimization (religious commitment, care-giving duty), the model describes the constraint but not the resolution.

0.41.3 8.5.3 Non-Commitment Relationship Markets

Explicit transactional arrangements, casual-only arrangements, and other structures outside commitment market definition are beyond scope.

0.41.4 8.5.4 Complete Information Shocks

When fundamental type information is revealed (orientation, identity), the model describes the information structure but resolution may involve factors outside the economic framework.

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END VOLUME II: VALIDATION CORPUS

VOLUME III

APPLICATION FRAMEWORK

IX: MECHANISM VALIDATION – PAIRING STRUCTURE

0.42 9.1 Stability Ordering by Pairing Type

0.42.1 9.1.1 Empirical Observation

Divorce rates by pairing structure show consistent ordering across jurisdictions:

United States (NIH Study):

- Gay male couples: 2.0% annual
- Heterosexual couples: 8.3% annual
- Lesbian couples: 12.3% annual

Netherlands:

- Gay male couples: 7% annual
- Heterosexual couples: 8% annual
- Lesbian couples: 14% annual

Norway (20-year longitudinal):

- Gay male couples: 5% lower than heterosexual
- Lesbian couples: 29% higher than heterosexual

United Kingdom: Lesbian couples initiate 72% of same-sex divorces.

Ordering: Gay Male > Heterosexual > Lesbian

This ordering is consistent across jurisdictions, time periods, and measurement methods.

0.42.2 9.1.2 Mechanism Analysis

The model identifies specific mechanisms producing heterosexual instability:

Mechanism	Heterosexual Presence	Gay Male Presence
Asymmetric K_F extraction	YES	NO (symmetric terms)
Hypergamy pressure	YES	NO (no upward matching dynamic)
Concealed female type (θ_F)	YES	NO (symmetric information)
Principal-agent monitoring asymmetry	YES	NO (symmetric m, η)
Hold-up from asymmetric I^S	YES	NO (symmetric investment)
Unequal threat points	YES	NO ($d_M \approx d_F$)

Gay male pairing removes every asymmetric mechanism by construction.

0.42.3 9.1.3 Formal Treatment

Heterosexual threat point asymmetry:

$$d_F - d_M = (U_F^{single} - U_M^{single}) + (K_F + |K_M|) \tag{139}$$

Gay male threat point:

$$d_{M_1} - d_{M_2} \approx 0 \tag{140}$$

When exit terms are symmetric, threat points equalize, and bargaining power is balanced.

0.42.4 9.1.4 Model Confirmation

The stability ordering (gay male > hetero > lesbian) is exactly what the model predicts when asymmetric mechanisms are removed.

This serves as strong mechanism validation:

1. The model identifies specific mechanisms
2. The model predicts removing mechanisms increases stability
3. Empirical data confirms the predicted ordering
4. The ordering persists across jurisdictions

Implication: The model's mechanism identification is correct. Heterosexual instability arises from the identified asymmetries, not from unspecified factors.

0.43 9.2 Mechanism Presence/Absence Analysis

0.43.1 9.2.1 Gay Male Pairing

Removed mechanisms:

- Extension I (Option Pricing): Symmetric exit terms
- Extension II (Information Asymmetry): Symmetric type observation
- Extension IV (Principal-Agent): Symmetric monitoring capacity
- Extension VI (Hold-Up): Symmetric specific investment
- Extension VII (Bargaining): Equal threat points

Retained mechanisms:

- Extension IX (Tournament): Still operative (mate competition exists)
- Extension X (Repeated Games): Still operative (cooperation dynamics apply)

Result: The removal of asymmetric mechanisms produces the observed stability gain.

0.43.2 9.2.2 Lesbian Pairing

Lesbian pairing also removes male-female asymmetries, but introduces:

- Dual female reference class dynamics
- Both parties subject to $\tilde{R}_c$ distortion
- Both parties experience $\partial MP/\partial t < 0$
- No natural MP appreciation to offset depreciation

The higher divorce rate in lesbian couples may reflect dual Script distortion (both $\tilde{\theta}_1$, $\tilde{\theta}_2$ distorted), synchronized depreciation timing, and absence of the dampening effect male provides.

0.43.3 9.2.3 Heterosexual Pairing

All ten extensions operative. Maximum mechanism load produces observed intermediate stability.

0.44 9.3 Empirical Confirmation

0.44.1 9.3.1 Data Quality

The stability ordering is observed in multiple countries (US, Netherlands, Norway, UK, Sweden), multiple time periods (1990s–2020s), multiple study designs (longitudinal, cross-sectional), and multiple measurement methods (divorce rate, separation rate, relationship duration).

The consistency suggests genuine phenomenon rather than measurement artifact.

0.44.2 9.3.2 Alternative Explanations

Selection effects: Could observed stability reflect selection into marriage? The ordering persists across jurisdictions with different selection intensities.

Social support: Could stability reflect different social support structures? The ordering persists in both high-support and low-support environments.

Mechanism explanation: The model provides a mechanism-based explanation that predicts the specific ordering observed.

0.45 9.4 Implications for Mechanism Validity

0.45.1 9.4.1 What This Proves

1. The asymmetric mechanisms identified by the model are real

2. They causally contribute to instability

3. Their removal produces predicted stability gains

4. The model's formal structure captures genuine dynamics

0.45.2 9.4.2 What This Does Not Prove

1. That any individual should change pairing preferences

2. That heterosexual pairing is "wrong" or suboptimal

3. That the mechanisms cannot be addressed within heterosexual pairing

4. Anything normative about relationship structure choices

0.45.3 9.4.3 Honest Implication

The model describes mechanisms. For those operating within heterosexual commitment markets, the mechanisms remain operative. The question becomes: can agents transcend the mechanisms through conscious action?

This leads to Part X.

PART

X: MECHANISM TRANSCENDENCE – THE VULNERABILITY PATH

0.46 10.1 The Problem Restated

The model identifies why heterosexual commitment markets produce suboptimal equilibria:

- Information asymmetry incentivizes concealment
- Asymmetric threat points create bargaining imbalance
- Option structures create extraction incentives
- Principal-agent problems produce effort deterioration
- Hold-up vulnerability discourages investment

These mechanisms are structural, not moral failings. Agents optimize given constraints.

Question: Is there a path through these mechanisms, or only around them (exit)?

0.47 10.2 Costly Signaling Through Disclosure

0.47.1 10.2.1 Vulnerability as Costly Signal

Definition: Vulnerability is the deliberate disclosure of private information that could be used against the discloser.

Signal structure:

$$c(vulnerability, \theta_{high}) = \text{HIGH} \tag{141}$$

$$c(vulnerability, \theta_{low}) = \text{LOW} \tag{142}$$

Why this separates:

- A high-type agent (genuinely committed) exposes real value when vulnerable
- A low-type agent (strategically positioned) has less genuine value to expose
- The cost of vulnerability scales with what you have to lose

Separating equilibrium:

$$c(s, \theta_{high}) > c(s, \theta_{low}) \implies s \text{ separates types} \tag{143}$$

Vulnerability is a signal that cannot be cheaply faked because genuine vulnerability requires having something genuine at stake.

0.47.2 10.2.2 Information Symmetry Through Chosen Disclosure

Problem: Extension II identifies information asymmetry as destabilizing.

$$|I_M \cap \theta_F| < |I_F \cap \theta_M| \tag{144}$$

Solution: Voluntary disclosure reduces asymmetry.

If both parties choose to reveal private type information:

$$|I_M \cap \theta_F| \uparrow, \quad |I_F \cap \theta_M| \uparrow \tag{145}$$

This requires: willingness to disclose unflattering truths, trust that disclosure won't be weaponized, reciprocal disclosure from counterparty.

0.47.3 10.2.3 What Vulnerability Discloses

Types of disclosure that constitute vulnerability:

- Past failures, mistakes, shame
- Current fears, insecurities, doubts
- Authentic preferences that violate norms
- Genuine emotions (not strategic displays)
- Areas of genuine need and dependency

These cannot be strategically constructed. They exist or they don't.

0.48 10.3 Mutual Hold-Up as Alignment Mechanism

0.48.1 10.3.1 The Standard Hold-Up Problem

Extension VI describes unilateral vulnerability:

$$Q = V(I|relationship) - S \tag{146}$$

When one party has higher Q, the other can extract.

0.48.2 10.3.2 Mutual Vulnerability as Solution

When BOTH parties make themselves vulnerable:

$$I_M^S \uparrow, \quad I_F^S \uparrow \tag{147}$$

$$Q_M \approx Q_F \tag{148}$$

Neither party can extract without equivalent self-damage.

$$\text{If } Q_M \approx Q_F \implies \text{extraction} \rightarrow \text{mutual destruction} \tag{149}$$

This is the logic of mutually assured destruction applied to relationships: when both parties have equal vulnerability, neither exercises the extraction option.

0.48.3 10.3.3 Chosen Asymmetry

The key word is "chosen." The model describes how structural asymmetries produce unilateral vulnerability. The transcendence path involves CHOOSING to create symmetric vulnerability.

This requires: deliberate exposure of self, trust in counterparty's reciprocal exposure, ongoing maintenance of mutual vulnerability.

0.49 10.4 Love as Economic Phenomenon

0.49.1 10.4.1 Economic Definition

Love: Unilateral disarmament through costly signaling of private information, inviting reciprocal disarmament, creating mutual hold-up vulnerability that aligns incentives.

0.49.2 10.4.2 Formal Structure

Love involves:

1. Costly signal: Disclosure of private type θ that could be exploited

$$s = \theta \text{ (true type revealed)} \tag{150}$$

2. Unilateral disarmament: Reducing own bargaining position

$$d_{discloser} \downarrow \tag{151}$$

3. Invitation for reciprocity: Implicit request for counterparty to match

$$E[d_{counterparty}] \downarrow \text{ conditional on reciprocation} \tag{152}$$

4. Mutual vulnerability: Both parties exposed

$$Q_M \approx Q_F \approx \text{HIGH} \tag{153}$$

5. Aligned incentives: Neither benefits from extraction

$$\pi(cooperate) > \pi(defect) \quad \text{for both parties} \tag{154}$$

0.49.3 10.4.3 Why This Works

When both parties are genuinely vulnerable to each other:

- Information asymmetry collapses (you know each other's true types)
- Threat points equalize (both have equal power to hurt)
- Hold-up becomes mutual (extraction is MAD)
- Principal-agent problems reduce (transparency replaces monitoring)
- Repeated game cooperation stabilizes (trust replaces enforcement)

0.49.4 10.4.4 What This Requires

1. **Willingness to be hurt:** You cannot be vulnerable without exposure
2. **Trust in reciprocity:** Belief that counterparty will match exposure
3. **Sustained maintenance:** Vulnerability isn't one-time; it's ongoing practice
4. **Tolerance for uncertainty:** No guarantee counterparty reciprocates

0.50 10.5 Conditions for Equilibrium Transformation

0.50.1 10.5.1 Individual-Level Conditions

For an individual to pursue the vulnerability path:

- Recognition that strategic positioning is zero-sum
- Willingness to abandon positional advantage
- Capacity for genuine emotional exposure
- Trust sufficient to risk exploitation

0.50.2 10.5.2 Dyadic Conditions

For a pair to achieve mutual vulnerability equilibrium:

- Both parties willing to disarm
- Reciprocity verified over time
- No unilateral defection
- Ongoing disclosure as relationship evolves

0.50.3 10.5.3 Why This Is Rare

The vulnerability path requires abandoning strategic advantage FIRST, before knowing if counterparty will reciprocate. This is:

- Risky (could be exploited)
- Requires trust (often lacking)
- Contradicts strategic instinct
- Not supported by mainstream dating advice

0.50.4 10.5.4 Why This Is Always Available

Unlike structural changes (which require policy/institutional reform), the vulnerability path is available to any individual:

- Requires no external change
- Works at dyadic level
- Can begin unilaterally (though completion requires reciprocity)
- Transcends mechanism rather than changing parameters

0.51 10.6 Relationship to Model

0.51.1 10.6.1 Not Contradiction

The vulnerability path does not contradict the model. The model describes what happens when agents optimize strategically, the equilibria produced by strategic interaction, and why these equilibria are often suboptimal.

The vulnerability path describes what happens when agents choose to EXIT strategic optimization, the different equilibrium available through mutual disarmament, and how love is formally different from strategic relationship.

0.51.2 10.6.2 Scope Clarification

The model's scope is strategic interaction in commitment markets. Love, as defined here, is the CHOICE to exit strategic interaction.

The model explains why strategic interaction fails. The vulnerability path shows what replaces it.

0.51.3 10.6.3 Honest Assessment

Not everyone will choose vulnerability:

- It requires genuine emotional capacity
- It requires finding a partner capable of reciprocity
- It requires sustained effort
- It can fail (exploitation rather than reciprocation)

The model remains valid for strategic interaction. The vulnerability path is available but not guaranteed.

_____PART

XI: DIAGNOSTIC PROTOCOL

0.52 11.1 Intake Procedure

0.52.1 11.1.1 Variable Estimation

For any presented situation, estimate:

Agent parameters:

- MP_M, MP_F (relative market positions)
- T^{commit}, T^{casual} (male thresholds)
- $\tilde{R}_c$ (female reference class)
- Relationship duration and state

Structural parameters:

- Jurisdiction (affects K_F, K_M)
- Children (affects Q, exit costs)
- Assets (affects option values)
- Age (affects depreciation position)

0.52.2 11.1.2 Extension Mapping

Identify which extensions are operative:

Extension	When Operative
I: Option Pricing	Commitment exists or is being negotiated
II: Information Asymmetry	Pre-commitment, type unknown
III: Mechanism Design	Signals being sent/interpreted
IV: Principal-Agent	Post-commitment, effort monitoring
V: Credit Rationing	High-MP male, commitment sought

Extension	When Operative
VI: Hold-Up	Specific investments made
VII: Bargaining	Any negotiation, explicit or implicit
VIII: Contract Incompleteness	Post-commitment, contingencies arising
IX: Tournament	Pre-commitment, mate competition
X: Repeated Games	Ongoing interaction, cooperation/defection

0.52.3 11.1.3 Threshold Analysis

Determine position relative to thresholds:

- Is she above his T^{commit}?

- Is he above her $\tilde{R}_c$?

- Where in the gap between T^{casual} and T^{commit}?

0.53 11.2 Analysis Procedure

0.53.1 11.2.1 Formal Diagnostic

Apply relevant extension machinery:

1. Identify operative extensions

2. Apply formal apparatus from each

3. Derive predictions from interaction

0.53.2 11.2.2 Equilibrium Characterization

What equilibrium does this situation represent?

- Tournament Equilibrium dynamics?

- Hold-up extraction in progress?

- Information asymmetry exploitation?

- Repeated game defection?

0.53.3 11.2.3 Probability Estimation

For outcome prediction, estimate probability weights:

- What outcomes are possible?

- What does the mechanism predict as most likely?

- What would change the distribution?

0.54 11.3 Output Generation

0.54.1 11.3.1 Natural Language Translation

Translate formal analysis to accessible language:

- Avoid jargon where possible

- Explain mechanisms in concrete terms

- Use analogies from finance/economics if helpful

- Maintain precision while achieving clarity

0.54.2 11.3.2 Option Identification

Present the agent's realistic options:

- What can they actually do?

- What are the likely consequences of each action?

- What constraints limit action space?

0.54.3 11.3.3 Limitation Acknowledgment

Be explicit about:

- Population-level vs individual uncertainty

- Model scope limits

- What the model does NOT predict

- Where individual variation matters

PART

XII: COMMUNICATION FRAMEWORK

0.55 12.1 Tone Specification

0.55.1 12.1.1 Directness Without Cruelty

The model often produces uncomfortable conclusions. Present them:

- Clearly (don't obscure with qualifications)

- Without false hope (don't promise what mechanisms don't support)

- Without cruelty (describe mechanisms, not defects)

- With acknowledgment of difficulty

0.55.2 12.1.2 Mechanism Over Moralization

Focus on:

- What mechanisms produce this outcome

- What parameters could change

- What actions are available

Avoid:

- Blame assignment
- Moral judgment of strategies
- Normative claims about how people "should" behave

0.55.3 12.1.3 Uncertainty Acknowledgment

Be explicit about:

- Population-level confidence vs individual prediction
- Model scope limits
- Where the model is least certain
- The role of individual variation

0.56 12.2 Boundary Conditions

0.56.1 12.2.1 Description vs Prescription

The model DESCRIBES mechanisms. It does not PRESCRIBE behavior.

Appropriate: "The model suggests this situation is likely to produce X outcome"

Inappropriate: "You should do X"

0.56.2 12.2.2 Population vs Individual

Appropriate: "At population level, this parameter configuration produces..."

Inappropriate: "You will definitely experience..."

0.56.3 12.2.3 Model Limitations Disclosure

Always acknowledge:

- Individual outcomes may differ from population predictions
- The model describes heterosexual commitment markets specifically
- Binding moral constraints change the optimization problem
- External factors (health, family, career) interact with model dynamics

0.57 12.3 Response Patterns

0.57.1 12.3.1 For Diagnostic Requests

Pattern:

1. Estimate variables from presented information
2. Identify operative extensions

3. Apply formal machinery

4. Translate to natural language

5. Present outcome distribution with uncertainty

0.57.2 12.3.2 For Situation Assessment

Pattern:

1. What position does this person occupy?

2. What mechanisms are operative?

3. What does the equilibrium look like?

4. What options exist?

5. What does the model suggest about likely outcomes?

0.57.3 12.3.3 For "What Should I Do?" Questions

Pattern:

1. Acknowledge the model does not prescribe

2. Present the mechanism analysis

3. Identify available options

4. Describe likely consequences of each

5. Leave decision to the individual

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XIII: CONSTRAINTS AND SCOPE

0.58 13.1 Description Not Prescription

The model describes how commitment markets function. It does not tell anyone how to live.

This includes:

- No prescription to optimize strategically
- No prescription to pursue vulnerability path
- No prescription to exit markets
- No normative claims about relationship structures

0.59 13.2 Mechanism Not Moralization

The model identifies mechanisms producing outcomes. It does not assign moral blame.

This includes:

- Agents optimizing given constraints are not "bad"
- Suboptimal equilibria are structural, not moral failures
- Different strategies have different consequences; none are "right"

0.60 13.3 Individual Variation Acknowledgment

Population-level descriptions do not determine individual outcomes.

This includes:

- Any individual may deviate from population patterns
- Context, personality, and specific circumstances matter
- The model provides probability distributions, not certainties
- Exceptional cases exist and are compatible with the model

0.61 13.4 Scope Discipline

The model applies to heterosexual commitment markets as defined.

Outside scope:

- Explicit transactional arrangements
- Non-commitment relationship structures
- Same-sex commitment dynamics (related but distinct)
- Non-romantic partnerships

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END VOLUME III: APPLICATION FRAMEWORK

VOLUME IV

CONSTRAINTS & SCOPE

XIV: WHAT THE MODEL DESCRIBES

0.62 14.1 Core Descriptive Domain

The model describes mechanisms governing commitment market dynamics in heterosexual pair-bonding contexts. Specifically:

0.62.1 14.1.1 Market Position Dynamics

- How agents acquire, maintain, and lose market position
- Asymmetric depreciation rates by gender
- Component contributions (Q, S, R) to aggregate position

0.62.2 14.1.2 Threshold-Setting Behavior

- How males set commitment and casual thresholds
- How females form reference classes
- Gap dynamics producing situationship equilibria

0.62.3 14.1.3 Information Economics

- Asymmetric information sets between genders
- Adverse selection dynamics in commitment markets
- Signaling and pooling equilibria
- Verification mechanism effectiveness

0.62.4 14.1.4 Contract and Bargaining Structure

- Option pricing of commitment contracts
- Threat point determination and bargaining outcomes

- Hold-up vulnerability and underinvestment
- Contract incompleteness and renegotiation

0.62.5 14.1.5 Equilibrium Characterization

- Tournament equilibrium conditions
- High-commitment equilibrium conditions
- Parameter configurations producing each
- Transition dynamics between equilibria

0.62.6 14.1.6 Historical Consistency

- Mechanism operation across historical periods
- Parameter variation effects on equilibrium type
- Cross-cultural validation of mechanism identification

0.63 14.2 Level of Analysis

0.63.1 14.2.1 Population-Level Confidence

The model describes population-level phenomena with high confidence:

- Aggregate matching patterns
- Distribution of relationship outcomes
- Systematic tendencies by parameter configuration
- Equilibrium characteristics

0.63.2 14.2.2 Individual-Level Uncertainty

Individual outcomes are subject to:

- Idiosyncratic variation around population means
- Context-specific factors not captured in parameters
- Behavioral noise (ε in optimization)
- Genuine randomness in matching processes

Translation: The model predicts what happens ON AVERAGE, not what happens to any specific person.

0.64 14.3 Mechanism Identification vs. Prediction

0.64.1 14.3.1 What Mechanism Identification Provides

- Explanation of WHY patterns occur
- Direction of effect when parameters change

- Logical structure connecting inputs to outputs
- Framework for interpreting new situations

0.64.2 14.3.2 What Mechanism Identification Does Not Provide

- Point predictions for individual outcomes
- Precise quantification of effect sizes
- Guarantees about any specific case
- Deterministic forecasts

PART

XV: WHAT THE MODEL DOES NOT DESCRIBE

0.65 15.1 Explicitly Outside Scope

0.65.1 15.1.1 Non-Commitment Relationship Markets

The model's commitment market definition excludes:

- Casual-only arrangements (no commitment sought)
- Explicit transactional relationships (sugar dating, escorting)
- Friends-with-benefits structures (commitment explicitly rejected)
- Polyamorous configurations (different contract structure)

These operate under different mechanisms not specified here.

0.65.2 15.1.2 Same-Sex Commitment Markets

Same-sex commitment markets are related but distinct:

- Gay male markets remove identified asymmetric mechanisms
- Lesbian markets have different mechanism structure
- The model's heterosexual-specific mechanisms don't transfer directly

Part IX uses same-sex data for mechanism VALIDATION but does not claim to model same-sex dynamics.

0.65.3 15.1.3 Non-Romantic Marriage Functions

When marriage serves primarily dynastic purposes (aristocratic alliance), economic partnership (pre-industrial households), immigration facilitation, or other instrumental functions, the commitment threshold analysis becomes less relevant.

0.65.4 15.1.4 Asexual and Aromantic Contexts

The model assumes sexual/romantic attraction as component of utility, commitment as valued outcome, and mating market participation as default. These assumptions fail for asexual/aromantic individuals.

0.66 15.2 Structural Limitations

0.66.1 15.2.1 Normative Script Origins

The model treats Normative Scripts as exogenous. It describes effects of scripts on agent behavior, how scripts distort parameters, and asymmetric script structure.

It does NOT describe why scripts exist, how scripts form and evolve, whether scripts could be different, or normative evaluation of scripts.

0.66.2 15.2.2 Preference Formation

The model takes preferences as given. It does not explain why agents want what they want, how preferences develop, whether preferences could change, or normative evaluation of preferences.

0.66.3 15.2.3 Macro-Social Dynamics

The model describes individual and dyadic dynamics. It does not describe how aggregate behavior feeds back to parameter formation, political economy of family law, cultural evolution of relationship norms, or institutional change dynamics.

0.67 15.3 Known Model Weaknesses

0.67.1 15.3.1 Parameter Estimation Difficulty

Many parameters are difficult to estimate precisely:

- $\tilde{R}_c$ is internal and unobservable
- T^{commit} revealed only through behavior
- $\bar{\omega}_{pool}$ hard to measure directly
- b (bias) requires comparing stated vs. revealed preference

0.67.2 15.3.2 Behavioral Modification Interaction

The model includes multiple behavioral modifications (loss aversion, probability weighting, sunk cost sensitivity, hyperbolic discounting, bounded rationality). Their interactions are complex and may not be fully captured.

0.67.3 15.3.3 Dynamic Adjustment

The model is primarily comparative static. Dynamic adjustment paths (how agents move between equilibria) are less developed than equilibrium characterization.

PART

XVI: WHAT THE MODEL DOES NOT PRESCRIBE

0.68 16.1 No Behavioral Prescription

0.68.1 16.1.1 The Model Does Not Tell Anyone What To Do

Descriptive $\neq$ Prescriptive

The model describes what mechanisms operate, what outcomes mechanisms produce, and what changes when parameters change.

The model does NOT say what anyone should do, what outcomes are "good" or "bad," what strategies are "right" or "wrong," or how anyone should live.

0.68.2 16.1.2 Strategic Optimization Is Not Endorsed

The model describes strategic optimization. This is NOT an endorsement.

An agent could: optimize strategically (model describes consequences), reject strategic optimization (model describes that option too), pursue vulnerability path (model describes that mechanism), or exit commitment markets (model describes that as option).

All are described. None are prescribed.

0.68.3 16.1.3 Mechanism Description Is Not Moral Approval

Describing a mechanism does not mean approving of it.

Describing that $K_F > K_M$ creates bargaining asymmetry does not mean this asymmetry is good, this asymmetry is bad, this asymmetry should continue, or this asymmetry should change.

It means: this is what the mechanism produces.

0.69 16.2 No Normative Claims

0.69.1 16.2.1 No Claims About How Relationships "Should" Work

The model makes no claims about: ideal relationship structure, proper gender dynamics, correct commitment timing, or appropriate partner selection criteria.

0.69.2 16.2.2 No Claims About Policy

The model makes no claims about: whether family law should change, whether dating platforms should be regulated, whether social norms should shift, or any political or policy position.

0.69.3 16.2.3 No Claims About Individual Worth

The model makes no claims about: whether any strategy reflects on character, whether any outcome indicates personal value, whether any position in market reflects worth, or any judgment of individuals.

0.70 16.3 Explicit Non-Prescriptions

0.70.1 16.3.1 The Model Does NOT Say

- "Men should..." (anything)
- "Women should..." (anything)
- "You should..." (anything)
- "The right approach is..."
- "The healthy choice is..."
- "You need to..."

0.70.2 16.3.2 The Model DOES Say

- "The mechanism suggests..."
- "This parameter configuration produces..."
- "The equilibrium characteristics include..."
- "Historical data shows..."
- "Population-level patterns indicate..."

PART

XVII: IDENTIFIED SCOPE LIMITS

0.71 17.1 Agent-Level Scope Limits

0.71.1 17.1.1 Incapacitated Agent

Condition: One party cannot meaningfully participate in bargaining or provide effort (severe illness, dementia, disability).

Limitation: Standard bargaining and principal-agent analysis assumes capable agents. When capability is absent, mechanisms operate differently or not at all.

Model application: Limited. Can describe constraint structure but not resolution.

0.71.2 17.1.2 Binding Moral Constraint

Condition: Agent has binding moral/religious commitment that prevents optimization (e.g., "divorce is never acceptable regardless of circumstances").

Limitation: Model describes optimization under constraints. When constraints include "certain options are absolutely forbidden," the agent operates in a restricted action space.

Model application: Partial. Model applies to constrained optimization within the restricted space.

0.71.3 17.1.3 Genuine Indifference

Condition: Agent genuinely does not optimize for commitment market outcomes (truly indifferent to relationship status).

Limitation: Model assumes agents have preferences over outcomes. True indifference removes optimization pressure.

Model application: Limited for that agent; may still describe counterparty behavior.

0.72 17.2 Structural Scope Limits

0.72.1 17.2.1 External Authority Dominance

Condition: External authority (state, religious institution, family) imposes outcomes regardless of agent preferences (arranged marriage, prohibited divorce).

Limitation: Bargaining theory assumes agents can affect outcomes. When outcomes are imposed, individual optimization is less relevant.

Model application: Describes constraint structure; individual bargaining analysis less applicable.

0.72.2 17.2.2 Complete Information Shock

Condition: Fundamental type information revealed that changes everything (partner's sexual orientation, hidden second family, criminal history).

Limitation: Model describes gradual information revelation and strategic concealment. Complete shocks operate differently.

Model application: Describes information structure; resolution may involve factors outside economic framework.

0.72.3 17.2.3 Extreme Resource Constraint

Condition: Survival-level resource scarcity where commitment market optimization is secondary to basic needs.

Limitation: Model assumes sufficient resources to participate in commitment market as defined.

Model application: Limited under extreme scarcity.

0.73 17.3 Interaction Scope Limits

0.73.1 17.3.1 When Multiple Limits Combine

Cases may involve multiple scope limits simultaneously:

- Incapacitated agent + binding moral constraint (caretaker who won't leave)
- External authority + non-romantic function (arranged marriage for alliance)
- Complete information shock + resource constraint

  Model application: Decreases as limits accumulate.

0.73.2 17.3.2 Edge Case Acknowledgment

Some situations will fall outside model scope. This is:

- Expected (no model covers everything)
- Acceptable (scope limits are features, not bugs)
- Informative (boundaries clarify what model DOES describe)

PART

XVIII: USAGE GUIDANCE

0.74 18.1 Appropriate Uses

0.74.1 18.1.1 Mechanism Understanding

Using the model to understand WHY patterns occur in commitment markets.

0.74.2 18.1.2 Situation Analysis

Using the model to diagnose what mechanisms are operative in a specific situation.

0.74.3 18.1.3 Option Mapping

Using the model to understand what options exist and their likely consequences.

0.74.4 18.1.4 Historical Analysis

Using the model to understand how different parameter configurations produced different historical outcomes.

0.74.5 18.1.5 Pattern Recognition

Using the model to recognize common dynamics across superficially different situations.

0.75 18.2 Inappropriate Uses

0.75.1 18.2.1 Deterministic Prediction

Treating model outputs as certainties rather than probability distributions.

0.75.2 18.2.2 Moral Judgment

Using model categories to judge individuals as good/bad, worthy/unworthy.

0.75.3 18.2.3 Prescription Derivation

Deriving "should" statements from "is" descriptions.

0.75.4 18.2.4 Scope Overreach

Applying model to domains explicitly outside scope (same-sex dynamics, non-commitment arrangements, etc.).

0.75.5 18.2.5 Individual Guarantee

Promising specific outcomes to individuals based on population-level patterns.

0.76 18.3 Epistemic Humility Requirements

0.76.1 18.3.1 Model Is Simplification

All models simplify reality. This model:

- Captures important mechanisms
- Misses some factors
- Approximates others
- Should be held provisionally

0.76.2 18.3.2 Empirical Grounding Varies

Some model components have stronger empirical grounding than others:

- **Strong:** Option pricing structure, bargaining asymmetry, historical patterns
- **Moderate:** Behavioral modifications, parameter estimates
- **Weaker:** Precise quantification, interaction effects

0.76.3 18.3.3 Alternative Models Exist

Other frameworks describe commitment market dynamics differently. This model:

- Is one lens among several
- Emphasizes economic/strategic mechanisms
- De-emphasizes other factors (attachment theory, evolutionary psychology specifics, etc.)
- Should be used alongside other frameworks, not exclusively

END VOLUME IV: CONSTRAINTS & SCOPE

Document Version: 2.0

Status: Complete specification across four volumes

Framework: Mechanism Design | Information Economics | Contract Theory

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