

房地產估價中的理論與實務落差：功能、邊界與張力的結構化闡述（繁體中文版）

繁體中文譯本，由人工智慧輔助翻譯並經編輯部審校；英文版為權威版本。

William Bert Craytor

第 1 卷 第 1 期 · 2026 年 5 月 21 日

發表於 2026 年 7 月 1 日

DOI: [10.67330/x7pbf13](https://doi.org/10.67330/x7pbf13)

© 2026 William Bert Craytor. Published by Pacific Vista Net.

本開放取用文章依據 [創用 CC 姓名標示 4.0 國際授權條款 \(CC BY 4.0\)](#) 的條款發布。

摘要。房地產估價事關重大公共利益，但其官方理論——以過去與當前條件下的市場價值意見為核心——與估價產品在當代金融流程中的實際用途之間的張力正日益加劇。本文分五個階段建構這一論證，每個階段均配有明確、可查詢的 Prolog 知識庫：前兩個階段確立估價所承擔的社會與經濟功能；第三個階段指出其主要最終產品——市場價值意見；第四個階段考察估價相對於量化預測與金融預測的時間取向和方法論取向，以及將兩者分隔開來的監管邊界。這些內容匯聚為第五個階段的核心主張：在抵押貸款中，按貸款價值比折算的市場價值實際上充當著未來法拍價值的隱性替代指標——這是一種面向未來的用途，而現值理論並不予以承認。許多估價師並未意識到這一擔保品估值角色，因而未能以應有的審慎態度對待市場價值的未來走勢——本文旨在揭示這一問題，並歡迎後續研究。

關鍵詞：房地產估價，市場價值，估價理論，知識表示，估價準則，法拍價值

目錄

1 社會重要性	1
2 經濟重要性	6
3 市場價值估計作為估價最終產品的重要性	10
4 估價活動的時間取向	13
5 市場價值 × LTV 作為法拍價值的替代指標	19
6 結論	25

1 社會重要性

房地產及其他資產估價透過協助買方、賣方、貸款機構、保險公司、投資人、法院、稅務機關以及社會大眾，就財產及其他形式財富的移轉、融資、課稅與管理作出知情且公平的決定，發揮著不可或缺的社會與經濟功能。高品質的估價以證據、分析與專業判斷為基礎，提供獨立且論據充分的價值意見，從而促進市場透明度、公眾信心、資本的高效配置以及金融機構的穩定。(LaCour-Little and Malpezzi 2003; K'Akumu and Larsen 2024; Hendershott and Kane 1995; Lee, Peng, and Liao 2020)

相反地，低品質的估價可能在多個時間層面造成嚴重後果。短期內，不準確的估價可能使個別買方或賣方因買價過高、賣價過低、稅負過重或不當的放款決定而蒙受直接經濟損失。中期內，系統性的估價缺陷可能扭曲市場訊號、損害授信審核、助長投機行為、導致不公平的課稅或保險承保，並加劇訴訟與交易層面的不信任。長期而言，估價品質的持續缺失可能動搖公

眾對市場與制度的信心，導致金融不穩定、資源錯置、社區衰敗或過度投資，並造成波及家庭、企業與社區的更廣泛的社會不公。(LaCour-Little and Malpezzi 2003; Mayer and Nothhaft 2022)

由於房地產及其他資產往往佔個人、企業與公共財富的相當大比重，估價品質不僅僅是私人層面的技術問題，而是關乎經濟韌性、公平與長期公共福祉的重大公共利益事項。(Mayer and Nothhaft 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
    ]).

:- discontiguous social_effect/4.
:- discontiguous 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 經濟重要性

房地產及其他資產估價透過支持信用市場、投資決策、稅制、財務報告、保險承保、遺產管理、公司交易以及公共政策規劃的高效運作，發揮著基礎性的經濟作用。可靠的估價有助於建立可信的擔保品價值與市場價值衡量標準，使資本得以在借款人、貸款機構、投資人、政府與企業之間更有效率地流動。(LaCour-Little and Malpezzi 2003; Ebrahim and Hussain 2010)

短期內，準確的估價可以降低交易不確定性、改善放款決策、促進公平協商，並有助於防止因高估或低估而產生的直接經濟損失。中期內，估價品質透過影響抵押貸款風險、投資配置、租稅公平、保險充足性以及市場參與者的定價行為，左右著更廣泛市場的穩定與效率。在此期間，薄弱或存在系統性偏誤的估價可能助長資產泡沫膨脹、損害放款組合、扭曲開發誘因，並加大違約或訴訟風險。(LaCour-Little and Malpezzi 2003; Hendershott and Kane 1992; Griffin and Maturana 2016)

長期來看，估價品質的累積經濟後果更為顯著，影響著資本形成模式、基礎建設投資、跨世代財富移轉、公共收入、住宅可負擔性以及整個金融體系的韌性。估價實務的長期缺陷可能導致資本的慢性錯置、銀行體系不穩定、投資人信心下降以及土地與生產性資產的低效率利用；而嚴格的估價準則則有助於支撐穩定的市場、穩健的經濟規劃與長期經濟成長。(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
    ]).
```

```

:- discontinuous economic_effect/4.
:- discontinuous 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 市場價值估計作為估價最終產品的重要性

市場價值估價在擔保品風險分析中發揮著重要作用，因為它就財產或資產在正常市場條件下可能實現的價格提供了專業形成的估計，從而為評估信用曝險與潛在法拍結果的貸款機構、投資人和擔保品分析師提供了基礎性基準。(Agarwal, Ben-David, and Yao 2015) 儘管由於不利的銷售條件、縮短的出售期間、法律費用、實體耗損或負面市場情緒，法拍價值 (foreclosure value) 或清算價值可能與市場價值相差甚遠，擔保品分析師仍經常以市場價值估價作為在壓力情境下估算回收潛力的起點。(Campbell, Giglio, and Pathak 2011; Pennington-Cross 2006; Clauretie and Daneshvary 2009)

透過分析市場價值、貸款餘額、貸款價值比 (loan-to-value ratio, LTV)、市場趨勢、房產狀況、流動性以及當地供需狀況之間的關係，擔保品分析師評估借款人違約情況下損失發生的可能性及其嚴重程度。(Qi and Yang 2009)

短期內，準確的市場價值估價有助於貸款機構作出審慎的授信決定並建立適當的擔保品安全邊際。中期內，它們透過協助機構評估經濟循環中擔保品充足性的變化，支持投資組合風險管理、貸款證券化、準備金配置與法令遵循。長期而言，持續可靠的估價實務透過降低過度槓桿、擔保不足的放款以及抵押資產系統性錯誤定價的風險，為金融體系穩定作出貢獻——這些風險會在市場承壓時期放大法拍損失和更廣泛的經濟動盪。(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
    ]).

:- disjoint collateral_effect/4.
:- disjoint 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 估價活動的時間取向

估價師通常就某一特定生效日期形成時點性的市場價值意見——回顧性的（過去）、當前的，或在明確限制下前瞻性的（未來）——而不是對較長時間區間作出機率性預測。這種時間與方法論取向是受監管的估價實務與量化分析師、金融分析師、投資分析師及經濟學家的工作之間的核心區別之一。（Quan and Quigley 1991）

在大多數估價業務中，特別是依據《專業估價實務統一準則》（Uniform Standards of Professional Appraisal Practice, USPAP）或《國際評價準則》（International Valuation Standards, IVS）等準則進行的市場價值估價，估價師給出的是一個經調和的點估計（或在允許的情形下給出一個窄幅區間），錨定於某一生效日期的可觀察市場證據、當時的市場條件和公認的方法。USPAP 明確允許價值結論以具體金額、數值區間或與某一基準的關係的形式給出，但經調和的意見仍然是與該日期掛鉤的一個可信的點位指示。（The Appraisal Foundation 2024; International Valuation Standards Council 2025）

儘管估價師必然會納入市場參與者對趨勢、供需、折舊、資本化率或折現率以及去化速度的合理預期，但這樣做是為了支持生效日期上有市場依據的價值，而非預測投機性波動。前瞻性價值意見（例如開發案完工後的穩定價值）需要明示的特殊假設或假定條件，並且仍被限定於一個明確的未來生效日期，且須有源自市場的支持。

相比之下，量化分析師、金融分析師與投資分析師經常透過涵蓋各時間區間內一系列可能結果的估計來處理不確定性，運用機率分布、蒙地卡羅模擬、情境分析、敏感度檢定或風險值（Value at Risk, VaR）等指標。他們的關注點往往是預期的未來表現、經風險調整的報酬，或

特定主體在不同期限內的投資價值，而不是某一日期上的單一市場價值點位。(Hull 2018)

這類工作還預設了估價師執照既不要求也不認證的技術能力。例如，擬合多元自適應迴歸樣條 (MARS) 模型需要控制模型複雜度的判斷力，使得強勁的樣本內擬合 (高 R^2) 不是以過擬合為代價換來的，而是能夠延續到保留資料上 (高交叉驗證 R^2)，而這又以對底層演算法的切實理解為前提。(Friedman 1991; Steurer, Hill, and Pfeifer 2021) 除這類量化能力之外，這項工作還要求具備處理高度結構化概念、辨析細微語意差別以及吸收陌生方法的概念能力。這些是技能而非資格：持照估價師可能具備它們，無照分析師也可能欠缺它們——這正是它們本身並不能決定某項任務落在監管界線哪一側的原因。

估價師也可以從事有限的面向未來的工作，例如在折現現金流分析中預測收入流、空置率、費用和復歸價值，或在開發或訴訟情境中估計前瞻性價值。只要立足於當前市場證據，並遵循強調可支持性、避免無依據投機的專業準則，這些內容就仍處於估價的邊界之內。(Diaz and Wolverton 1998; Gallimore 1996; Crosby, Lizieri, and McAllister 2010) 現代估價實務越來越多地融合統計工具、情境考量與風險分析——尤其是在大量估價、自動估價模型或投資組合業務中——但核心交付成果通常仍是時點性的市場價值意見。(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)

可以這樣概括：估價實務主要是證據導向的，面向從過去到現在（或有限前瞻）的點估計；而金融與量化分析則更具機率性、分布性，並且明確面向各個時間跨度上的未來。(Geltner 1991) 估價師問的是：“在現有證據和既定假設下，截至指定生效日期，最有依據的市場價值指示是什麼？”金融與量化分析師則更常問：“未來一段時期內可能出現何種結果區間、機率幾何，以及應如何配置資源？”

這條邊界並非絕對，並且隨著市場複雜性的提高而持續演變。儘管如此，在目的（市場價值與投資價值之別）、證據要求和監管框架方面，根本性差異依然存在。

然而，真正起作用的界線不是由技能而是由法律劃定的：決定性的問題只是某項任務在法律上是否要求持有估價師執照。量化分析師、金融分析師、經濟學家、投資分析師、投資組合經理人及相關專業人士可以在不持有房地產估價師執照的情況下，合法地估計、預測、建模或分析未來資產價值——包括分布式或區間式的預測——只要該工作不構成受監管的估價。(Murphy 2012)

關鍵區別在於：

1. 價值類型（例如市場價值點估計，還是投資價值或機率性預測）；
2. 時間焦點（特定生效日期，還是某一時間區間或期限）；
3. 輸出形式（點估計或窄幅區間，還是完整的機率分布）；
4. 預期用途以及該工作是否以估價的名義出具；以及
5. 是否涉及要求遵守 USPAP 等準則的受監管放款或法律情境。

這一框架在很大程度上源於美國 1989 年《金融機構改革、復甦與執行法》(FIRREA) 等銀行監管法規，其目的在於確保聯邦相關交易能夠獲得可信、獨立的市場價值意見。(United States Congress 1989; K'Akumu and Larsen 2024) 許多高度複雜的估值活動——股票研究目標價、可行性研究、投資組合風險建模、選擇權定價或預測分析——都不在執照管轄範圍之內，因為它們服務於投資、預測或諮詢目的，而非受監管的估價職能。

```
%% 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
    ] ).

:- disjoint regulation_unlicensed_activity/2.
:- disjoint regulation_licensed_activity/2.
:- disjoint 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_app
    ↪ raisal).

```

```

%% --- 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 市場價值 × LTV 作為法拍價值的替代指標

前面各節闡明了估價的用途、估價的產出，以及估價的理論邊界與監管邊界之所在；本節則觸及它們一路鋪陳而來的那個張力。

抵押貸款與擔保品分析背後一個更深層的實際現實是：就實際經濟功能而言，用於抵押貸款授信審核的市場價值估價往往充當著對未來某一持有期內預期擔保品可回收性的隱性替代指標，儘管在形式上該估價被表述為截至特定生效日期的當前市場價值意見。(Foster and Van Order 1984; Kau et al. 1995; Deng, Quigley, and Van Order 2000)

80% 的貸款價值比並非隨意設定。從歷史上看，它在一定程度上是作為保護貸款機構的風險緩衝而演變形成的，用以抵禦：

- 溫和的市場下行、
- 法拍費用、
- 清算折價、
- 持有成本、
- 法律費用、
- 應計利息、
- 以及違約後處分擔保品所需時間內的不確定性。(Foote, Gerardi, and Willen 2008; Qi and Yang 2009)

這一緩衝也解釋了為何貸款金額本身——市場價值與允許的貸款價值比之乘積——可以被解讀為貸款機構對可回收法拍價值的工作估計：將貸款上限設定為市場價值的某一比例，實際上是在押注強迫出售所得不會跌破貸款餘額。然而，這一折減應當有多大，遠比 80% 這個整數所暗示的更難確定。對法拍折價的估計因市場、方法和時期而差異巨大；一項被頻繁引用的強迫出售研究將其定在比可比正常交易價格低約 27% 的水準 (Campbell, Giglio, and Pathak 2011)，而其他分析——在校正房產狀況、區位和樣本選擇之後——報告的幅度則大不相同。(Pennington-Cross 2006; Clauretie and Daneshvary 2009)

相比之下，常規的 80% 門檻本質上是一個全國統一的單一參數，被套用於千差萬別的地方市場和信用循環的先後階段。它無法追蹤任何特定市場的折價，因此只是一個非常粗略的、一體適用的近似，而非從市場價值到法拍回收額的精確映射。真要說的話，它還是一個偏薄的緩衝：20% 的折減低於上述研究報告的 27% 折價，因此即便尚未扣除前文列舉的處分成本，常規貸款的最高額度就可能超過強迫出售的毛收入。

在借款人權益過薄、不足以構成這一緩衝的情形下，便以抵押貸款保險取而代之。對此最好的理解不是把它當作一個政策旋鈕，而是一種風險分配的權衡：有一部分借款人資產薄弱但收入穩定，向他們承作 LTV 超過 80% 的貸款所帶來的增量違約與損失風險由保險人預測並承擔——民間管道是高 LTV 常規貸款上的私人抵押貸款保險，公共管道則是聯邦住宅管理局 (Federal Housing Administration)。然而，使這種權衡成為常態的市場本身是聯邦住宅政策的產物：主導常規貸款市場的政府贊助企業依其特許章程被禁止在缺乏此類信用增強的情況下購買 LTV 超過 80% 的貸款 (United States Code 1970)。保險終止的條件同樣是制度選擇而非風險計算的結果，並且在不同方案之間差異懸殊。¹

因此，儘管估價師在官方口徑上估計的是“當前市場價值”，貸款機構在經濟上卻是透過一個前瞻性風險視角來解讀這一價值的。實際上，貸款機構間的問題更接近於：

“如果這位借款人在可預見的未來某個時候違約，擔保品是否仍可能足以涵蓋未償債務和與法拍相關的損失？”

這在本質上是一個面向未來的問題。

這有賴於以下兩者之間刻意的概念區分：

- 估價師的“當前市場價值”意見，以及
- 貸款機構在實務中將該意見用作抵禦未來擔保品減值的預測緩衝。

從歷史與法律上看，監管機關曾力圖防止估價師變成投機性預測者，因為：

- 投機性預測曾是以往放款危機的成因之一，
- 法院希望估價與可觀察的證據掛鉤，
- 而銀行監管機關則尋求標準化、可辯護的估價實務。

於是，估價理論朝著以下方向演進：

¹根據 1998 年《屋主保護法》(Homeowners Protection Act)，常規貸款中由借款人支付的私人抵押貸款保險在 LTV 降至 78% 時自動終止，在 80% 時可申請終止。(United States Congress 1998) 聯邦住宅管理局的保費規則更為嚴格：對於 2013 年 6 月 3 日及以後承作、原始貸款價值比高於 90% (例如頭期款 3.5%) 的貸款，年度保費貫穿貸款整個存續期，而 LTV 不高於 90% 的貸款則在十一年後取消。(U.S. Department of Housing and Urban Development 2013) 因此，許多 FHA 借款人只能透過轉貸改為接近 80% LTV 的常規貸款來擺脫抵押貸款保險。

- 現值、
- 當前市場證據、
- 明確的生效日期、
- 以及受約束的假設。

與此同時，貸款機構、投資人和擔保品分析師卻在機率性的未來風險框架中例行使用這些同樣的估價。

現實中，抵押貸款授信審核是一個綜合系統，涉及：

1. 當前市場估值、
2. 未來風險估計、
3. 違約機率、
4. 法拍時點、
5. 清算損失嚴重度、
6. 總體經濟預期、
7. 以及投資組合壓力分析。

估價師正式貢獻的主要是第 (1) 項，而貸款機構在內部將這一結果與其餘各項相結合。

這一區分在實務中變得模糊。如果貸款機構只有在相信擔保品未來大機率能保有足夠價值時才肯放款，那麼估價實際上就間接地充當了未來價值保護模型的一部分——即使估價準則在正式表述上迴避這樣描述它。

隨著以下因素的出現，這一張力愈發突出：

- 自動估價模型 (AVM)、
- 機構投資組合分析、
- 證券化模型、
- 機器學習估值系統、
- 巴塞爾資本建模、
- 以及大規模抵押貸款壓力測試。

現代擔保品分析日益將財產價值視為隨時間變化的機率量，而非單點靜態估計。(Basel Committee on Banking Supervision 2017; Steurer, Hill, and Pfeifer 2021; Board of Governors of the Federal Reserve System 2021)

可以認為，傳統的估價監管反映了一種歷史性妥協：

- 估價師提供有紀律的、基於證據的現值之錨，
- 而金融機構承擔未來風險解讀的責任。

這種分工在現代金融體系中是否仍然完全自治，是一個正當且日益受到討論的問題。

由此可以得出對估價實務本身的一個現實啟示。大多數估價師並未意識到這一擔保品估值角色——貸款機構將市場價值用作前瞻性緩衝的做法在估價業務內部很難看到——因而沒有以該角色所要求的、對未來價值走勢的審慎態度來對待自己的市場價值結論。認識到現值意見實際上是怎麼被使用的，是彌合這一落差的第一步，也是本文希望為後續研究開啟的領域。

```
%% 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).
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).
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 結論

前述知識庫所編碼的五段論述，從五個互補的視角描述了同一個職業。孤立地看，每段論述都是一份自成一體的闡述：它們所承載的社會與公共利益關切、估價所支持的經濟功能、其在擔保品風險分析中的操作角色、將其與相鄰量化工作分隔開來的監管邊界，以及其正式表述與實際用途之間的張力。合在一起，並藉助 Prolog 將結構顯性化之後，它們描述的是某種更有意味的東西——一個其官方理論與經濟功能被刻意分置的職業，其內在自洽性正日益受到如今施加於其產出之上的分析工具的考驗。

前三個知識庫共享一個共同模式：effect(Quality, Horizon, Domain, Effect)。每一個都將估價品質框定為一種因果輸入，其後果在短期、中期與長期跨度上傳播，區別僅在於解讀這些後果所經由的領域。經濟視角透過信用市場、投資配置、租稅和資本形成來解讀；社會視角透過公平、公眾信心和社區結果來解讀；擔保品視角透過授信審核、投資組合管理和金融體系穩定來解讀。共享模式並非巧合。它反映了貫穿三段論述的一個實質性主張：估值工作的品質是有後果的，這些後果隨時間放大，而同樣的底層失效模式會因所關注利益主體的不同而以不同方式顯現。謂詞參數側的共享原子——尤其是品質與時間跨度詞彙——使三套詞彙表得以互通，從而像系統性高估這樣的單一失效能夠同時經由經濟上的錯誤定價、社會上的不公與擔保品上的錯誤計量得到追蹤。

第四個知識庫轉換了論域。它描述的不是估價品質的後果，而是估價在方法論和法律意義上是什麼。其謂詞是分類性的而非因果性的，其推理機制回答的是管轄問題而非影響問題。這一轉換是必要的，因為前三段論述的後果式框架預設了對被評價活動的定義，而這一定義本身是有爭議的。scope 謂詞記錄估價師做什麼——基於證據的現值意見，輔以邊界狹窄的前瞻性成分——而 regulation 謂詞記錄該活動落入持照執業範圍的條件。前向鏈推理規則(requires_license/1、exempt_from_appraisal_license/1、regulated_appraisal/1)提供了一種機制，用以詢問某項估值工作落在受監管邊界之內還是之外——這個問題是前三個知識庫預設已經得到回答的。

第五個知識庫提出了一個論題。其他知識庫或描述、或分類、或追蹤後果，而 proxy 知識庫則論證：現值估價與未來價值預測之間審慎的理論分隔——即 regulation 知識庫所記錄的那種分隔——與估價在抵押貸款中的實際經濟功能存在張力。80% 的貸款價值比慣例、它所緩衝的七類具體風險、逐字記錄的貸款機構的底層問題（“如果這位借款人在可預見的未來某個時候違約，擔保品是否仍可能足以...”），以及由七個組成部分構成的綜合授信審核系統，都支持同一個主張：估價在形式上是現值意見，在經濟上是未來價值緩衝。促成這一安排的歷史性妥協——估價師充當有紀律的現值之錨，貸款機構充當未來風險解讀的中樞——在估價執照制度形成的歷史條件下是一種可以辯護的因應，但文中列舉的現代強化因素（AVM、機器學習估值系統、巴塞爾資本建模、證券化分析、大規模壓力測試）將財產價值作隨時間變化的機率化處理。這些工具把在理論上被分隔的層次重新拉回同一條運算流程，層與層之間的概念分隔也因此愈發難以維繫。

這種調和是否可以實現、以何種條件實現，正是 proxy 段落收束時提出的問題。這些知識庫並未回答它。但它們確實為回答該問題提供了一份明確、可查詢的相關考量清單：估值品質在各時間跨度與領域中的後果、決定哪些後果落入受監管實務的管轄邊界，以及該邊界如今承壓的結構性原因。這份闡述是進一步建構更具體論證——關於方法論、關於準則改革、關於估價實務與更廣泛的量化估值體系之間關係——的基礎。

關於知識表示的說明

有三個結構性模式值得明確記錄，因為它們產生於編碼過程本身，而非源自任何單獨一段論述。

第一，這一知識庫家族並不是扁平的。五個知識庫中有三個共享同一模式；一個提供決定該模式何時適用的管轄性限定；一個就正式表述與經濟功能之間的落差提出論題。將五者結合的橋接層並不把它們當作同一矩陣的五個直欄。它把前三者視為對後果的描述，把第四個視為對這些描述在何處有效的約束，把第五個視為對該約束本身承壓之處的識別。這種非對稱結構是特性而非缺陷：它映照了專業實務的實際組織方式——在其中，描述性主張、管轄性主張與批判性主張佔據著確實不同的認識論角色。

第二，區分各模組的前綴紀律 (economic_、social_、collateral_、scope_/regulation_、proxy_/underwriting_) 只有在存在衝突風險之處才真正發揮作用。在各模組間有直接對應物的謂詞才配得上前綴；某一概念領域獨有的謂詞則不需要。參數側的共享取值詞彙——品質、時間跨度和領域原子——恰恰是各模組得以互通的關鍵，給這些取值加前綴反而會破壞這一點。由此浮現的模式具有普遍性：謂詞加前綴，參數共享原子，並且在謂詞為單一視角獨有時採用選擇性前綴而非一律加前綴。

第三，proxy 知識庫所識別的核心張力與 scope/regulation 知識庫所識別的監管不對稱密切相關，卻又彼此不同。兩者透過平行的二元謂詞——regulatory_asymmetry/2 與

proxy_doctrine_practice_gap/2——加以記錄，並刻意採用不同的名稱，因為它們描述的是同一底層安排的不同軸線。監管不對稱關乎誰受監管、監管程度多深；理論與實務落差關乎對估價師產品的正式表述與其實際經濟用途之間的落差。兩種張力相互強化。監管把估價師推向現值理論；經濟功能把他們的產出拉向未來價值用途。合起來的圖景是：這一職業的官方自我描述，與其產品所匯入的分析流程之間，正變得越來越難以調和。

參考文獻

- Agarwal, Sumit, Itzhak Ben-David, and Vincent Yao (2015). “Collateral Valuation and Borrower Financial Constraints: Evidence from the Residential Real Estate Market”. In: *Management Science* 61.9, pp. 2220–2240. DOI: [10.1287/mnsc.2014.2002](https://doi.org/10.1287/mnsc.2014.2002).
- Alexandrov, Alexei, Laurie Goodman, and Michael Neal (Jan. 2023). *Reengineering the Appraisal Process: Better Leveraging Both Automated Valuation Models and Manual Appraisals*. Tech. rep. Urban Institute. URL: <https://www.urban.org/sites/default/files/2023-01/Reengineering%20the%20Appraisal%20Process.pdf>.
- Basel Committee on Banking Supervision (2017). *Basel III: Finalising Post-Crisis Reforms*. Standards d424. Bank for International Settlements. URL: <https://www.bis.org/bcbs/publ/d424.pdf>.
- Board of Governors of the Federal Reserve System (Mar. 2021). *Dodd-Frank Act Stress Test 2021: Supervisory Stress Test Methodology*. Tech. rep. Board of Governors of the Federal Reserve System. URL: <https://www.federalreserve.gov/publications/files/2021-april-supervisory-stress-test-methodology.pdf>.
- Campbell, John Y., Stefano Giglio, and Parag Pathak (2011). “Forced Sales and House Prices”. In: *American Economic Review* 101.5, pp. 2108–2131. DOI: [10.1257/aer.101.5.2108](https://doi.org/10.1257/aer.101.5.2108).
- Clauretie, Terrence M. and Nasser Daneshvary (2009). “Estimating the House Foreclosure Discount Corrected for Spatial Price Interdependence and Endogeneity of Marketing Time”. In: *Real Estate Economics* 37.1, pp. 43–67. DOI: [10.1111/j.1540-6229.2009.00235.x](https://doi.org/10.1111/j.1540-6229.2009.00235.x).
- Crosby, Neil, Colin M. Lizieri, and Patrick M. McAllister (2010). “Means, Motive and Opportunity? Disentangling Client Influence on Performance Measurement Appraisals”. In: *Journal of Property Research* 27.2, pp. 181–201. DOI: [10.1080/09599916.2010.499014](https://doi.org/10.1080/09599916.2010.499014).
- Deng, Yongheng, John M. Quigley, and Robert Van Order (2000). “Mortgage Terminations, Heterogeneity and the Exercise of Mortgage Options”. In: *Econometrica* 68.2, pp. 275–307. DOI: [10.1111/1468-0262.00110](https://doi.org/10.1111/1468-0262.00110).
- Diaz Julian, III and Marvin L. Wolverton (1998). “A Longitudinal Examination of the Appraisal Smoothing Hypothesis”. In: *Real Estate Economics* 26.2, pp. 349–358. DOI: [10.1111/1540-6229.00749](https://doi.org/10.1111/1540-6229.00749).
- Ebrahim, M. Shahid and Sikandar Hussain (2010). “Financial Development and Asset Valuation: The Special Case of Real Estate”. In: *Journal of Banking & Finance* 34.1, pp. 150–162. DOI: [10.1016/j.jbankfin.2009.07.011](https://doi.org/10.1016/j.jbankfin.2009.07.011).
- Eriksen, Michael D. et al. (2019). “The Influence of Contract Prices and Relationships on Appraisal Bias”. In: *Journal of Urban Economics* 111, pp. 132–143. DOI: [10.1016/j.jue.2019.03.001](https://doi.org/10.1016/j.jue.2019.03.001).
- Foote, Christopher L., Kristopher Gerardi, and Paul S. Willen (2008). “Negative Equity and Foreclosure: Theory and Evidence”. In: *Journal of Urban Economics* 64.2, pp. 234–245. DOI: [10.1016/j.jue.2008.07.006](https://doi.org/10.1016/j.jue.2008.07.006).
- Foster, Chester and Robert Van Order (1984). “An Option-Based Model of Mortgage Default”. In: *Housing Finance Review* 3.4, pp. 351–372.
- Friedman, Jerome H. (1991). “Multivariate Adaptive Regression Splines”. In: *The Annals of Statistics* 19.1, pp. 1–67. DOI: [10.1214/aos/1176347963](https://doi.org/10.1214/aos/1176347963).
- Gallimore, Paul (1996). “Confirmation Bias in the Valuation Process: A Test for Corroborating Evidence”. In: *Journal of Property Research* 13.4, pp. 261–273. DOI: [10.1080/095999196368781](https://doi.org/10.1080/095999196368781).

- Geltner, David M. (1991). "Smoothing in Appraisal-Based Returns". In: *The Journal of Real Estate Finance and Economics* 4.3, pp. 327–345. DOI: [10.1007/BF00161933](https://doi.org/10.1007/BF00161933).
- Ghent, Andra C., Walter N. Torous, and Rossen I. Valkanov (2019). "Commercial Real Estate as an Asset Class". In: *Annual Review of Financial Economics* 11, pp. 153–171. DOI: [10.1146/annurev-financial-110118-123121](https://doi.org/10.1146/annurev-financial-110118-123121).
- Griffin, John M. and Gonzalo Maturana (2016). "Who Facilitated Misreporting in Securitized Loans?" In: *The Review of Financial Studies* 29.2. Evidence of appraisal inflation and its consequences, pp. 384–419. DOI: [10.1093/rfs/hhv130](https://doi.org/10.1093/rfs/hhv130).
- Hendershott, Patric H. and Edward J. Kane (July 1992). *Office Market Values During the Past Decade: How Distorted Have Appraisals Been?* NBER Working Paper 4128. Available at SSRN: <https://ssrn.com/abstract=226786>. National Bureau of Economic Research. DOI: [10.3386/w4128](https://doi.org/10.3386/w4128). URL: <https://www.nber.org/papers/w4128>.
- (1995). "U.S. Office Market Values During the Past Decade: How Distorted Have Appraisals Been?" In: *Real Estate Economics* 23.2, pp. 101–116. DOI: [10.1111/1540-6229.00660](https://doi.org/10.1111/1540-6229.00660).
- Hull, John C. (2018). *Options, Futures, and Other Derivatives*. 10th ed. New York: Pearson. ISBN: 978-0-13-447208-9.
- International Association of Assessing Officers (2017). *Standard on Mass Appraisal of Real Property*. International Association of Assessing Officers, Kansas City, MO. URL: https://www.iaao.org/wp-content/uploads/Standard_on_Mass_Appraisal.pdf.
- International Valuation Standards Council (2025). *International Valuation Standards (IVS)*. International Valuation Standards Council, London. Published 31 January 2024; effective 31 January 2025. URL: <https://www.ivsc.org/>.
- K'Akumu, Owiti A. and James E. Larsen (2024). "A Primer on Regulations and the Practice of Residential Property Appraisal". In: *Journal of Real Estate Practice and Education*. Focus on regulatory and public interest aspects. DOI: [10.1080/15214842.2024.2377869](https://doi.org/10.1080/15214842.2024.2377869).
- Kau, James B. et al. (1995). "The Valuation at Origination of Fixed-Rate Mortgages with Default and Prepayment". In: *The Journal of Real Estate Finance and Economics* 11.1, pp. 5–36. DOI: [10.1007/BF01097934](https://doi.org/10.1007/BF01097934).
- LaCour-Little, Michael and Stephen Malpezzi (2003). "Appraisal Quality and Residential Mortgage Default: Evidence from Alaska". In: *The Journal of Real Estate Finance and Economics* 27.2, pp. 211–233. DOI: [10.1023/A:1024728420837](https://doi.org/10.1023/A:1024728420837).
- Lee, Ming-Hsiang, Chien-Wen Peng, and Hui-Fen Liao (2020). "An Analysis of Objectivity in the Real Estate Appraisal Process". In: *International Real Estate Review* 23.4, pp. 483–504.
- Mayer, Yanling G. and Frank E. Nothaft (2022). "Appraisal Overvaluation: Evidence of Price Adjustment Bias in Sales Comparisons". In: *Real Estate Economics* 50.3, pp. 862–881. DOI: [10.1111/1540-6229.12351](https://doi.org/10.1111/1540-6229.12351).
- Murphy, Edward V. (2012). *Regulation of Real Estate Appraisers*. CRS Report RS22953. Congressional Research Service. URL: <https://sgp.fas.org/crs/misc/RS22953.pdf>.
- 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). *Quality Control Standards for Automated Valuation Models*. Final Rule, 89 Fed. Reg. 64538 (Aug. 7, 2024). URL: <https://www.federalregister.gov/documents/2024/08/07/2024-16197/quality-control-standards-for-automated-valuation-models>.
- Pennington-Cross, Anthony (2006). "The Value of Foreclosed Property". In: *Journal of Real Estate Research* 28.2, pp. 193–214. DOI: [10.1080/10835547.2006.12091177](https://doi.org/10.1080/10835547.2006.12091177).
- Qi, Min and Xiaolong Yang (2009). "Loss Given Default of High Loan-to-Value Residential Mortgages". In: *Journal of Banking & Finance* 33.5, pp. 788–799. DOI: [10.1016/j.jbankfin.2008.09.010](https://doi.org/10.1016/j.jbankfin.2008.09.010).

- Quan, Daniel C. and John M. Quigley (1991). “Price Formation and the Appraisal Function in Real Estate Markets”. In: *The Journal of Real Estate Finance and Economics* 4.2, pp. 127–146. DOI: [10.1007/BF00173120](https://doi.org/10.1007/BF00173120).
- Steurer, Miriam, Robert J. Hill, and Norbert Pfeifer (2021). “Metrics for Evaluating the Performance of Machine Learning Based Automated Valuation Models”. In: *Journal of Property Research* 38.2, pp. 99–129. DOI: [10.1080/09599916.2020.1858937](https://doi.org/10.1080/09599916.2020.1858937).
- The Appraisal Foundation (2024). *Uniform Standards of Professional Appraisal Practice (USPAP), 2024 Edition*. The Appraisal Foundation, Appraisal Standards Board, Washington, DC. Effective January 1, 2024. URL: <https://www.appraisalfoundation.org/>.
- U.S. Department of Housing and Urban Development (2013). *Revision of Federal Housing Administration Policies Concerning Cancellation of the Annual Mortgage Insurance Premium*. Mortgagee Letter 2013-04, Federal Housing Administration. Effective June 3, 2013; the annual MIP continues for the life of loans with original LTV above 90%, and for 11 years at or below 90%. URL: <https://www.hud.gov/sites/documents/13-04ml.pdf>.
- United States Code (1970). *Federal National Mortgage Association and Federal Home Loan Mortgage Corporation Charter Acts*. 12 U.S.C. § 1717(b)(2) (Fannie Mae) and 12 U.S.C. § 1454(a)(2) (Freddie Mac). Prohibit GSE purchase of conventional mortgages exceeding 80% LTV absent credit enhancement (private mortgage insurance, seller recourse/repurchase, or a retained seller participation).
- United States Congress (1989). *Financial Institutions Reform, Recovery, and Enforcement Act of 1989*. Pub. L. No. 101-73, 103 Stat. 183; Title XI codified at 12 U.S.C. §§ 3331–3356. URL: <https://www.govinfo.gov/content/pkg/STATUTE-103/pdf/STATUTE-103-Pg183.pdf>.
- (1998). *Homeowners Protection Act of 1998*. Pub. L. No. 105-216, 112 Stat. 897; codified at 12 U.S.C. §§ 4901–4910. Automatic termination of borrower-paid private mortgage insurance at 78% LTV; cancellation may be requested at 80%.