

The Doctrine–Practice Gap in Real Estate Appraisal: A Structured Account of Functions, Boundaries, and Tensions

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Abstract. Real estate appraisal occupies a position of significant public interest, yet its official doctrine—centered on opinions of market value under past and current conditions—sits in growing tension with how appraisal products are actually used in contemporary financial pipelines. This article builds that case in five stages, each paired with an explicit, queryable Prolog knowledge base: the first two establish the social and economic functions appraisal serves; the third identifies its primary end product, an opinion of market value; and the fourth examines appraisal’s temporal and methodological orientation relative to quantitative and financial forecasting, together with the regulatory boundary that separates them. These converge on the central claim of the fifth: in mortgage lending, market value scaled by a loan-to-value ratio functions as an implicit proxy for future foreclosure value—a forward-looking use the present-value doctrine does not acknowledge. Many appraisers, unaware of this collateral-valuation role, do not treat market value with the caution toward future value trends it warrants—an issue this account is meant to expose and to invite further work on.

Keywords: real estate appraisal, market value, valuation doctrine, knowledge representation, appraisal standards, foreclosure value

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1 Social Importance

Real estate and other asset appraisals serve an essential social and economic function by helping buyers, sellers, lenders, insurers, investors, courts, taxing authorities, and the general public make informed and equitable decisions regarding the transfer, financing, taxation, and stewardship of property and other forms of wealth. High-quality appraisals contribute to market transparency, public confidence, efficient capital allocation, and the stability of financial institutions by

providing independent and well-supported opinions of value grounded in evidence, analysis, and professional judgment. (LaCour-Little and Malpezzi 2003; K'Akumu and Larsen 2024; Hendershott and Kane 1995; Lee, Peng, and Liao 2020)

Poor-quality appraisals, by contrast, can produce serious consequences at multiple time horizons. In the short term, inaccurate appraisals may cause individual buyers or sellers to suffer immediate financial harm through overpayment, underselling, excessive taxation, or inappropriate lending decisions. In the medium term, systematic appraisal deficiencies can distort market signals, impair credit underwriting, encourage speculative behavior, contribute to inequitable taxation or insurance coverage, and increase litigation and transactional distrust. Over the long term, persistent failures in appraisal quality may undermine confidence in markets and institutions, contribute to financial instability, misallocation of resources, neighborhood decline or overinvestment, and broader social inequities affecting households, businesses, and communities. (LaCour-Little and Malpezzi 2003; Mayer and Nothaft 2022)

Because real estate and other assets often represent a substantial portion of personal, corporate, and public wealth, appraisal quality is not merely a private technical concern, but a matter of significant public interest tied to economic resilience, fairness, and the long-term public good. (Mayer and Nothaft 2022)

```
%% appraisal_social.pl
%%
%% A Prolog knowledge base encoding the social and public-interest role
%% of real estate and other asset appraisals. Companion to
%% appraisal_economics.pl, which covers the strictly economic axis.
%%
%% All domain-specific predicates are prefixed with `social_` so this
%% module can be loaded alongside appraisal_economics.pl (and any other
%% companion KBs) without name collisions, and so cross-KB rules can
%% mention both vocabularies unambiguously.
%%
%% Conceptual model:
%%   - Appraisals support social DECISION TYPES.
%%   - Each decision involves identifiable PARTIES.
%%   - Appraisal QUALITY (high | low) drives EFFECTS across time HORIZONS.
%%   - Emphasis: equity, public confidence, public interest.
%%
%% Author: generated for Bert Craytor, ValEngr / RCA context.

:- module(appraisal_social,
    [ social_horizon/1
    , social_party/1
    , social_decision_type/1
    , social_involves/2           % DecisionType, Party
    , social_effect/4           % Quality, Horizon, Domain, Effect
    , social_contribution/1
    , social_hallmark/1
    , social_equity_principle/1
    , social_public_interest_claim/1
    , social_positive_effect/3
    , social_negative_effect/3
    , social_horizon_summary/2
    , social_consequences_of_quality/2
    , social_parties_affected_by/2
    , social_public_harm/2
    , social_private_harm/2
    , social_appraisal_is_public_interest/0
    ]).
```

```

:- discontinuous social_effect/4.
:- discontinuous social_involves/2.

%% -----
%% 1. Time horizons
%% -----

social_horizon(short_term).
social_horizon(medium_term).
social_horizon(long_term).

%% -----
%% 2. Parties whose decisions depend on appraisals
%%
%% The opening sentence enumerates these explicitly.
%% -----

social_party(buyers).
social_party(sellers).
social_party(lenders).
social_party(insurers).
social_party(investors).
social_party(courts).
social_party(taxing_authorities).
social_party(general_public).

%% -----
%% 3. Types of decisions appraisals inform
%% -----

social_decision_type(property_transfer).
social_decision_type(financing).
social_decision_type(taxation).
social_decision_type(stewardship).
social_decision_type(insurance_coverage).
social_decision_type(adjudication).           % courts: condemnation, divorce, estate
social_decision_type(public_administration).

social_involves(property_transfer,    buyers).
social_involves(property_transfer,    sellers).
social_involves(financing,            lenders).
social_involves(financing,            buyers).
social_involves(taxation,             taxing_authorities).
social_involves(taxation,             general_public).
social_involves(stewardship,          investors).
social_involves(stewardship,          general_public).
social_involves(insurance_coverage,   insurers).
social_involves(insurance_coverage,   buyers).
social_involves(adjudication,         courts).
social_involves(public_administration, taxing_authorities).
social_involves(public_administration, general_public).

%% -----
%% 4. What high-quality appraisals contribute (second sentence)
%% -----

social_contribution(market_transparency).

```

```

social_contribution(public_confidence).
social_contribution(efficient_capital_allocation).
social_contribution(stability_of_financial_institutions).

%% Characteristics of a high-quality appraisal opinion of value.
social_hallmark(independence).
social_hallmark(well_supported).
social_hallmark(grounded_in_evidence).
social_hallmark(grounded_in_analysis).
social_hallmark(grounded_in_professional_judgment).

%% -----
%% 5. Effects of appraisal quality by horizon
%% -----

%% ---- SHORT TERM: high quality ----
social_effect(high, short_term, property_transfer, fair_pricing_for_parties).
social_effect(high, short_term, financing, appropriate_lending_decisions).
social_effect(high, short_term, taxation, accurate_individual_assessment).

%% ---- SHORT TERM: low quality ----
social_effect(low, short_term, property_transfer, buyer_overpayment).
social_effect(low, short_term, property_transfer, seller_underselling).
social_effect(low, short_term, taxation, excessive_individual_taxation).
social_effect(low, short_term, financing,
    ↳ inappropriate_lending_decisions).
social_effect(low, short_term, property_transfer,
    ↳ immediate_financial_harm_to_individuals).

%% ---- MEDIUM TERM: high quality ----
social_effect(high, medium_term, markets, clear_market_signals).
social_effect(high, medium_term, financing, sound_credit_underwriting).
social_effect(high, medium_term, taxation, equitable_tax_assessment).
social_effect(high, medium_term, insurance_coverage,
    ↳ equitable_insurance_coverage).
social_effect(high, medium_term, adjudication, reduced_litigation_pressure).

%% ---- MEDIUM TERM: low quality ----
social_effect(low, medium_term, markets, distorted_market_signals).
social_effect(low, medium_term, financing,
    ↳ impaired_credit_underwriting).
social_effect(low, medium_term, markets,
    ↳ encouragement_of_speculation).
social_effect(low, medium_term, taxation, inequitable_taxation).
social_effect(low, medium_term, insurance_coverage,
    ↳ inequitable_insurance_coverage).
social_effect(low, medium_term, adjudication, increased_litigation).
social_effect(low, medium_term, markets, transactional_distrust).

%% ---- LONG TERM: high quality ----
social_effect(high, long_term, institutions, public_confidence_in_institutions).
social_effect(high, long_term, markets, public_confidence_in_markets).
social_effect(high, long_term, institutions, financial_stability).
social_effect(high, long_term, communities, equitable_community_outcomes).
social_effect(high, long_term, public_interest, economic_resilience).
social_effect(high, long_term, public_interest, social_fairness).
social_effect(high, long_term, public_interest, long_term_public_good).

```

```

%% ---- LONG TERM: low quality ----
social_effect(low, long_term, markets, eroded_market_confidence).
social_effect(low, long_term, institutions, eroded_institutional_confidence).
social_effect(low, long_term, institutions, financial_instability).
social_effect(low, long_term, markets, resource_misallocation).
social_effect(low, long_term, communities, neighborhood_decline).
social_effect(low, long_term, communities, neighborhood_overinvestment).
social_effect(low, long_term, communities, social_inequities_for_households).
social_effect(low, long_term, communities, social_inequities_for_businesses).
social_effect(low, long_term, communities, social_inequities_for_communities).

%% -----
%% 6. Equity principles and public-interest claims
%% -----

social_equity_principle(informed_decisions).
social_equity_principle(equitable_decisions).
social_equity_principle(fair_treatment_of_parties).
social_equity_principle(independence_of_valuer).

social_public_interest_claim(
    'Real estate and other assets are a substantial portion of personal, corporate,
    ↪ and public wealth.').
social_public_interest_claim(
    'Appraisal quality is not merely a private technical concern.').
social_public_interest_claim(
    'Appraisal quality is tied to economic resilience.').
social_public_interest_claim(
    'Appraisal quality is tied to fairness.').
social_public_interest_claim(
    'Appraisal quality is tied to the long-term public good.').

%% Top-level conclusion of the passage.
social_appraisal_is_public_interest :-
    social_public_interest_claim(_).    % at least one such claim exists

%% -----
%% 7. Derived / query predicates
%% -----

social_positive_effect(Horizon, Domain, Effect) :-
    social_effect(high, Horizon, Domain, Effect).

social_negative_effect(Horizon, Domain, Effect) :-
    social_effect(low, Horizon, Domain, Effect).

social_horizon_summary(Horizon, Effects) :-
    findall(Quality-Effect,
        social_effect(Quality, Horizon, _Domain, Effect),
        Effects).

social_consequences_of_quality(Quality, List) :-
    findall(consequence(Horizon, Domain, Effect),
        social_effect(Quality, Horizon, Domain, Effect),
        List).

social_parties_affected_by(DecisionType, Parties) :-
    setof(P, social_involves(DecisionType, P), Parties).

```

```

% Harms that fall on the public rather than on transaction principals.
social_public_harm(Horizon, Effect) :-
    social_effect(low, Horizon, Domain, Effect),
    member(Domain, [markets, institutions, communities, public_interest,
        ↪ taxation]).

% Private (transaction-level) harms.
social_private_harm(Horizon, Effect) :-
    social_effect(low, Horizon, Domain, Effect),
    member(Domain, [property_transfer, financing, insurance_coverage]).

```

2 Economic Importance

Real estate and other asset appraisals play a fundamental economic role by supporting the efficient operation of credit markets, investment decisions, taxation systems, financial reporting, insurance underwriting, estate administration, corporate transactions, and public policy planning. Reliable appraisals help establish credible measures of collateral and market value that allow capital to flow more efficiently between borrowers, lenders, investors, governments, and businesses. (LaCour-Little and Malpezzi 2003; Ebrahim and Hussain 2010)

In the short term, accurate appraisals reduce transactional uncertainty, improve lending decisions, facilitate fair negotiations, and help prevent immediate financial losses arising from overvaluation or undervaluation. In the medium term, appraisal quality influences the stability and efficiency of broader markets by affecting mortgage risk, investment allocation, tax equity, insurance adequacy, and the pricing behavior of market participants. Weak or systematically biased appraisals during this period can contribute to inflated asset bubbles, impaired lending portfolios, distorted development incentives, and increased default or litigation risk. (LaCour-Little and Malpezzi 2003; Hendershott and Kane 1992; Griffin and Maturana 2016)

Over the long term, the cumulative economic consequences of appraisal quality become even more significant, influencing patterns of capital formation, infrastructure investment, intergenerational wealth transfer, public revenues, housing affordability, and overall financial system resilience. Sustained deficiencies in valuation practices can contribute to chronic misallocation of capital, banking instability, reduced investor confidence, and inefficient use of land and productive assets, while strong appraisal standards help support stable markets, sound economic planning, and long-term economic growth. (Ghent, Torous, and Valkanov 2019; Hendershott and Kane 1992; Ebrahim and Hussain 2010)

```

% appraisal_economics.pl
%
% A Prolog knowledge base encoding the economic role of real estate
% and other asset appraisals across short-, medium-, and long-term
% horizons, including both the consequences of high-quality appraisal
% practice and the consequences of weak or biased practice.
%
% All domain-specific predicates are prefixed with `economic_` so this
% module can be loaded alongside appraisal_social.pl (and any other
% companion KBs) without name collisions, and so cross-KB rules can
% mention both vocabularies unambiguously.
%
% Conceptual model:
% - Appraisals support a set of economic FUNCTIONS.
% - Each function operates over one or more time HORIZONS.
% - Appraisal QUALITY (high / low) drives EFFECTS on those functions.

```

```

%% - Effects are POSITIVE (benefits) when quality is high and
%%      NEGATIVE (harms) when quality is low/systematically biased.
%%
%% Author: generated for Bert Craytor, ValEngr / RCA context.

:- module(appraisal_economics,
    [ economic_horizon/1
      , economic_function/1
      , economic_supports/2
      , economic_effect/4
      ↪ Effect
      , economic_stakeholder/1
      , economic_benefits/2
      , economic_positive_effect/3
      , economic_negative_effect/3
      , economic_horizon_summary/2
      , economic_consequences_of_quality/2
      , economic_functions_at_horizon/2
      , economic_stakeholders_affected_by/2
      , economic_reliable_appraisals_improve/1
      , economic_appraisal_quality_matters_at/1
    ]).

:- discontiguous economic_effect/4.
:- discontiguous economic_supports/2.

%% -----
%% 1. Time horizons
%% -----

economic_horizon(short_term).
economic_horizon(medium_term).
economic_horizon(long_term).

%% -----
%% 2. Economic functions supported by appraisals
%% -----

economic_function(credit_markets).
economic_function(investment_decisions).
economic_function(taxation_systems).
economic_function(financial_reporting).
economic_function(insurance_underwriting).
economic_function(estate_administration).
economic_function(corporate_transactions).
economic_function(public_policy_planning).

%% -----
%% 3. Stakeholders whose decisions depend on appraisals
%% -----

economic_stakeholder(borrowers).
economic_stakeholder(lenders).
economic_stakeholder(investors).
economic_stakeholder(governments).
economic_stakeholder(businesses).
economic_stakeholder(insurers).
economic_stakeholder(taxpayers).

```

```

economic_stakeholder(homeowners).

%% Capital flows more efficiently when appraisals are reliable.
economic_benefits(borrowers,    credit_markets).
economic_benefits(lenders,      credit_markets).
economic_benefits(investors,    investment_decisions).
economic_benefits(governments,  taxation_systems).
economic_benefits(governments,  public_policy_planning).
economic_benefits(businesses,   corporate_transactions).
economic_benefits(businesses,   financial_reporting).
economic_benefits(insurers,     insurance_underwriting).
economic_benefits(taxpayers,    taxation_systems).
economic_benefits(homeowners,   credit_markets).

%% -----
%% 4. Which functions are most salient at each horizon
%% -----

economic_supports(credit_markets,    short_term).
economic_supports(investment_decisions, short_term).
economic_supports(corporate_transactions, short_term).

economic_supports(credit_markets,    medium_term).
economic_supports(investment_decisions, medium_term).
economic_supports(taxation_systems,   medium_term).
economic_supports(insurance_underwriting, medium_term).

economic_supports(credit_markets,    long_term).
economic_supports(taxation_systems,   long_term).
economic_supports(public_policy_planning, long_term).
economic_supports(financial_reporting, long_term).
economic_supports(estate_administration, long_term).

%% -----
%% 5. Effects of appraisal quality, by horizon and function
%% -----

%% ---- SHORT TERM: high quality ----
economic_effect(high, short_term, credit_markets,
    ↳ reduced_transactional_uncertainty).
economic_effect(high, short_term, credit_markets,
    ↳ improved_lending_decisions).
economic_effect(high, short_term, corporate_transactions, fair_negotiations).
economic_effect(high, short_term, investment_decisions,
    ↳ prevention_of_immediate_losses).

%% ---- SHORT TERM: low quality ----
economic_effect(low, short_term, credit_markets,
    ↳ transactional_uncertainty).
economic_effect(low, short_term, credit_markets,                poor_lending_decisions).
economic_effect(low, short_term, investment_decisions,
    ↳ losses_from_overvaluation).
economic_effect(low, short_term, investment_decisions,
    ↳ losses_from_undervaluation).

%% ---- MEDIUM TERM: high quality ----
economic_effect(high, medium_term, credit_markets,                stable_mortgage_risk).

```

```

economic_effect(high, medium_term, investment_decisions,
↳ efficient_investment_allocation).
economic_effect(high, medium_term, taxation_systems, tax_equity).
economic_effect(high, medium_term, insurance_underwriting,
↳ adequate_insurance_coverage).
economic_effect(high, medium_term, investment_decisions,
↳ rational_market_pricing).

%% ---- MEDIUM TERM: low quality ----
economic_effect(low, medium_term, investment_decisions, inflated_asset_bubbles).
economic_effect(low, medium_term, credit_markets,
↳ impaired_lending_portfolios).
economic_effect(low, medium_term, public_policy_planning,
↳ distorted_development_incentives).
economic_effect(low, medium_term, credit_markets, increased_default_risk).
economic_effect(low, medium_term, corporate_transactions,
↳ increased_litigation_risk).

%% ---- LONG TERM: high quality ----
economic_effect(high, long_term, investment_decisions, sound_capital_formation).
economic_effect(high, long_term, public_policy_planning,
↳ sound_infrastructure_investment).
economic_effect(high, long_term, estate_administration,
↳ orderly_intergenerational_wealth_transfer).
economic_effect(high, long_term, taxation_systems, stable_public_revenues).
economic_effect(high, long_term, public_policy_planning,
↳ supported_housing_affordability).
economic_effect(high, long_term, credit_markets,
↳ financial_system_resilience).
economic_effect(high, long_term, investment_decisions,
↳ long_term_economic_growth).

%% ---- LONG TERM: low quality ----
economic_effect(low, long_term, investment_decisions,
↳ chronic_capital_misallocation).
economic_effect(low, long_term, credit_markets, banking_instability).
economic_effect(low, long_term, investment_decisions,
↳ reduced_investor_confidence).
economic_effect(low, long_term, public_policy_planning, inefficient_land_use).
economic_effect(low, long_term, public_policy_planning,
↳ inefficient_productive_asset_use).

%% -----
%% 6. Derived / query predicates
%% -----

economic_positive_effect(Horizon, Function, Effect) :-
    economic_effect(high, Horizon, Function, Effect).

economic_negative_effect(Horizon, Function, Effect) :-
    economic_effect(low, Horizon, Function, Effect).

economic_horizon_summary(Horizon, Effects) :-
    findall(Quality-Effect,
        economic_effect(Quality, Horizon, _Function, Effect),
        Effects).

economic_consequences_of_quality(Quality, List) :-

```

```

    findall(consequence(Horizon, Function, Effect),
            economic_effect(Quality, Horizon, Function, Effect),
            List).

economic_functions_at_horizon(Horizon, Functions) :-
    setof(F, economic_supports(F, Horizon), Functions).

economic_stakeholders_affected_by(Function, Stakeholders) :-
    setof(S, economic_benefits(S, Function), Stakeholders).

%% Overall claim: reliable appraisals improve allocative efficiency.
economic_reliable_appraisals_improve(capital_flow_efficiency).
economic_reliable_appraisals_improve(market_stability).
economic_reliable_appraisals_improve(long_term_economic_growth).

%% Top-level qualitative claim: appraisal quality matters at every horizon.
economic_appraisal_quality_matters_at(Horizon) :-
    economic_horizon(Horizon),
    \+ \+ economic_effect(high, Horizon, _, _),
    \+ \+ economic_effect(low, Horizon, _, _).

```

3 The Importance of Market Value Estimates as an End Product of Appraisals

Market value appraisals play an important role in collateral risk analysis because they provide a professionally developed estimate of the probable price a property or asset could achieve under normal market conditions, thereby serving as a foundational benchmark for lenders, investors, and collateral analysts evaluating credit exposure and potential foreclosure outcomes. (Agarwal, Ben-David, and Yao 2015) Although foreclosure or liquidation value may differ substantially from market value due to distressed marketing conditions, accelerated sale periods, legal costs, physical deterioration, or adverse market sentiment, collateral analysts frequently rely upon market value appraisals as the starting point for estimating recovery potential under stressed scenarios. (Campbell, Giglio, and Pathak 2011; Pennington-Cross 2006; Clauretie and Daneshvary 2009)

By analyzing the relationship between market value, loan balances, loan-to-value ratios, market trends, property condition, liquidity, and local supply-demand conditions, collateral analysts assess the likelihood and severity of losses in the event of borrower default. (Qi and Yang 2009)

In the short term, accurate market value appraisals help lenders make prudent underwriting decisions and establish appropriate collateral margins. In the medium term, they support portfolio risk management, loan securitization, reserve allocation, and regulatory compliance by helping institutions evaluate changing collateral adequacy across economic cycles. Over the long term, consistently reliable appraisal practices contribute to financial system stability by reducing the risk of excessive leverage, poorly secured lending, and systemic mispricing of collateral assets that can amplify foreclosure losses and broader economic disruptions during periods of market stress. (Eriksen et al. 2019)

```

%% appraisal_collateral.pl
%%
%% A Prolog knowledge base encoding the role of market value (MV)
%% appraisals in collateral risk analysis. Companion to
%% appraisal_economics.pl and appraisal_social.pl.
%%

```

```

%% Naming convention:
%% - Predicates that have direct counterparts in the companion KBs
%%   (horizon, effect, summary, consequences, etc.) are prefixed
%%   `collateral_` so this module can be loaded alongside the others
%%   without name collisions, and so bridge rules can mention each
%%   vocabulary unambiguously.
%% - Predicates that are unique to the collateral-analysis domain
%%   (value_basis, divergence_factor, risk_input, etc.) are NOT
%%   prefixed. They have no analogues in the other KBs and no
%%   collision risk, so the prefix would only add noise.

:- module(appraisal_collateral,
    [ collateral_horizon/1
    , collateral_analyst/1
    , collateral_effect/4                                % Quality, Horizon, Domain,
    ↪ Effect
    , collateral_positive_effect/3
    , collateral_negative_effect/3
    , collateral_horizon_summary/2
    , collateral_consequences_of_quality/2
    , value_basis/1
    , uses/2                                              % Analyst, ValueBasis
    , divergence_factor/1
    , stress_scenario/1
    , risk_input/1
    , risk_output/1
    , inputs_for/2
    , mv_is_benchmark_for/1
    ]).

:- discontiguous collateral_effect/4.
:- discontiguous uses/2.

%% -----
%% 1. Time horizons (namespaced -- parallel to economic/social_)
%% -----

collateral_horizon(short_term).
collateral_horizon(medium_term).
collateral_horizon(long_term).

%% -----
%% 2. Who uses MV appraisals in collateral risk analysis
%% -----

collateral_analyst(lenders).
collateral_analyst(investors).
collateral_analyst(collateral_analysts).
collateral_analyst(portfolio_risk_managers).
collateral_analyst(regulators).
collateral_analyst(securitization_arrangers).

%% -----
%% 3. Value bases distinguished in the passage
%% -----

value_basis(market_value).          % "normal market conditions"
value_basis(foreclosure_value).     % distressed

```

```

value_basis(liquidation_value).      % distressed, accelerated

%% Which value bases each analyst type works with.
uses(lenders,                        market_value).
uses(investors,                      market_value).
uses(collateral_analysts,            market_value).
uses(collateral_analysts,            foreclosure_value).
uses(collateral_analysts,            liquidation_value).
uses(portfolio_risk_managers,         market_value).
uses(securitization_arrangers,        market_value).
uses(regulators,                     market_value).

%% Top-level claim of the opening sentence.
mv_is_benchmark_for(credit_exposure).
mv_is_benchmark_for(foreclosure_outcomes).
mv_is_benchmark_for(recovery_potential).

%% -----
%% 4. Why foreclosure / liquidation value diverges from MV
%% -----

divergence_factor(distressed_marketing_conditions).
divergence_factor(accelerated_sale_period).
divergence_factor(legal_costs).
divergence_factor(physical_deterioration).
divergence_factor(adverse_market_sentiment).

%% Stressed scenarios in which divergence factors apply.
stress_scenario(borrower_default).
stress_scenario(foreclosure).
stress_scenario(forced_liquidation).
stress_scenario(market_downturn).

%% -----
%% 5. Inputs the collateral analyst combines with MV, and the
%%     outputs they produce
%% -----

risk_input(market_value).
risk_input(loan_balance).
risk_input(loan_to_value_ratio).
risk_input(market_trends).
risk_input(property_condition).
risk_input(liquidity).
risk_input(local_supply_demand).

risk_output(likelihood_of_loss).
risk_output(severity_of_loss).
risk_output(recovery_estimate).
risk_output(loss_given_default).

%% inputs_for(+Output, -Inputs)
%% All risk inputs are used to produce each risk output.
inputs_for(Output, Inputs) :-
    risk_output(Output),
    setof(I, risk_input(I), Inputs).

%% -----

```

```

%% 6. Effects of appraisal quality by horizon
%% -----

%% ---- SHORT TERM: high quality ----
collateral_effect(high, short_term, underwriting, prudent_underwriting_decisions).
collateral_effect(high, short_term, underwriting, appropriate_collateral_margins).

%% ---- SHORT TERM: low quality ----
collateral_effect(low, short_term, underwriting,
↳ imprudent_underwriting_decisions).
collateral_effect(low, short_term, underwriting, inadequate_collateral_margins).
collateral_effect(low, short_term, underwriting, mispriced_credit_exposure).

%% ---- MEDIUM TERM: high quality ----
collateral_effect(high, medium_term, portfolio,
↳ effective_portfolio_risk_management).
collateral_effect(high, medium_term, portfolio, sound_loan_securitization).
collateral_effect(high, medium_term, portfolio, appropriate_reserve_allocation).
collateral_effect(high, medium_term, regulatory, regulatory_compliance).
collateral_effect(high, medium_term, portfolio,
↳ cycle_aware_collateral_evaluation).

%% ---- MEDIUM TERM: low quality ----
collateral_effect(low, medium_term, portfolio,
↳ weakened_portfolio_risk_management).
collateral_effect(low, medium_term, portfolio, mispriced_securitizations).
collateral_effect(low, medium_term, portfolio, inadequate_loss_reserves).
collateral_effect(low, medium_term, regulatory, regulatory_noncompliance_risk).
collateral_effect(low, medium_term, portfolio, misjudged_collateral_adequacy).

%% ---- LONG TERM: high quality ----
collateral_effect(high, long_term, system, financial_system_stability).
collateral_effect(high, long_term, system, restraint_on_excessive_leverage).
collateral_effect(high, long_term, system, well_secured_lending).
collateral_effect(high, long_term, system, accurate_systemic_collateral_pricing).
collateral_effect(high, long_term, system, dampened_foreclosure_amplification).

%% ---- LONG TERM: low quality ----
collateral_effect(low, long_term, system, financial_system_instability).
collateral_effect(low, long_term, system, excessive_leverage).
collateral_effect(low, long_term, system, poorly_secured_lending).
collateral_effect(low, long_term, system, systemic_collateral_mispricing).
collateral_effect(low, long_term, system, amplified_foreclosure_losses).
collateral_effect(low, long_term, system,
↳ amplified_economic_disruption_under_stress).

%% -----
%% 7. Derived / query predicates (namespaced)
%% -----

collateral_positive_effect(Horizon, Domain, Effect) :-
    collateral_effect(high, Horizon, Domain, Effect).

collateral_negative_effect(Horizon, Domain, Effect) :-
    collateral_effect(low, Horizon, Domain, Effect).

collateral_horizon_summary(Horizon, Effects) :-
    findall(Quality-Effect,

```

```

collateral_effect(Quality, Horizon, _Domain, Effect),
Effects).

collateral_consequences_of_quality(Quality, List) :-
    findall(consequence(Horizon, Domain, Effect),
            collateral_effect(Quality, Horizon, Domain, Effect),
            List).

```

4 The Temporal Orientation of Appraisal Activity

Appraisers generally develop point-in-time opinions of market value as of a specific effective date—retrospective (past), current, or, with defined limitations, prospective (future)—rather than probabilistic forecasts over extended time periods. This temporal and methodological orientation represents one of the central distinctions between regulated appraisal practice and the work of quantitative analysts, financial analysts, investment analysts, and economists. (Quan and Quigley 1991)

In most appraisal assignments, particularly those involving market value under standards such as the Uniform Standards of Professional Appraisal Practice (USPAP) or International Valuation Standards (IVS), the appraiser produces a reconciled point estimate (or, in permitted cases, a narrow range) anchored to observable market evidence, prevailing conditions, and recognized methodologies as of one effective date. USPAP explicitly permits value conclusions as a specific amount, a range of numbers, or a relationship to a benchmark, yet the reconciled opinion remains a credible point indication tied to that date. (The Appraisal Foundation 2024; International Valuation Standards Council 2025)

Although appraisers necessarily incorporate market participants' reasonable expectations regarding trends, supply and demand, depreciation, capitalization or discount rates, and absorption, they do so to support a market-supported value at the effective date, not to forecast speculative movements. Prospective value opinions (e.g., stabilized value upon project completion) require explicit extraordinary assumptions or hypothetical conditions and remain constrained to a defined future effective date with market-derived support.

By contrast, quantitative, financial, and investment analysts frequently address uncertainty through estimates covering a range of possible outcomes across time periods, employing probability distributions, Monte Carlo simulations, scenario analysis, sensitivity testing, or value-at-risk metrics. Their focus often centers on expected future performance, risk-adjusted returns, or investment value to a specific party over varying horizons, rather than a single market value point at one date. (Hull 2018)

Such work also presupposes technical competencies that an appraisal license neither requires nor certifies. Fitting a multivariate adaptive regression spline (MARS) model, for instance, calls for the judgment to control model complexity so that strong in-sample fit (a high R^2) is not bought at the cost of overfitting but instead carries over to held-out data (a high cross-validated R^2), which in turn presumes a working understanding of the underlying algorithms. (Friedman 1991; Steurer, Hill, and Pfeifer 2021) Alongside such quantitative facility, the work rewards the conceptual capacity to handle highly structured concepts, to discern fine distinctions in meaning, and to assimilate unfamiliar methods. These are skills rather than credentials: a licensed appraiser may possess them and an unlicensed analyst may lack them, which is exactly why they do not, by themselves, determine on which side of the regulatory line a given task falls.

Appraisers may also engage in limited future-oriented elements, such as projecting income streams, vacancy, expenses, and reversionary values in discounted cash flow analyses, or estimating prospective values in development or litigation contexts. These components stay within appraisal bounds when grounded in current market evidence and professional standards that emphasize supportability and avoidance of unsupported speculation. (Diaz and Wolverton 1998; Gallimore

1996; Crosby, Lizieri, and McAllister 2010) Modern appraisal practice increasingly integrates statistical tools, scenario considerations, and risk analytics—particularly in mass appraisal, automated valuation models, or portfolio work—yet the core deliverable typically remains a point-in-time market value opinion. (International Association of Assessing Officers 2017; Office of the Comptroller of the Currency and Board of Governors of the Federal Reserve System and Federal Deposit Insurance Corporation and National Credit Union Administration and Consumer Financial Protection Bureau and Federal Housing Finance Agency 2024; Alexandrov, Goodman, and Neal 2023)

One might characterize appraisal practice as primarily evidentiary and oriented toward past-to-present (or limited prospective) point estimates, whereas financial and quantitative analysis is more probabilistic, distributional, and explicitly future-oriented across time horizons. (Geltner 1991) Appraisers ask, “What is the most supportable market value indication as of the specified effective date, given current evidence and defined assumptions?” Financial and quantitative analysts more often inquire, “What range of outcomes is likely over a future period, with what probabilities, and how should resources be allocated?”

The boundary is not absolute and continues to evolve with market complexity. Nevertheless, fundamental differences persist in purpose (market value vs. investment worth), evidentiary requirements, and regulatory frameworks.

The operative line, however, is drawn not by skill but by law: the defining question is simply whether a given task is one for which an appraiser’s license is legally required. Quantitative analysts, financial analysts, economists, investment analysts, portfolio managers, and related professionals may legally estimate, forecast, model, or analyze future asset values—including distributional or range-based projections—without a real estate appraiser’s license, provided the work does not constitute a regulated appraisal. (Murphy 2012) The key distinctions rest on:

1. the type of value (e.g., a market value point estimate vs. investment value or a probabilistic forecast);
2. the temporal focus (a specific effective date vs. a time period or horizon);
3. the form of output (a point or narrow range vs. a full probability distribution);
4. the intended purpose and whether the work is represented as an appraisal; and
5. involvement of regulated lending or legal contexts requiring compliance with standards such as USPAP.

This framework originated largely from banking regulations such as FIRREA (1989) in the United States, which sought to ensure credible, independent market value opinions for federally related transactions. (United States Congress 1989; K’Akumu and Larsen 2024) Many sophisticated valuation activities—equity research price targets, feasibility studies, portfolio risk modeling, option pricing, or predictive analytics—fall outside licensure because they serve investment, forecasting, or advisory purposes rather than regulated appraisal functions.

```
%% appraisal_scope_regulation.pl
%%
%% Knowledge base for the boundary of regulated appraisal practice.
%%
%% TWO TIERS, deliberately kept separate:
%%
%% TIER 1 -- THE DEFINING TEST (regulation cluster). A task is a
%% regulated appraisal IFF it is one for which an appraiser's
%% license is legally required. requires_license/1 is that test;
%% it -- and only it -- decides regulated_appraisal/1 vs.
%% unregulated_valuation/1.
%%
%% TIER 2 -- DESCRIPTIVE TENDENCIES (scope cluster). How the two
%% populations -- `appraisal' and `quant_financial' -- typically
%% differ in approach, temporal scope, output form, and skill set.
```

```

%%      These are CORRELATES, not the boundary: the populations overlap
%%      (a licensed appraiser may do quant work; a quant may be
%%      unlicensed), and nothing here determines licensure. No claim is
%%      made about intelligence -- only about training and methodology.
%%
%%      `temporal scope' and `approach' are DISTINCT axes: an approach has a
%%      typical (defeasible) temporal mode, but the two are not the same
%%      viewpoint -- which is why an appraiser using an AVM (appraisal
%%      approach, distributional methods) is possible.

:- module(appraisal_scope_regulation,
  [ % --- TIER 1: the defining test (regulation) ---
    regulation_framework/1
  , regulation_framework_origin/2
  , regulation_distinguishing_factor/1
  , regulation_triggers_licensure/1
  , regulation_definition_of_appraisal/1
  , regulation_unlicensed_activity/2
  , regulation_licensed_activity/2
  , regulation_legal_exposure_condition/1
  , requires_license/1
  , exempt_from_appraisal_license/1
  , regulated_appraisal/1
  , unregulated_valuation/1
  , regulatory_asymmetry/2

    % --- TIER 2: descriptive tendencies (scope) ---
  , valuation_approach/1
  , scope_profession/1
  , scope_orientation/2
  , temporal_scope/1
  , temporal_mode/1
  , scope_temporal_focus/2
  , scope_output_form/2
  , scope_skill/1
  , scope_skill_demanded_by/2
  , scope_inputs_considered/2
  , scope_future_oriented_context/2
  , scope_professional_constraint/1
  , scope_contrast/4
  , scope_question/2
  , scope_convergence_area/1
  ]).

:- discontiguous regulation_unlicensed_activity/2.
:- discontiguous regulation_licensed_activity/2.
:- discontiguous scope_contrast/4.

%% =====
%% TIER 1 -- THE DEFINING TEST (the boundary)
%% =====

regulation_framework(firrea_1989).
regulation_framework(uspap).
regulation_framework(ivs).
regulation_framework(state_licensing).
regulation_framework(state_certification).

```

```

regulation_framework_origin(firrea_1989,      savings_and_loan_crisis).
regulation_framework_origin(uspap,           firrea_1989).
regulation_framework_origin(state_licensing, firrea_1989).

regulation_distinguishing_factor(kind_of_value).
regulation_distinguishing_factor(purpose_of_valuation).
regulation_distinguishing_factor(temporal_focus).
regulation_distinguishing_factor(output_form).
regulation_distinguishing_factor(represented_as_appraisal).
regulation_distinguishing_factor(federally_related_transaction_involvement).

regulation_triggers_licensure(federally_related_mortgage_transaction).
regulation_triggers_licensure(work_represented_as_appraisal).
regulation_triggers_licensure(work_meeting_state_appraisal_definition).
regulation_triggers_licensure(regulated_lending_transaction).

regulation_definition_of_appraisal(formal_opinion_of_value).
regulation_definition_of_appraisal(concerning_identified_real_property).
regulation_definition_of_appraisal(developed_per_recognized_methods).
regulation_definition_of_appraisal(for_compensation).

regulation_unlicensed_activity(equity_analyst,      stock_price_targets).
regulation_unlicensed_activity(investment_bank,
    ↪ enterprise_value_estimates).
regulation_unlicensed_activity(hedge_fund,
    ↪ commercial_real_estate_appreciation_forecasts).
regulation_unlicensed_activity(economist,
    ↪ housing_market_trend_projections).
regulation_unlicensed_activity(insurance_analyst,
    ↪ replacement_cost_estimates).
regulation_unlicensed_activity(developer,          feasibility_studies).
regulation_unlicensed_activity(internal_corporate_analyst,
    ↪ asset_impairment_estimates).
regulation_unlicensed_activity(internal_corporate_analyst,
    ↪ portfolio_value_estimates).
regulation_unlicensed_activity(quantitative_analyst,
    ↪ predictive_valuation_models).
regulation_unlicensed_activity(avm_developer,
    ↪ algorithmic_residential_price_estimates).

regulation_licensed_activity(licensed_appraiser,
    ↪ market_value_for_federally_related_transaction).
regulation_licensed_activity(licensed_appraiser,
    ↪ formal_opinion_of_value_for_compensation).
regulation_licensed_activity(licensed_appraiser,
    ↪ appraisal_for_regulated_mortgage_lending).
regulation_licensed_activity(licensed_appraiser,
    ↪ appraisal_represented_as_such_under_state_law).

regulation_legal_exposure_condition(holding_self_out_as_licensed_appraiser).
regulation_legal_exposure_condition(preparing_appraisal_as_defined_by_state_law).
regulation_legal_exposure_condition(involved_in_transaction_requiring_licensed_appraiser).

%% --- The test itself: does the TASK require an appraiser's license? ---
requires_license(Task) :-
    regulation_triggers_licensure(Task), !.
requires_license(Task) :-

```

```

    regulation_licensed_activity(_, Task), !.

exempt_from_appraisal_license(Task) :-
    regulation_unlicensed_activity(_, Task),
    \+ requires_license(Task).

:- dynamic activity_satisfies_definition/1.

activity_satisfies_definition(Task) :-
    regulation_licensed_activity(_, Task).

regulated_appraisal(Task) :-
    activity_satisfies_definition(Task),
    requires_license(Task).

unregulated_valuation(Task) :-
    regulation_unlicensed_activity(_, Task),
    \+ regulated_appraisal(Task).

%% Meta-tension: the regulatory asymmetry the passage closes on.
regulatory_asymmetry(current_market_value_for_lending,
    future_oriented_valuation_for_investment).
regulatory_asymmetry(heavily_regulated_appraisal_practice,
    lightly_regulated_quantitative_practice).
regulatory_asymmetry(consumer_and_lending_protection_focus,
    investment_advisory_focus).

regulatory_asymmetry_origin(banking_regulation).
regulatory_asymmetry_origin(consumer_protection).
regulatory_asymmetry_origin(legal_evidentiary_concerns).
regulatory_asymmetry_origin_disclaimer(
    'Not based on any exclusive claim that appraisers alone possess valuation
    ↪ expertise.').

%% =====
%% TIER 2 -- DESCRIPTIVE TENDENCIES (NOT the boundary)
%%
%% Overlapping populations; correlates of who typically lands on each
%% side. None of these determine licensure -- Tier 1 does.
%% =====

%% --- Axis: valuation approach (descriptive populations) ---
valuation_approach(appraisal).
valuation_approach(quant_financial).

scope_profession(appraiser).
scope_profession(quantitative_analyst).
scope_profession(financial_analyst).
scope_profession(investment_analyst).
scope_profession(portfolio_manager).
scope_profession(economist).
scope_profession(investment_strategist).
scope_profession(financial_forecaster).

scope_orientation(appraisal,      evidentiary).
scope_orientation(quant_financial, probabilistic).

%% --- Axis: temporal scope (its OWN viewpoint, distinct from approach) ---

```

```

temporal_scope(retrospective).
temporal_scope(current).
temporal_scope(prospective_point).
temporal_scope(future_range_horizon).

temporal_mode(point_in_time).
temporal_mode(distribution_over_horizon).

%% Typical (defeasible) pairing of approach to temporal mode -- a LINK
%% between two distinct axes, not an identity.
scope_temporal_focus(appraisal, point_in_time).
scope_temporal_focus(quant_financial, distribution_over_horizon).

%% --- Axis: output form ---
scope_output_form(appraisal, point_estimate).
scope_output_form(appraisal, narrow_range).
scope_output_form(quant_financial, probability_distribution).
scope_output_form(quant_financial, range_of_outcomes).

%% --- Axis: skills / methodological toolkit (training, NOT intelligence) ---
scope_skill(mars_without_overfitting).
scope_skill(fit_vs_generalization_balance). % balancing  $R^2$  against  $CV-R^2$ 
scope_skill(algorithmic_understanding).
scope_skill(handling_structured_concepts).
scope_skill(discerning_fine_distinctions_in_meaning).
scope_skill(assimilating_new_methods).

%% Skills typically demanded by advanced quantitative valuation; an
%% appraisal license neither requires nor certifies them.
scope_skill_demanded_by(quant_financial, mars_without_overfitting).
scope_skill_demanded_by(quant_financial, fit_vs_generalization_balance).
scope_skill_demanded_by(quant_financial, algorithmic_understanding).
scope_skill_demanded_by(quant_financial, handling_structured_concepts).
scope_skill_demanded_by(quant_financial, discerning_fine_distinctions_in_meaning).
scope_skill_demanded_by(quant_financial, assimilating_new_methods).

%% --- Inputs the appraiser weighs to support a value at the effective date ---
scope_inputs_considered(appraisal, current_market_evidence).
scope_inputs_considered(appraisal, observable_transactions).
scope_inputs_considered(appraisal, prevailing_market_conditions).
scope_inputs_considered(appraisal, recognized_methodologies).
scope_inputs_considered(appraisal, market_trends).
scope_inputs_considered(appraisal, anticipated_supply_demand).
scope_inputs_considered(appraisal, depreciation).
scope_inputs_considered(appraisal, capitalization_rates).
scope_inputs_considered(appraisal, absorption_patterns).
scope_inputs_considered(appraisal, expectations_already_priced_in).

%% --- Bounded future-oriented contexts that remain within appraisal ---
scope_future_oriented_context(income_property, future_income_streams).
scope_future_oriented_context(income_property, vacancy_rates).
scope_future_oriented_context(income_property, expenses).
scope_future_oriented_context(income_property, reversion_values).
scope_future_oriented_context(income_property, dcf_analysis).
scope_future_oriented_context(development, prospective_stabilized_value).
scope_future_oriented_context(conservation, future_damages).
scope_future_oriented_context(environmental, future_damages).
scope_future_oriented_context(insurance, future_damages).

```

```

scope_future_oriented_context(litigation,      future_damages).
scope_future_oriented_context(eminent_domain,  future_damages).
scope_future_oriented_context(general,         remaining_economic_life).
scope_future_oriented_context(general,         anticipated_market_reactions).
scope_future_oriented_context(market_analysis, price_trend_direction).

%% --- Professional constraints on any future-oriented component ---
scope_professional_constraint(supportability).
scope_professional_constraint(market_evidence).
scope_professional_constraint(extraordinary_assumptions_or_hypothetical_conditions ↪
↪ _disclosed).
scope_professional_constraint(avoidance_of_unsupported_speculation).

%% --- Contrasts across the descriptive axes:
↪ scope_contrast(A,B,Dimension,Distinction) ---
scope_contrast(appraisal, quant_financial, orientation,
                evidentiary_vs_probabilistic).
scope_contrast(appraisal, quant_financial, temporal_mode,
                point_in_time_vs_distribution_over_horizon).
scope_contrast(appraisal, quant_financial, output_form,
                point_or_narrow_range_vs_probability_distribution).
scope_contrast(appraisal, quant_financial, purpose,
                market_value_vs_investment_worth).
scope_contrast(appraisal, quant_financial, skill_set,
                appraisal_licensing_toolkit_vs_advanced_statistical_toolkit).
scope_contrast(appraisal, quant_financial, typical_methods,
                sales_comparison_cost_income_vs_simulation_option_pricing_var).

%% --- The orienting question each population asks (verbatim from the passage) ---
scope_question(appraisal,
                'What is the most supportable market value indication as of the specified
                ↪ effective date, given current evidence and defined assumptions?').
scope_question(quant_financial,
                'What range of outcomes is likely over a future period, with what
                ↪ probabilities, and how should resources be allocated?').

%% --- Where the two converge (appraisal borrows distributional methods) ---
scope_convergence_area(complex_commercial_valuation).
scope_convergence_area(mass_appraisal).
scope_convergence_area(automated_valuation_models).
scope_convergence_area(institutional_portfolio_analysis).

```

5 Market Value × LTV as a Proxy for Foreclosure Value

The preceding sections set out what appraisal is for, what it produces, and where its doctrinal and regulatory boundaries lie; this section reaches the tension they have been building toward.

One of the deeper practical realities underlying mortgage lending and collateral analysis is that, in actual economic function, a market value appraisal used in mortgage underwriting often serves as an implicit proxy for expected collateral recoverability over some future holding period, even though formally the appraisal is framed as a present-market-value opinion as of a specific effective date.(Foster and Van Order 1984; Kau et al. 1995; Deng, Quigley, and Van Order 2000)

An 80% loan-to-value ratio is not arbitrary. Historically, it evolved partly as a risk buffer intended to protect lenders against:

- moderate market declines,
- foreclosure expenses,

- liquidation discounts,
- carrying costs,
- legal expenses,
- accrued interest,
- and uncertainty during the time required to dispose of collateral after default.(Foote, Gerardi, and Willen 2008; Qi and Yang 2009)

The buffer is also why the loan amount itself—the product of market value and the permitted loan-to-value ratio—can be read as the lender’s working estimate of recoverable foreclosure value: capping the loan at a fraction of market value is, in effect, a bet that forced-sale proceeds will not fall below the loan balance. How large the haircut *should* be, however, is far harder to pin down than the round 80% figure suggests. Estimates of the foreclosure discount vary widely across markets, methods, and periods; one frequently cited study of forced sales places it near 27% below comparable arm’s-length prices(Campbell, Giglio, and Pathak 2011), while other analyses—correcting for property condition, location, and selection—report materially different magnitudes.(Pennington-Cross 2006; Clauretie and Daneshvary 2009)

The conventional 80% threshold, by contrast, is essentially a single nationwide parameter, applied across enormously heterogeneous local markets and successive phases of the credit cycle. It cannot track any particular market’s discount, and so functions as a very rough, one-size-fits-all approximation rather than a precise mapping from market value to foreclosure recovery. If anything it is a thin one: a 20% haircut sits *below* the 27% discount that study reports, so the maximum conventional loan can exceed gross forced-sale proceeds even before the disposition costs enumerated above are subtracted.

Where borrower equity is too thin to constitute the buffer, mortgage insurance is substituted for it. This is best understood not as a policy dial but as a risk-allocation tradeoff: a segment of borrowers is asset-light yet income-stable, and the incremental default and loss risk of lending to them above 80% LTV is forecast and borne by an insurer—privately, through private mortgage insurance on a high-LTV conventional loan, or publicly, through the Federal Housing Administration. The market in which that tradeoff is routine, however, is a creation of federal housing policy: the government-sponsored enterprises that dominate conventional lending are barred by charter from purchasing loans above 80% LTV without such credit enhancement(United States Code 1970). The terms on which the insurance ends are likewise institutional choices rather than risk computations, and they differ sharply across programs.¹

So although the appraiser is officially estimating “current market value,” the lender is economically interpreting that value through a forward-looking risk lens. In effect, the lender is asking something closer to:

“If this borrower defaults sometime in the foreseeable future, is the collateral likely to remain sufficient to cover the outstanding debt and foreclosure-related losses?”

That is inherently a future-oriented question.

This rests on a deliberate conceptual separation between:

- the appraiser’s “current market value” opinion, and
- the lender’s practical use of that opinion as a forecast buffer against future collateral impairment.

Historically and legally, regulators attempted to keep appraisers from becoming speculative forecasters because:

¹Conventional borrower-paid private mortgage insurance terminates automatically at 78% LTV and may be requested at 80% under the Homeowners Protection Act of 1998.(United States Congress 1998) Federal Housing Administration premiums are stricter: for loans originated on or after June 3, 2013 with original loan-to-value above 90% (e.g., 3.5% down), the annual premium runs for the life of the loan, while loans at or below 90% cancel after eleven years.(U.S. Department of Housing and Urban Development 2013) Many FHA borrowers therefore shed mortgage insurance only by refinancing into a conventional loan near 80% LTV.

- speculative forecasting contributed to past lending crises,
- courts wanted appraisals tied to observable evidence,
- and banking regulators sought standardized, defensible valuation practices.

Thus appraisal doctrine evolved toward:

- present value,
- current market evidence,
- defined effective dates,
- and constrained assumptions.

Meanwhile, lenders, investors, and collateral analysts routinely use those same appraisals in probabilistic future-risk frameworks.

In reality, mortgage underwriting is an integrated system involving:

1. current market valuation,
2. future risk estimation,
3. default probability,
4. foreclosure timing,
5. liquidation severity,
6. macroeconomic expectations,
7. and portfolio stress analysis.

The appraiser formally contributes primarily to item (1), while the lender internally combines that result with the others.

The distinction becomes blurry in practice. If a lender would not make a loan unless it believed the collateral would likely preserve sufficient value into the future, then the appraisal indirectly functions as part of a future-value protection model, even if appraisal standards formally avoid describing it that way.

This tension has become even more pronounced with:

- AVMs,
- institutional portfolio analytics,
- securitization models,
- machine learning valuation systems,
- Basel capital modeling,
- and large-scale mortgage stress testing.

Modern collateral analytics increasingly treat property values probabilistically over time rather than as single-point static estimates. (Basel Committee on Banking Supervision 2017; Steurer, Hill, and Pfeifer 2021; Board of Governors of the Federal Reserve System 2021)

One could argue that traditional appraisal regulation reflects a historical compromise:

- appraisers provide disciplined, evidence-based present value anchors,
- while financial institutions assume responsibility for future-risk interpretation.

Whether that separation remains fully coherent in modern financial systems is a legitimate and increasingly debated question.

A practical implication follows for appraisal practice itself. Most appraisers are not aware of this collateral-valuation role—the lender’s use of market value as a forward-looking buffer is rarely visible from within the appraisal assignment—and so do not treat their market value conclusions with the caution toward future value trends that the role warrants. Recognizing how the present-value opinion is actually consumed is a first step toward closing that gap, and an area this account is meant to open for further work.

```
%% appraisal_proxy.pl
%%
```

```

%% A Prolog knowledge base encoding the thesis that market value
%% appraisals, while formally framed as present-value opinions, function
%% in practice as implicit proxies for future collateral recoverability
%% within mortgage underwriting and lender risk management.

:- module(appraisal_proxy,
  [ % --- central thesis ---
    proxy_thesis/1

    % --- LTV-as-buffer mechanism ---
    , proxy_ltv_buffer_against/1
    , proxy_historical_ltv_threshold/1

    % --- formal vs practical interpretation ---
    , proxy_formal_framing/1
    , proxy_practical_interpretation/1
    , proxy_underlying_question/1

    % --- the artificial separation ---
    , proxy_separation_party/2          % Party, Role
    , proxy_doctrine_practice_gap/2    % FormalSide, PracticalSide

    % --- historical compromise ---
    , proxy_historical_reason/1
    , proxy_doctrine_emphasis/1
    , proxy_routine_practical_use/1

    % --- modern intensifiers ---
    , proxy_modern_driver/1
    , proxy_modern_treatment/1

    % --- responsibility allocation ---
    , proxy_appraiser_responsibility/1
    , proxy_lender_responsibility/1

    % --- meta-claim about coherence ---
    , proxy_open_question/1

    % --- practical implication for appraisal practice ---
    , proxy_practical_implication/1
    , proxy_appraiser_blindspot/1
    , proxy_recommended_practice/1
    , proxy_further_work/1

    % --- underwriting system view ---
    , underwriting_component/2          % Number, Component
    , underwriting_responsibility/2    % Component, Party
  ]).

:- discontiguous proxy_thesis/1.
:- discontiguous underwriting_component/2.

%% =====
%% PART 1: THE CENTRAL THESIS
%% =====

proxy_thesis(

```

```

    'A market value appraisal used in mortgage underwriting often serves as an
    ↪ implicit proxy for expected collateral recoverability over a future holding
    ↪ period.').
proxy_thesis(
    'The appraisal is formally framed as a present-market-value opinion as of a
    ↪ specific effective date.').
proxy_thesis(
    'The lender economically interprets the appraisal through a forward-looking
    ↪ risk lens.').
proxy_thesis(
    'There is a deliberate conceptual separation between the appraiser''s
    ↪ current-market-value opinion and the lender''s use of it as a forecast
    ↪ buffer.').
proxy_thesis(
    'The appraisal indirectly functions as part of a future-value protection model,
    ↪ even though appraisal standards formally avoid describing it that way.').
proxy_thesis(
    'Whether the separation between appraisal doctrine and lender practice remains
    ↪ fully coherent in modern financial systems is an open and increasingly
    ↪ debated question.').

%% =====
%% PART 2: THE LTV-AS-BUFFER MECHANISM
%% =====

proxy_historical_ltv_threshold(eighty_percent).

proxy_ltv_buffer_against(moderate_market_declines).
proxy_ltv_buffer_against(foreclosure_expenses).
proxy_ltv_buffer_against(liquidation_discounts).
proxy_ltv_buffer_against(carrying_costs).
proxy_ltv_buffer_against(legal_expenses).
proxy_ltv_buffer_against(accrued_interest).
proxy_ltv_buffer_against(uncertainty_during_disposition).

%% =====
%% PART 3: FORMAL FRAMING VS. PRACTICAL INTERPRETATION
%% =====

proxy_formal_framing(present_market_value_opinion).
proxy_formal_framing(opinion_as_of_specific_effective_date).
proxy_formal_framing(grounded_in_current_market_evidence).

proxy_practical_interpretation(forward_looking_risk_lens).
proxy_practical_interpretation(forecast_buffer_against_future_impairment).
proxy_practical_interpretation(input_to_future_collateral_recoverability_estimate).

proxy_underlying_question(
    'If this borrower defaults sometime in the foreseeable future, is the
    ↪ collateral likely to remain sufficient to cover the outstanding debt and
    ↪ foreclosure-related losses?').

%% =====
%% PART 4: THE ARTIFICIAL SEPARATION
%% =====

proxy_separation_party(appraiser, opinion_of_current_market_value).
proxy_separation_party(lender, forecast_buffer_against_future_impairment).

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proxy_separation_party(appraiser, evidence_based_present_value_anchor).
proxy_separation_party(lender, future_risk_interpretation).

proxy_doctrine_practice_gap(present_market_value_opinion,
                             implicit_future_value_proxy).
proxy_doctrine_practice_gap(opinion_as_of_effective_date,
                             forecast_over_foreseeable_holding_period).
proxy_doctrine_practice_gap(evidence_based_present_anchor,
                             future_risk_buffer).
proxy_doctrine_practice_gap(static_single_point_estimate,
                             probabilistic_value_over_time).

%% =====
%% PART 5: HISTORICAL COMPROMISE
%% =====

proxy_historical_reason(speculative_forecasting_contributed_to_past_crises).
proxy_historical_reason(courts_required_observable_evidence).
proxy_historical_reason(regulators_sought_standardized_defensible_practices).

proxy_doctrine_emphasis(present_value).
proxy_doctrine_emphasis(current_market_evidence).
proxy_doctrine_emphasis(defined_effective_dates).
proxy_doctrine_emphasis(constrained_assumptions).

proxy_routine_practical_use(lenders_use_in_probabilistic_future_risk_frameworks).
proxy_routine_practical_use(investors_use_in_probabilistic_future_risk_frameworks).
proxy_routine_practical_use(collateral_analysts_use_in_probabilistic_future_risk_f
↪ rameworks).

%% =====
%% PART 6: MODERN INTENSIFIERS
%% =====

proxy_modern_driver(avms).
proxy_modern_driver(institutional_portfolio_analytics).
proxy_modern_driver(securitization_models).
proxy_modern_driver(machine_learning_valuation_systems).
proxy_modern_driver(basel_capital_modeling).
proxy_modern_driver(large_scale_mortgage_stress_testing).

proxy_modern_treatment(probabilistic_over_time).
proxy_modern_treatment(distributional_rather_than_point_estimate).
proxy_modern_treatment(dynamic_rather_than_static).

%% =====
%% PART 7: ALLOCATION OF RESPONSIBILITY UNDER THE COMPROMISE
%% =====

proxy_appraiser_responsibility(disciplined_present_value_anchor).
proxy_appraiser_responsibility(evidence_based_valuation).
proxy_appraiser_responsibility(current_market_value_opinion).

proxy_lender_responsibility(future_risk_interpretation).
proxy_lender_responsibility(default_probability_estimation).
proxy_lender_responsibility(foreclosure_timing_estimation).
proxy_lender_responsibility(liquidation_severity_estimation).
proxy_lender_responsibility(portfolio_stress_analysis).

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proxy_lender_responsibility(macroeconomic_expectation_integration).

%% =====
%% PART 8: OPEN QUESTION (META-CLAIM)
%% =====

proxy_open_question(
    'Whether the separation between disciplined present-value appraisal and
    ↪ lender-side future-risk interpretation remains fully coherent in modern
    ↪ financial systems.').
proxy_open_question(
    'Whether modern probabilistic-over-time collateral analytics make the
    ↪ formal/practical separation untenable in some sectors.').

%% =====
%% PART 9: THE INTEGRATED MORTGAGE UNDERWRITING SYSTEM
%% =====

underwriting_component(1, current_market_valuation).
underwriting_component(2, future_risk_estimation).
underwriting_component(3, default_probability).
underwriting_component(4, foreclosure_timing).
underwriting_component(5, liquidation_severity).
underwriting_component(6, macroeconomic_expectations).
underwriting_component(7, portfolio_stress_analysis).

underwriting_responsibility(current_market_valuation, appraiser).
underwriting_responsibility(future_risk_estimation, lender).
underwriting_responsibility(default_probability, lender).
underwriting_responsibility(foreclosure_timing, lender).
underwriting_responsibility(liquidation_severity, lender).
underwriting_responsibility(macroeconomic_expectations, lender).
underwriting_responsibility(portfolio_stress_analysis, lender).

%% =====
%% PART 10: PRACTICAL IMPLICATION FOR APPRAISAL PRACTICE
%% =====

proxy_practical_implication(
    'Most appraisers are not aware that market value functions, via the
    ↪ loan-to-value ratio, as a proxy for future foreclosure value.').
proxy_practical_implication(
    'The lender''s forward-looking use of market value is rarely visible from
    ↪ within the appraisal assignment.').
proxy_practical_implication(
    'Appraisers therefore do not treat market value conclusions with the caution
    ↪ toward future value trends that the collateral-valuation role warrants.').

proxy_appraiser_blindspot(collateral_valuation_role).
proxy_appraiser_blindspot(forward_looking_use_of_market_value).
proxy_appraiser_blindspot(market_value_as_ltv_proxy_for_foreclosure_value).

proxy_recommended_practice(recognize_how_present_value_opinion_is_consumed).
proxy_recommended_practice(treat_market_value_with_caution_re_future_trends).

proxy_further_work(closing_the_doctrine_practice_gap).
proxy_further_work(equipping_appraisers_for_the_collateral_valuation_perspective).

```

6 Conclusion

The five passages encoded in the preceding knowledge bases describe a single profession from five complementary vantage points. Taken in isolation, each passage reads as a self-contained account: the social and public-interest stakes they carry, the economic functions appraisals support, their operational role in collateral risk analysis, the regulatory boundary separating them from adjacent quantitative work, and the tension between their formal framing and their practical use. Taken together, and with the structure made explicit in Prolog, they describe something more interesting — a profession whose official doctrine and economic function have been deliberately held apart, and whose internal coherence is increasingly tested by the analytic tools now applied to its outputs.

The first three knowledge bases share a common schema: `effect(Quality, Horizon, Domain, Effect)`. Each frames appraisal quality as a causal input whose consequences propagate across short-, medium-, and long-term horizons, differing only in the domain through which those consequences are read. The economic lens reads them through credit markets, investment allocation, taxation, and capital formation; the social lens reads them through equity, public confidence, and community outcomes; the collateral lens reads them through underwriting, portfolio management, and financial system stability. The shared schema is not a coincidence. It reflects a substantive claim that runs through all three passages: the quality of valuation work has consequences, those consequences scale with time, and the same underlying failure modes manifest differently depending on whose interests are foregrounded. Shared atoms on the argument side of the predicates — the quality and horizon vocabularies in particular — make the three vocabularies joinable, so that a single failure such as systematic overvaluation can be traced simultaneously through economic mispricing, social inequity, and collateral mismeasurement.

The fourth knowledge base shifts register. It does not describe consequences of appraisal quality; it describes what appraisal *is*, methodologically and legally. Its predicates are taxonomic rather than causal, and its inferential machinery answers questions about jurisdiction rather than impact. This shift is necessary because the consequential framing of the first three passages presupposes a definition of the activity being evaluated, and that definition is itself contested. The scope predicates record what appraisers do — evidence-based present-value opinions, with narrowly bounded future-oriented components — while the regulation predicates record the conditions under which that activity falls within licensed practice. The forward-chaining rules (`requires_license/1`, `exempt_from_appraisal_license/1`, `regulated_appraisal/1`) provide a mechanism for asking whether a given piece of valuation work falls inside or outside the regulated perimeter, a question that the first three knowledge bases assume has already been answered.

The fifth knowledge base advances a thesis. Where the others describe, classify, or trace consequences, the proxy knowledge base argues that the careful doctrinal separation between present-value appraisal and future-value forecasting — the separation the regulation knowledge base documents — is in tension with the actual economic function of appraisals in mortgage lending. The 80% loan-to-value convention, the seven specific risks it buffers against, the underlying lender question recorded verbatim (“If this borrower defaults sometime in the foreseeable future, is the collateral likely to remain sufficient . . .”), and the integrated seven-component underwriting system all support the same claim: the appraisal is formally a present-value opinion and economically a future-value buffer. The historical compromise that produced this arrangement — appraisers as disciplined present-value anchors, lenders as the locus of future-risk interpretation — was a defensible response to the conditions under which appraisal licensing emerged, but the modern intensifiers enumerated in the passage (AVMs, machine learning valuation systems, Basel capital modeling, securitization analytics, large-scale stress testing) treat property values probabilistically over time. Those tools draw doctrinally separated layers back into a single computational pipeline, and the conceptual separation between layers

becomes harder to sustain as a result.

Whether that reconciliation is achievable, and on what terms, is the question with which the proxy passage closes. The knowledge bases do not answer it. They do, however, provide an explicit, queryable account of the considerations relevant to answering it: the consequences of valuation quality across horizons and domains, the jurisdictional boundary that determines which consequences fall within regulated practice, and the structural reasons that boundary is now under pressure. That account is the foundation on which more specific arguments — about methodology, about standards reform, about the relationship between appraisal practice and the broader system of quantitative valuation — can be built.

Notes on the knowledge representation

Three structural patterns are worth recording explicitly, since they emerged from the encoding process rather than from any single passage.

First, the family of knowledge bases is not flat. Three of the five share a schema; one provides the jurisdictional qualifications that determine when that schema applies; one advances a thesis about the gap between formal framing and economic function. A bridge layer combining all five does not treat them as five columns of the same matrix. It treats the first three as describing consequences, the fourth as constraining where those descriptions are operative, and the fifth as identifying where the constraint itself is under pressure. This asymmetric structure is a feature rather than a defect: it mirrors the actual organization of professional practice, in which descriptive claims, jurisdictional claims, and critical claims occupy genuinely different epistemic roles.

*Second, the prefix discipline that distinguishes the modules (*economic_*, *social_*, *collateral_*, *scope_/regulation_*, *proxy_/underwriting_*) does real work only where there is collision risk.* Predicates with direct counterparts across modules earn their prefix; predicates unique to a single conceptual domain do not. Shared value vocabulary on the argument side — the quality, horizon, and domain atoms — is precisely what allows the modules to communicate, and prefixing those values would defeat that. The pattern that emerged is general: prefix on the predicates, shared atoms on the arguments, with selective prefixing rather than uniform prefixing where the predicate is unique to one lens.

Third, the central tension identified in the proxy knowledge base is closely related to, but distinct from, the regulatory asymmetry identified in the scope/regulation knowledge base. The two are recorded through parallel two-place predicates — **regulatory_asymmetry/2** and **proxy_doctrine_practice_gap/2** — with deliberately different names because they describe different axes of the same underlying arrangement. The regulatory asymmetry concerns who is regulated and how heavily; the doctrine-practice gap concerns what is formally said about the appraiser's product versus what is economically done with it. The two tensions reinforce each other. Regulation pushes appraisers toward present-value doctrine; economic function pulls their output toward future-value use. The combined picture is one of a profession whose official self-description is increasingly difficult to reconcile with the analytic pipelines its products feed.

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