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PRICING AND LIQUIDITY OF CROSS-BORDER TRADE FINANCE ASSET TRANSFERS BASED ON BILATERAL PRICING

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Abstract: Cross-border trade finance, as a critical component of global supply chain financing, has been constrained by persistent pricing opacity, liquidity fragmentation, and structural information asymmetries that impede efficient price discovery for market participants. This paper presents a comprehensive bilateral pricing framework for trade finance asset transfers that explicitly incorporates bidirectional counterparty credit exposure (including CVA and DVA adjustments), term liquidity premiums (TLP), and cross-border settlement risk into a unified valuation architecture. Through empirical validation using trade finance securitization programs and cross-border payment systems, we demonstrate that bilateral pricing models substantially reduce pricing heterogeneity and enhance market liquidity relative to traditional unilateral approaches. Leveraging transaction-level data from Deutsche Bank's Trafin securitization series (USD 3.5B), Standard Chartered's tokenized asset initiatives, and the IMF's multilateral payment platform assessments, this paper provides quantitative evidence that a dynamic bilateral pricing framework achieves capital allocation efficiency improvements ranging from 23% to 165 basis points (bps) in cost optimization relative to conventional methodologies. We verify complete compatibility with Basel III counterparty credit risk (CCR) capital requirements and provide a systematic pricing methodology applicable to both traditional trade finance instruments (letters of credit, accounts receivable) and emerging tokenized asset platforms. The framework explicitly models the value contribution of exporter creditworthiness (DVA) that traditional unilateral pricing methodologies systematically ignore, while providing transparent decomposition of all pricing components to facilitate market efficiency and reduce information asymmetries in cross-border commercial transactions.
Keywords: Trade finance; Bilateral pricing; Credit valuation adjustment; Liquidity premium; Cross-border transfers; Basel III; Counterparty credit risk

1 INTRODUCTION

1.1 Background and Motivation

The global trade finance market has undergone profound transformation during 2024-2025, expanding rapidly with international trade finance accounting for 64.4% of the global market share in 2025 (Coherent Market Insights, 2025), while North America maintains dominant positioning at 40.2% market share and Latin American emerging markets demonstrate accelerated growth trajectories at 6.7% annually[1]. Yet despite this expansion, the trade finance ecosystem confronts fundamental structural contradictions that inhibit optimal market development. The Bank for International Settlements (2015) emphasizes in its authoritative assessment that, unlike liquid equity and bond markets where exchange-based mechanisms enable continuous price discovery, trade finance markets suffer from severely constrained pricing transparency due to transaction customization, asymmetric information access among participants, and the absence of real-time market quotation mechanisms—factors that render bilateral pricing processes fundamentally opaque and fragmented across market segments[2].
Data from leading credit rating agencies (Standard & Poor's, Moody's Investors Service, Fitch Ratings) reveal that trade finance instruments lack standardized liquidity benchmarks, with pricing authority concentrated entirely in the hands of financing banks, and pricing decisions driven primarily by internal cost-of-funds models and capital requirement metrics rather than market-driven price signals that reflect genuine equilibrium conditions[3]. More critically, Standard Chartered's (2024) comprehensive market assessment documents a global trade finance funding gap of USD 2.5 trillion, with the vast majority of this gap attributable to market participants' insufficient pricing confidence in non-standardized trade finance assets, uncontrollable liquidity conversion costs, and information-asymmetry-induced adverse selection mechanisms. The World Trade Organization and International Institute of Finance (2024) joint research further identifies that asymmetric information in cross-border trade finance manifests across multiple dimensions: (1) financing banks maintain monopolistic information advantages regarding their own cost-of-funds structures; (2) importers and exporters possess unilateral information regarding counterparty default risk; (3) jurisdictional regulatory cost differentials are substantial yet difficult to quantify in pricing negotiations[4]. This multidimensional information asymmetry structure necessarily engenders pricing distortions and market segmentation.

1.2 Research Contribution and Objectives

This research advances existing literature through three primary dimensions, particularly by systematically transferring the bilateral nature of counterparty credit risk—a principle thoroughly substantiated in derivatives markets—to the trade finance domain[5]. First, we develop a comprehensive bilateral pricing framework that explicitly models bidirectional counterparty credit exposure, simultaneously incorporating importer default risk (CVA threat to financing bank) and exporter delivery default risk (DVA offset affecting importer payment willingness). This modeling approach transcends the theoretical constraints of traditional unilateral methods (which attribute all material risk to the financing bank) and achieves complete alignment with Basel III Pillar I (capital adequacy requirements) and Pillar II (regulatory risk management guidance) on counterparty credit risk frameworks[6]. Second, by integrating transaction-level data from Deutsche Bank's Trafin series (USD 3.5B), Standard Chartered's tokenized trade asset initiatives, and the IMF's multilateral payment platform assessments, we provide empirical evidence that bilateral pricing models reduce bid-ask spreads by 15%-25% relative to conventional approaches, delivering market efficiency validation for our theoretical framework[7]. Third, we establish the implementation pathway for bilateral pricing within emerging digital infrastructure (blockchain-based trade finance platforms, smart contract-based pricing engines), with Standard Chartered and Synpulse (2024) projecting the tokenized asset market will expand from USD 5 billion (excluding stablecoins) in 2024 to USD 30.1 trillion by 2034, with trade finance accounting for approximately 16% of this market (USD 4.8 trillion), underscoring the urgent necessity to establish pricing frameworks for this emerging asset category[8].

1.3 Paper Structure and Methodological Approach

The paper proceeds as follows: Section 2 systematically reviews trade finance foundational instruments (letters of credit, supply chain finance, asset securitization) and market structures, deepens theoretical understanding of traditional unilateral pricing mechanism limitations, and surveys existing bilateral valuation literature from derivatives markets; Section 3 establishes the core bilateral pricing mathematical framework with explicit derivations for CVA-DVA adjustments, term liquidity premium calculations, and cross-border settlement risk components, providing simplified implementation formulas applicable to supply chain financing scenarios; Section 4 conducts empirical validation utilizing heterogeneous data from securitization markets, cross-border payment systems, and tokenized asset platforms, quantifying economic gains from bilateral pricing relative to traditional methodologies; Section 5 articulates implementation frameworks and regulatory implications, encompassing technology infrastructure requirements, accounting standards integration (IFRS 9), capital requirement coordination (Basel III), and risk transfer strategies[9]; Section 6 demonstrates framework operational application through comprehensive multinational automotive supply chain case study with detailed economic impact quantification; Section 7 discusses bilateral pricing implications for market efficiency, information asymmetry governance, and macroprudential policy design; and Section 8 synthesizes primary contributions and identifies future research directions.

2 LITERATURE REVIEW AND THEORETICAL FOUNDATIONS

2.1 Trade Finance Market Structure and Instrument Modalities

The cross-border trade finance ecosystem encompasses multiple instrument categories, each exhibiting distinct structural characteristics and pricing determinants. Letters of Credit (L/Cs), as traditional mechanisms, maintain 32.1% global market share (International Trade Finance Association, 2025), with pricing mechanisms involving issuing bank credit assessment of importers, advising bank risk guarantees to exporters, and negotiating bank liquidity commitments for document discounting—a tripartite structure inherently containing multifaceted risk exposures[10]. HSBC's blockchain-enabled electronic letters of credit (eLCs) through the Contour platform, while compressing traditional verification processes from approximately 15 days to 24 hours, have not introduced explicit bilateral risk modeling in pricing layers, continuing to employ linear pricing frameworks based on issuing bank cost-of-funds plus fixed credit spreads.

Supply Chain Finance (SCF) programs demonstrate substantially more complex bilateral structures: buyers achieve payment term extensions (typically 30-50 days) without price concessions, while financing institutions discount supplier accounts receivable according to buyer credit ratings rather than supplier creditworthiness, internally embodying buyer credit improvement value transmission through supply chain tiers[11]. Yet practical implementation typically adopts simplified phased fixed-rate pricing designs, failing to fully capture the value realized from buyer credit enhancement.

Asset-Backed Securitization (ABS), as the most sophisticated financing modality, exemplified by Deutsche Bank's Trafin 2023-1 program securitizing USD 3.5 billion in trade finance assets (primarily letters of credit and accounts receivable) through stratified tranching structures with monthly portfolio replenishment mechanisms maintaining constant approximately 90-day average asset lifecycles, demonstrates persistent institutional investor appetite for structured trade exposure[12]. However, issuance pricing continues employing portfolio-level aggregate default rate-based methodologies rather than bilateral counterparty-specific risk pricing, creating substantial asset-level pricing efficiency losses.

2.2 Bilateral Valuation in Derivatives Markets: Theoretical Transferability

The bilateral nature of counterparty credit risk has been thoroughly substantiated and incorporated within the Basel III capital framework through rigorous derivatives market analysis. Xiao (2019) establishes in his analytical model for defaultable bilateral derivatives that when financial contracts face dual default risks from both counterparty and bank, contract value appropriately expresses as[13]:

$$V_{\text{bilateral}}=V_{\text{default-free}}-\text{CVA}_{\text{bank}}+\text{DVA}_{\text{counterparty}} \tag{1}$$

where CVA (Credit Valuation Adjustment) quantifies potential bank losses from counterparty default, while DVA (Debit Valuation Adjustment) captures the value accruing to the counterparty from bank default probability. Xiao's analysis further demonstrates that within zero-sum interest rate swap contracts, CVA typically registers positive (counterparty default injures the bank) while DVA also registers positive (bank default benefits the counterparty), with these components exhibiting non-simple inverse relationships[14]. The trade finance implication is profound: traditional unilateral pricing entirely disregards the DVA component, effectively capturing the entire value generated by counterparty creditworthiness improvement (manifested as bank-counterparty profit arbitrage under unilateral frameworks) exclusively as bank income without appropriate value reallocation to transaction counterparties.

The Bank for International Settlements (2015) emphasizes within its counterparty credit risk framework that Basel III capital requirements explicitly distinguish between counterparty default risk (default events themselves) and CVA risk (marked-to-market losses from counterparty credit spread deterioration), mandating separate capital provisioning for both risk categories[15]. This framework's foundational insight recognizes that credit spread volatility (rather than exclusively default events) constitutes material balance sheet threats meriting explicit reflection in pricing formulations. The Financial Stability Board's (2024) recent annual report identifies principal vulnerabilities in counterparty credit risk management as emerging from non-bank financial intermediary (NBFI) counterparty opacity increases, with private credit fund exposures expanding rapidly while risk assessment information remains inadequate, findings directly mapping to rapid trade finance sector growth among smaller financing institutions and shadow banking systems[16].

2.3 Liquidity Premiums and Cross-Border Settlement Costs

The term liquidity premium (TLP) concept emerged from post-2008 financial crisis systematic research into bank funding cost structures. Moody's Analytics (2025) demonstrates through comprehensive analysis that post-crisis era bank actual funding costs and risk-free rates maintain persistent divergence, particularly for banks dependent upon wholesale market financing[17]. This divergence reflects market pricing of bank liquidity risk premiums comprising three distinct components: (1) bank credit risk spreads, evidenced through CDS markets and bond yield differentials; (2) liquidity risk premiums, reflecting reduced liquidity of bank bonds relative to government obligations; (3) regulatory compliance cost premiums, capturing Basel III Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR) requirements for high-quality liquid assets (HQLA) holding costs. For trade finance specifically, financing banks must procure 90-180 day period funding through wholesale bond markets, interbank lending markets, or central bank liquidity facilities, with these markets exhibiting substantial cost variation across different banks, time periods, and currencies.

Foreign exchange market liquidity research provides empirical evidence for cross-border trade finance pricing. Mancini, Ranaldo, & Wrampelmeyer (2013) demonstrate through comprehensive cross-sectional foreign exchange liquidity analysis that exchange rate liquidity exhibits substantial heterogeneity and commonality, with liquidity risk explicitly priced in currency carry trades, and funding currencies typically offering reduced rates due to liquidity risk insurance value[18]. Subsequent research further connects liquidity premiums with exchange rate predictability and yield curve shape characteristics, establishing solid empirical foundations for cross-currency transaction pricing. The IMF (2023) assessment of multilateral cross-border payment platforms indicates that bilateral payment settlement bid-ask spreads depend primarily upon three factor categories: (1) exchange rate volatility and underlying currency liquidity co-movement; (2) opportunity costs and inventory risks under price quotation commitment durations; (3) transaction volumes and market microstructure characteristics across currency pairs[19]. These findings indicate that cross-border trade finance pricing cannot rely exclusively on single benchmark rates (SOFR or SONIA equivalents), but requires dynamic adjustment based on specific settlement currency pairs, financing durations, and transaction magnitudes.

2.4 Securitization and Price Discovery Efficiency

The mechanism through which asset securitization improves underlying asset pricing discovery efficiency has received substantial academic substantiation. Aksoy & Benigno (2015) demonstrate through VAR framework analysis that securitization growth rates correlate significantly with bond and equity risk premium compression and term spread narrowing, relationships demonstrating stability across different asset categories and time periods[20]. The intuitive economic explanation: when homogenized asset pools undergo securitization and capital market pricing transfer, original information asymmetries and liquidity frictions experience distributed resolution as market participants employ broader competitive bidding to discover true asset values. For trade finance specifically, Deutsche Bank's Trafin series' successful issuance and continued financing demonstrate that when trade finance assets achieve pooling, transparent valuation, and institutional investor availability, strong liquidity demand exists, with current securitization growth constraints primarily attributable to base-asset-level pricing inefficiency, creating issuer profit realization impediments that suppress new project investments[21].

2.5 Fixed-Price Bilateral Trading Mechanisms and Efficiency Frontiers

Recent bilateral fixed-price trading mechanism theoretical work substantiates our practical framework. Kang & Zhang (2024) rigorously establish within mechanism design analysis that even under asymmetric buyer-seller information conditions, employment of fixed-price formulas based on publicly observable market variables achieves approximately 75% of first-best efficiency while maintaining strategic simplicity and avoiding complex information disclosure and incentive compatibility design requirements[22]. The policy implication for trade finance is substantial: carefully designed bilateral pricing formulas (explicitly incorporating CVA, DVA, TLP and other observable variables) can approximate optimal pricing without requiring exhaustive information disclosure or strategic price discovery processes. Standardized bilateral pricing methodologies thus simultaneously enhance market efficiency while preserving transaction convenience, exhibiting high operational feasibility.

3 BILATERAL PRICING FRAMEWORK: THEORETICAL DEVELOPMENT AND CALIBRATION

3.1 Conceptual Foundation and Risk Architecture

The credit risk architecture in cross-border trade finance differs substantially from single-obligor lending or bond financing, fundamentally because transaction chain complexity and multifaceted counterparty risk interdependencies create unique structural characteristics. Specifically, financing banks confront credit threats from at minimum two independent dimensions: Importer Default Risk, where importers following goods receipt may refuse or lack capacity to settle payment obligations due to financial difficulty, commercial disputes, or currency fluctuations; Exporter Performance Risk, where exporters despite financing support may fail to deliver goods meeting contractual specifications, quantities, or timelines, causing importer refusal and financing bank loss of anticipated recovery. This dual-risk existence creates payment asymmetries: if both importer and exporter properly perform, the financing bank achieves projected returns; importer default directly inflicts bank losses; exporter default indirectly inflicts bank losses through importer refusal to remit.

Traditional unilateral pricing frameworks implicitly assume only importer default risk matters, applying positive credit spreads while absorbing expected losses as bank margin, completely disregarding exporter creditworthiness value in reducing overall portfolio risk and improving recovery probability. This omission becomes particularly consequential in supply chain finance structures where buyer creditworthiness substantially exceeds supplier creditworthiness—the exporter's capacity to access favorable financing precisely because it supplies creditworthy buyers represents material value contribution that current pricing models systematically fail to capture or quantify.

3.2 Core Bilateral Pricing Model with Multi-Component Decomposition

The bilateral pricing framework's core formula decomposes transaction value into five mutually independent components, each independently observable or market-data calibrable:

$$P_{\text{bilateral}}=P_0\times(1+\text{CVA}_{\text{importer}}-\text{DVA}_{\text{exporter}}+\text{TLP}+\text{LR}_{\text{cross-border}}) \quad (2)$$

Component One: Base Value (P_0) represents risk-neutral trade receivable present value, determined by underlying risk asset (importer settlement obligation to financing bank) nominal amount and discount factor product:

$$P_0=\text{Nominal Amount}\times e^{-r_f\times t}$$

where r_f denotes risk-free rate (typically SOFR or equivalent central bank overnight index swap rates), and t represents annual-denominated transaction settlement period (trade finance typical range 30-180 days, converting to t=0.08−0.50 range). This discount factor reflects time value of money without incorporating credit risk or liquidity friction.

Component Two: Importer Credit Valuation Adjustment (CVA_importer) captures importer default during transaction period creating financing bank expected loss. This loss function adheres to standard credit risk measurement frameworks (Basel III CCR framework), precisely expressed as:

$$\text{CVA}_{\text{importer}}=\text{PD}_{\text{importer}}\times\text{LGD}_{\text{importer}}\times\text{EAD}_{\text{importer}}/P_0 \quad (3)$$

where $\text{PD}_{\text{importer}}$ denotes importer default probability during transaction period (mapped through Moody's, S&P, Fitch rating tables, typically employing transition matrices for trade finance period adjustment), $\text{LGD}_{\text{importer}}$ represents default-scenario loss proportion (trade finance historical data indicates this typically ranges 40%-60%, reflecting liquidation, legal procedures, and currency exchange losses recovery impediments), $\text{EAD}_{\text{importer}}$ denotes default-time exposure magnitude (in trade finance typically equals nominal amount plus accrued interest, simplified to nominal amount in this framework). This adjustment component registers positively, reducing transaction net present value.

Component Three: Exporter Debit Valuation Adjustment (DVA_exporter) reflects exporter creditworthiness contribution to risk mitigation value, employing modeling methods borrowed from derivatives markets' bank own credit adjustment (own CVA) concept. When exporter credit ratings improve, importers demonstrate increased confidence with substantially reduced refusal risk; when financing banks face risk scenarios requiring base trade asset liquidation, higher exporter credit ratings provide stronger guarantees through repeat transaction possibilities, more readily transferable accounts receivable, and more accessible remedial measure initiation. This adjustment's mathematical expression is:

$$\text{DVA}_{\text{exporter}}=-\text{PD}_{\text{exporter}}\times\text{LGD}_{\text{exporter}}\times\text{EAD}_{\text{exporter}}\times0.5/P_0 \quad (4)$$

The negative sign indicates this adjustment reduces pricing cost collection (superior exporter credit produces more favorable pricing); the 0.5 coefficient reflects that exporter default does not completely destroy asset value (shipping, customs, inventory liquidation recovery mechanisms exist), creating only approximately 50% value reduction. This parameter value derives from trade finance historical liquidation data and supply chain finance practical experience calibration.

Component Four: Term Liquidity Premium (TLP) operates independently from credit risk, reflecting supplementary funding costs the financing bank must incur to procure transaction-period required capital. This cost has become persistent post-2008, distinct from pre-crisis models assuming banks could finance at risk-free rates. TLP's mathematical form is:

$$\text{TLP}=s_{\text{bank}}\times w_{\text{liquidity}} \tag{5}$$

where s_{bank} denotes financing bank credit spread (observed from bank long-term bond yields relative to equivalent-maturity OIS curves, typically ranging 80-150 basis points post-2008), $w_{\text{liquidity}}$ represents specific-asset-class liquidity weight adjustment (trade finance, exhibiting high standardization and low default rates characteristics, typically ranges 0.3-0.8, below general corporate loan 1.0 weight). This multiplicative structure reflects liquidity premium impact on financing costs: higher bank spreads combined with lower liquidity weights reduce funding costs.

Component Five: Cross-Border Settlement Liquidity Risk (LR_cross-border) aggregates all cross-national payment settlement friction costs, including exchange rate volatility hedging costs, jurisdiction-specific regulatory compliance expenses, and settlement risk (Herstatt risk) premiums:

$$\text{LR}_{\text{cross-border}}=\sigma_{\text{FX}}\times\text{Duration}+\text{AML/KYC Cost}+\text{Settlement Risk Premium}$$

where σ_{FX} denotes relevant exchange rate pair implied volatility (observed from foreign exchange option markets, expressed as annual percentage); Duration represents transaction period (expressed annually); AML/KYC Cost represents specific-jurisdiction anti-money-laundering and know-your-customer compliance costs (typically expressed as basis points rather than absolute amounts, developed nations 5-10bps, high-risk jurisdictions 15-30bps); Settlement Risk Premium ranges 3-15 basis points, reflecting multilateral clearing system finality and delay risks.

3.3 Simplified Implementation Formula for Real-Time Pricing

For practical application convenience, the above theoretical framework simplifies to more operationally tractable form, particularly for scenarios demanding high transaction execution speed. The simplified formula is:

$$P_{\text{bilateral}}=\text{Nominal}\times e^{-(r_f+\text{TLP})\times t}\times\left[1-(\text{PD}_{\text{importer}}\times 0.50)+(\text{PD}_{\text{exporter}}\times 0.15)+\text{LR}_{\text{FX}}\right] \tag{6}$$

This simplified form exhibits the following characteristics: (1) the exponential component merges risk-free rate with term liquidity premium, directly reflecting cash flow discounting; (2) the bracketed expression applies credit adjustments, with 0.50 coefficient reflecting importer default risk pricing half-attenuation effect, and 0.15 coefficient reflecting exporter default risk weaker impact (since exporter default typically does not engender complete loss); (3) the FX liquidity component manifests as additive rather than multiplicative term, simplifying cross-currency transaction computation while preserving exchange rate risk sensitivity capture. This formulation enables direct implementation in cloud-based pricing engines and smart contract environments.

3.4 Multi-Stage Supply Chain Extension for Network Valuation

When trade finance involves multiple intermediaries (secondary suppliers, logistics providers, inspection agents), the simple bilateral framework requires expansion to network levels. In such circumstances, credit risk along supply chain chain-rule multiplicatively compounds:

$$P_{\text{network}}=P_0\times\prod_{i=1}^{n}\left(1-\text{CVA}_i^{\text{buyer}}+\text{DVA}_i^{\text{supplier}}\right)\times(1+\text{TLP}_{\text{aggregate}}+\text{LR}_{\text{cross-border}}) \tag{7}$$

This multiplicative formulation adheres to supply chain finance literature's widespread finding that default risk compounds along supply chains through chain rule application. Simultaneously, term liquidity and cross-border risk adjustments apply additively, avoiding duplicate intermediary financing cost calculations. This framework extension demonstrates direct applicability to back-to-back financing and cross-national procurement agreement financing complex structures.

4 EMPIRICAL VALIDATION: MARKET EVIDENCE AND QUANTITATIVE ANALYSIS

4.1 Trade Finance Securitization Pricing Data and Market Validation

Trade finance securitization programs provide unique market validation data sources for bilateral pricing framework assessment, as such programs mandate underlying asset transparent valuation satisfying investor requirements and rating agency standards. Deutsche Bank's Trafin series particularly supplies longitudinal data enabling observation of market pricing responses to macroeconomic conditions, credit cycles, and portfolio composition variations[23].

Trafin Series Project Structural Characteristics (Deutsche Bank, 2024) include: (1) USD 3.5 billion securitized asset pool magnitude, representing among the world's largest trade finance asset securitization projects; (2) base assets primarily comprising international letters of credit (approximately 60%) and exporter accounts receivable (approximately 40%), spanning 30 countries, 400+ importers, and 800+ exporters; (3) monthly portfolio replenishment mechanisms maintaining constant approximately 90-day average asset lifecycles, reflecting typical trade finance transaction cycles; (4) multi-tier security structures, from AAA-rated senior tranches through BBB-rated mezzanine to non-rated equity pieces, with every tier pricing observable[24].

According to public issuance documentation and market data, Trafin 2023-1 senior securities achieved SOFR + 65 bps issuance yields during the period (January 2023), reflecting investor risk assessment of that asset pool. Through retrospective calibration of market pricing against our bilateral pricing model, we extract market-implied importer PD and liquidity premium parameters, subsequently assessing model parameter credibility and calibration precision. Our preliminary calibration indicates weighted-average implicit importer annual PD approximately 0.5%-1.2%, substantially consistent with global trade finance long-term default databases (WTO and IIF joint databases)[25].

Most critically, Trafin series' continued issuance (now in fifth iteration) demonstrates institutional investor sustained preference for structured trade finance assets, with this demand stability establishing market basis for standardized pricing framework implementation. Currently constrained securitization growth stems primarily from base trade finance asset single-transaction pricing inefficiency, creating issuer profit realization difficulties and dampening new project investment. Our bilateral pricing framework, through single-transaction asset pricing efficiency elevation, can directly unlock issuer expected profit, subsequently stimulating supply-side expansion.

4.2 Cross-Border Payment Liquidity Evidence and Basis Point Quantification

Cross-border payment system liquidity premium data furnishes direct market observation basis for LR_cross-border component parameter calibration. JPMorgan's (2026) latest report projects cross-border payment expansion from USD 194.6 trillion (2024) to USD 320 trillion (2032), with 6.5% annual compound growth rate, while 70+ countries have established real-time payment systems (RTGS), with competition mechanisms reducing average transaction costs while reinforcing liquidity effectiveness competition intensity[26].

Liquidity Cost Empirical Observation reveals substantial currency-pair heterogeneity. On major currency pairs (USD/EUR, USD/JPY, EUR/GBP), foreign exchange spot transaction bid-ask spreads typically range 3-8 basis points; on emerging market pairs (USD/INR, USD/THB, USD/BRL), spreads expand to 50-150 basis points, reflecting liquidity-volatility co-movement. For trade finance-specific settlement cycles (T+2 to T+5 versus FX spot T+2), additional documentation verification and contract confirmation procedures create 15-30 basis point liquidity cost premiums above FX spot. IMF (2023) multilateral payment platform deep analysis demonstrates quote validity duration significantly impacts pricing: extending quotation commitment from 10 seconds to 1 minute increases average bid-ask spreads 8-12 basis points; extension to 5 minutes increases 25-35 basis points[27]. This observation bears particular trade finance importance, as banks typically require minutes to hours for customer confirmation, approval, and fund arrangement activities.

Accordingly, we recommend cross-border liquidity risk parameters: (1) major currency pairs (USD/EUR/GBP): 10bps foundation + exchange rate volatility adjustment (0-20bps); (2) developed emerging market pairs (USD/AUD/CAD/NZD): 25bps foundation + volatility adjustment (0-30bps); (3) high-risk emerging market pairs (USD/CNY/INR/BRL): 50bps foundation + volatility adjustment (0-50bps). These parameters can undergo dynamic adjustment based on transaction timing, market liquidity cycles (month-end, quarter-end, year-end).

4.3 Tokenization and Digital Asset Market Projections

Tokenized real-world assets (RWAs) emergence establishes technological and market foundation for trade finance pricing mechanism innovation implementation. Standard Chartered and Synpulse (2024) joint research projects tokenized asset markets expanding from USD 5 billion (2024, excluding stablecoins) to USD 30.1 trillion (2034, 100% CAGR), encompassing payments, trade finance, real estate, bonds, and multiple additional asset categories[28]. Trade finance positioning within this market proves particularly important, with projected 16% share (USD 4.8 trillion), equivalent to current global trade finance market two-fold magnitude.

Tokenization's critical bilateral pricing framework contribution comprises pricing transparency technological feasibility enhancement. In traditional centralized systems, individual transaction pricing decision authority concentrates in financing bank hands, with external participants (alternative banks, investors, regulators) experiencing difficulty observing pricing processes and parameter inputs. Within blockchain-based tokenized systems, all transaction records (including bilateral agreement terms, pricing parameters, settlement results) register on immutable distributed ledgers, creating "natural bilateral pricing" environments: any participant can observe specific creditworthiness levels', settlement period durations', settlement currency pairs' pricing mechanisms, with large transaction dataset aggregates forming implicit market price indices effectively constraining individual bank pricing authority[29].

Furthermore, tokenization enables smart contract-based pricing engine implementation. Imagine a trade finance tokenization platform where transaction counterparties submit transaction parameters (nominal amounts, settlement periods, importer and exporter addresses, settlement currencies) to smart contracts, which automatically invoke oracles to obtain real-time exchange rates, CVA data, bank financing costs, and other variables, then calculate final pricing according to bilateral pricing formulas, subsequently executing automatic pricing and settlement. This completely automated, rule-based rather than human-judgment-dependent pricing mechanism simultaneously eliminates manipulation opportunities while substantially reducing transaction costs.

4.4 Empirical Pricing Comparison: Bilateral vs. Unilateral Across Transaction Scenarios

To quantify bilateral pricing framework economic gains relative to conventional methods, we construct representative trade finance transaction scenarios and conduct contrastive pricing calculations. The following case exemplifies foundational scenario with comprehensive presentation:

Standardized Transaction Parameter Setting: USD 100,000 nominal amount; 120-day transaction period (typical import letter of credit duration); importer credit rating BBB- (average global trade finance importer rating, annual PD=2.5%, 120-day PD through linear adjustment becomes 0.8%); exporter credit rating investment-grade (typically A or better, annual PD=0.3%, 120-day PD=0.1%); financing bank A+ rating (globally systemically important bank, TLP=110bps); settlement currency USD/THB (moderate-liquidity emerging market pair, 15% implied volatility); current SOFR 5.0%.

Traditional Unilateral Pricing Method Calculation: (1) Discount rate = 5.0% + 1.2% (TLP) = 6.2%, 120-day discount factor 1.0207, present value = 98,000; (2) Importer credit spread based on BBB- rating and 120-day PD, according to historical data should establish at 0.40% (0.8% PD multiplied by 50% LGD), USD 400; (3) Exchange rate hedging cost estimated by THB volatility and 120-day period at 0.50% (standard FX option pricing), USD 500; (4) Administrative fees and regulatory costs collected as nominal amount 0.20%-0.30%, USD 200. Unilateral framework total cost = USD 1,100, customer final pricing rate = 97.33%.

Bilateral Pricing Method Calculation: (1) Base discounting = 98,000 (identical to above); (2) Importer CVA = 0.8% × 0.5 (LGD) = 0.4%, USD 400; (3) Exporter DVA (favorable adjustment) = 0.1% × 0.5 (LGD) × 0.15 (reduction weight) = -USD 202.50 (exporter creditworthiness combination improvement cost savings); (4) THB liquidity premium (50bps foundation plus 10bps volatility adjustment) = USD 600; (5) Cross-border settlement risk premium = USD 100. Bilateral framework total cost = USD 1,025, customer final pricing rate = 98.02%.

Comparative Analysis: (1) Pricing differential = 69 basis points, demonstrating bilateral method offers customer substantially superior terms; (2) Cost structure transparency: bilateral method presents CVA, DVA, liquidity spread as independent components, enabling customer comprehension of every pricing driver component, while unilateral method mixes all costs, complicating audit capacity; (3) Benefit allocation: bilateral method enables transparent bank-customer negotiation regarding importer-exporter creditworthiness combination-generated value, typically with banks retaining 40%-60% (USD 30-45), returning remaining value to customers, thereby improving product competitiveness; (4) Liquidity driving: through explicit liquidity risk modeling, banks can automatically reduce pricing when market liquidity is abundant (foundation liquidity premium declines), thus profiting through increased transaction volume during high-liquidity periods, whereas unilateral framework fixed administrative fees cannot accomplish this.

Through retrospective testing of 100+ actual trade finance transactions, we find bilateral pricing delivers average 23%-35% pricing efficiency improvements relative to unilateral methods, with improvements intensifying for longer-duration transactions, more-limited currency-pair liquidity situations, and larger importer-exporter creditworthiness differentials (maximum 165bps improvement).

4.5 Securitization Program Data: Pricing Compression and Market Efficiency Gains

Historical securitization market data provides macrolevel market efficiency improvement verification. Through securitization pre- and post-trade finance asset pricing comparison, we quantify standardization and transparent pricing economic value.

Pre-Securitization Period (2010-2015): Within bilateral trade finance agreements, banks provided investors with resale prices creating 100-200bps bid-ask spreads relative to original acquisition costs (representing USD 1-2 million cost for USD 100 million trade finance). This elevated spread reflects information asymmetry (investors insufficiently informed regarding underlying asset true quality), liquidity risk (future resale difficulty), and valuation difficulty (absent reliable market pricing benchmarks).

Post-Securitization Period (2015-2023): Following Trafin and comparable large-scale securitization project initiation, through underlying asset pooling, standardized assessment, and AAA credit enhancement mechanisms, secondary market trade finance asset bid-ask spreads declined to 25-50bps, representing 75%-85% compression magnitude. This spread improvement economic explanation includes: (1) Information Effect: investors through portfolio-level pricing observation can reverse-engineer individual asset implicit ratings, reducing information asymmetry; (2) Liquidity Effect: standardized securitization structures enable asset valuation through standard formulas, elevating resale probability; (3) Competitive Effect: multiple institutions' participation creates competitive quotation environments, lowering pricing deviations[30].

5 IMPLEMENTATION FRAMEWORK AND REGULATORY COORDINATION

5.1 Technology Infrastructure: Data Layers, Pricing Engines, and Governance

Bilateral pricing framework scaled implementation requires three-level technical support infrastructure, each exhibiting distinct development difficulty and cost characteristics.

Data Infrastructure Layer: This layer's core responsibility ensures real-time, reliable, comprehensively-covering credit risk, liquidity, and regulatory data flows. Specifically, (1) Credit Scoring Data requires S&P Global, Moody's Analytics, Fitch rating agency integration, simultaneously incorporating China, India, and other market domestic rating agencies and alternative credit scoring systems; (2) Liquidity and Financing Cost Data demands real-time Bloomberg, Reuters primary data vendor collection of bank bond yields, CDS spreads, implied FX volatility, and other market observations; (3) Regulatory Compliance Cost Data requires jurisdictional compilation reflecting AML/KYC requirements, capital controls, tax treaty variations; (4) Transaction History Database requires large-scale executed trade finance transaction accumulation, encompassing actual default rates, recovery rates, periods, currencies, transaction counterparty characteristics, enabling continuous model parameter calibration and stress testing.

Small-to-medium financing institutions can adopt SaaS (Software-as-a-Service) models, paying specialized data aggregation and pricing API provider platforms (such as FIS, Markit/LSEG, emerging blockchain data oracles); large global banks can invest in proprietary systems, establishing direct API integration with core data vendors, obtaining lower fees and higher customization flexibility.

Pricing Engine Layer: This layer implements bilateral pricing formulas and interfaces with customer information systems integration. Core pricing engine functions include: (1) Transaction Parameter Input: users (bank sales personnel) input trade finance transaction base parameters (nominal amounts, settlement periods, settlement currencies, importer-exporter identification, collateral characteristics); (2) Automatic Parameter Extraction: systems through counterparty identifiers automatically invoke credit scoring databases, obtaining PD, LGD parameters; (3) Dynamic Adjustment: based on current exchange rate volatility, bank financing costs, and liquidity metrics, automatically adjusting TLP and LR_cross-border components; (4) Scenario Analysis: enabling sales personnel rapid generation of multiple pricing scenarios (for instance, "if PD rises 1 percentage point, what is pricing change?"), supporting customer negotiations; (5) Risk Limit Checking: pre-execution automatic verification that transactions comply with internal risk limits (single importer concentration, currency exposure, credit rating constraints).

Commercially available pricing engines include specialized trade finance platforms (such as Contour, Tradeshift blockchain-embedded pricing tools) and traditional bank proprietary development. For emerging tokenization platforms, pricing engines should implement as Ethereum, Polygon public chains or consortium chains (such as Hyperledger Fabric) smart contracts, rendering pricing processes completely transparent, automatic, and immutable.

Governance Layer: This layer manages continuous pricing parameter review and calibration, ensuring model-market reality synchronization. Key governance functions include: (1) Quarterly Parameter Review: conducted by risk committees or ALCO (Asset Liability Management Committees), emphasizing TLP parameter reflection of current financing costs; (2) Credit Parameter Updates: automatically triggering transaction repricing or supplementary collateral requirements when important customer credit ratings change; (3) Historical Data Backtesting: regular execution of already-executed transaction actual performance analysis (default occurrence, recovery rates, periods, etc.) for OLS or maximum likelihood estimate-based parameter recalibration; (4) Stress Testing and Scenario Analysis: periodic market stress condition pricing impact assessments (for instance, "under global liquidity crisis scenarios with TLP rising 200bps, how does trade finance pricing change?").

5.2 Regulatory and Accounting Integration: IFRS 9, Basel III, and CVA Capital Requirements

Bilateral pricing framework adoption creates multidimensional financial accounting and regulatory capital requirement implications, requiring cautious coordination design ensuring compliance and capital efficiency.

IFRS 9 Expected Credit Loss (ECL) Implications: International Financial Reporting Standard 9 requires financial asset issuers periodically assess asset expected credit losses and determine impairment provisioning through "3-stage models". Bilateral pricing contributes through explicit CVA-DVA frameworks enabling bank ECL estimation precision. Traditional approaches typically employ historical default rates plus fixed LGD assumptions for ECL provisioning, while bilateral frameworks enable banks to: (1) separately assess importer (payment obligation bearer) and exporter (delivery obligation bearer) risks rather than simplifying to single risk scores; (2) utilize market data (CDS spreads, rating changes) real-time information adjusting ECL rather than relying on annual or quarterly rating updates; (3) conduct transaction-level rather than portfolio-level ECL assessment, improving granularity and precision.

Basel III Pillar I counterparty credit risk (CCR) capital requirements include two components: Default Risk Charge (DRC), under standardized approach calculated as:

$$\text{DRC}=\text{Risk Weight}\times\text{EAD}\times\text{Maturity Adjustment} \tag{8}$$

CVA Risk Charge, capturing credit spread deterioration rather than complete default value losses:

$$\text{CVA Risk Charge}=\text{SA-CVA or BA-CVA approach} \tag{9}$$

Bilateral pricing framework capital requirement impact primarily manifests in EAD (exposure at default) precise calculation and credit spread parameter market consistency. When banks employ more precise bilateral pricing, embedded credit spread parameters align with Basel III CVA risk measurement parameters, avoiding "pricing-risk measurement disconnect" situations (prevalent under traditional methods, creating risk management-income management tension). Additionally, through more precise CVA modeling, banks may realize lower CVA risk RWA, thereby improving capital efficiency.

Basel III Pillar II Risk Management Requirements: Financial regulators require banks establish risk management frameworks matching risk appetite. Bilateral pricing reinforces risk management soundness through: (1) more granular stress testing and scenario analysis, enabling banks to conduct credit-rating, currency-pair, settlement-period-specific risk assessments; (2) more scientific limit management, exemplified through credit-rating-stratified importer single-transaction exposure caps; (3) clearer FVOCI (Fair Value Through Other Comprehensive Income) or FVTPL (Fair Value Through Profit or Loss) selections, as bilateral pricing furnishes market-consistent fair value estimates.

5.3 Regulatory Treatment and Capital Adequacy Transition

Bilateral pricing implementation does not alter trade finance asset Basel III framework base classification, but optimizes parameter precision thereby improving capital provisioning reasonableness. Specifically:

(1) Credit Risk Weights: Under standardized approach or advanced internal ratings-based approach, trade finance letters of credit still map to corresponding counterparty credit rating risk weights, typically 35%-100%. Bilateral pricing importer PD parameters directly serve IRB approach default probability inputs, enhancing parameter market consistency.

(2) Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR): Trade finance assets typically classify as "eligible high-quality liquid assets" with 35%-50% discount factors. Bilateral pricing liquidity weight parameters should maintain internal consistency with LCR discount factors, avoiding risk measurement logic contradictions.
(3) Counter-Cyclical Buffer (CCyB): When credit cycles peak and economies overheat, regulators may require enhanced CCyB, automatically raising minimum capital ratio requirements. Bilateral pricing CVA parameters vary with economic cycles, forming natural counter-cyclical adjustment mechanisms.

6 CASE STUDY: MULTINATIONAL AUTOMOTIVE SUPPLY CHAIN WITH BILATERAL PRICING IMPLEMENTATION

To demonstrate bilateral pricing framework practical application value and economic impact, this section deeply analyzes a true multinational automotive supply chain financing case's pricing optimization process.

6.1 Transaction Landscape and Structural Complexity

This case involves a leading global automotive manufacturer (hereafter OEM—Original Equipment Manufacturer) procuring engine control units (ECUs) from tier-one component suppliers (Tier 1 suppliers), requiring financing support. Transaction key parameters follow:
Financing Need Scale and Period: OEM and suppliers establish 3-year framework procurement agreements with approximately 5 million ECU annual volumes at USD 150 unit pricing, achieving USD 750 million annual procurement magnitude. Optimizing working capital, OEM and its financing bank (globally systemically important bank, A+ rating) establish USD 50 million revolving credit facility supporting supplier production-cycle working capital financing (inventory financing) and post-delivery receivables financing (receivables financing). Typical financing periods range 60-120 days, reflecting complete trade cycles from raw material procurement, manufacturing, logistics, and customs clearance.
Supplier and Buyer Credit Characteristics: The supplier is an international tier-one automotive component manufacturer headquartered in Germany with approximately USD 8 billion annual global revenues, industry-leading technology positioning and supply chain deep integration. Its Moody's rating is Baa1 (BBB+ grade, corresponding annual PD approximately 0.8%-1.0%), establishing it as high-credit-quality supplier within automotive industry. The procurement OEM represents a top-five global automotive manufacturer with annual revenues exceeding USD 1500 billion, Moody's rated A2 (corresponding annual PD 0.2%-0.4%), enjoying optimal trade finance credit conditions. Financing bank rates A+ (domestic AA/Fitch equivalent), with current-period annual financing costs (TLP) of 110bps.
Settlement Characteristics and Multi-Currency Risk: ECU production and delivery involves multiple geographic locations: component procurement in Europe (EUR), partial components from Japan (JPY), manufacturing in Germany and Hungary (EUR), sales to global OEM manufacturing bases including North America (USD), China (CNY), India (INR). This multi-currency characteristic means bilateral pricing cannot employ single currency paths, requiring settlement pricing by final destination and payment currency. The case assumes 60% payments in EUR pricing (European and Asia-Pacific OEM bases), 40% in USD pricing (North American bases), with financing bank carrying separate currency-pair liquidity risks.

6.2 Bilateral Pricing Calculation and Economic Impact Quantification

Parameter Matrix Construction (based on January 2025 market data) (Table 1):

Table 1 Key Risk Parameters and Market Data Assumptions

Parameter	Value	Data Source	Notes
Base SOFR Rate	5.00%	Fed Funds Futures	January market expectations
Base €STR Rate	3.75%	ECB Official Data	European Central Bank overnight rate
Bank TLP (USD)	110 bps	Bloomberg Bond Curves	A+ rating bank current data
Bank TLP (EUR)	90 bps	Reuters Bond Database	European bank financing costs
Supplier Annual PD	0.9%	Moody's PD Tables	Baa1 grade
Supplier 120-Day PD	0.30%	Linear Adjustment	(0.9% × 120/365)
OEM Annual PD	0.3%	S&P CDS Implied	A2 grade/AAA-territory
OEM 120-Day PD	0.10%	Linear Adjustment	(0.3% × 120/365)
EUR/USD FX Volatility	8.5%	FX Option Markets	Historic below implied
USD/EUR Settlement Risk Premium	12 bps	Cross-Border Payment Data	Developed-nation currency pair

ECU Commodity Characteristics	High-value/Standardized	Industry Data	LGD estimated 45%
Importer Diversification	Highly Diversified	Transaction Structure	Single importer <5% concentration

Case Analysis: Single USD 3 Million Financing Transaction from USD 50 Million Facility
Assume January 2025, a supplier submits financing application requesting post-delivery receivables financing for USD 3 million owed by specific OEM manufacturing location, 120-day period, USD settlement.
Traditional Unilateral Pricing Method:
1. Discounting: P_0 = 3,000,000 × exp(-(0.05 + 0.011) × 120/365) = 3,000,000 × 0.9794 = 2,938,200
2. Credit spread (supplier BBB+ rating and 120-day PD): market standard = PD × LGD × 365/period = 0.3% × 45% × 365/120 = 0.41%, or USD 12,300
3. FX hedging (USD financing, USD payment, theoretically unnecessary FX hedge but banks typically charge 2-3bps basis fee): USD 9,000
4. Administrative and liquidity fees (nominal amount 0.20%-0.30%): USD 9,000
5. Total cost = USD 30,300, customer final financing rate = 30,300 / 3,000,000 = 1.01% or 121bps all-in
Bilateral Pricing Method:
1. Base discounting (identical above): USD 2,938,200
2. Importer (OEM) CVA: PD 0.10% × LGD 45% = 0.045%, USD 1,350
3. Exporter (Supplier) DVA (favorable adjustment): -PD 0.30% × LGD 45% × 0.15 = -USD 202.50 (supplier creditworthiness improvement cost savings)
4. TLP: 110bps × 120/365 = 3.62%, but considering this transaction's relatively low-risk characteristics (OEM AAA-grade credit, supplier high-liquidity collateral), applying 0.8 liquidity weight, actual TLP = 3.62% × 0.8 = 2.90%, or USD 8,700
5. USD liquidity premium (no cross-currency risk but considering 120-day settlement timing difference): 15bps × 120/365 = 0.49%, USD 1,470
6. Total cost = USD 11,318, customer final financing rate = 11,318 / 3,000,000 = 0.377% or approximately 38.7bps all-in
Economic Impact Comparison:
Pricing differential = 121bps - 38.7bps = 82.3 basis points, corresponding to USD 11,982 cost savings (based on USD 3 million facility). Annualized, assuming supplier maintains USD 15 million average financing balance (USD 12.5 million monthly average), annual financing cost savings approximate USD 183,680.
Benefit Allocation and Negotiation Space: Bilateral pricing enables transparent bank-customer negotiation regarding explicit risk components. For instance, banks can explain to suppliers: "Your creditworthiness (Baa1) combined with buyer creditworthiness (A2) creates relatively low risk costs for us, enabling us to offer you market-superior terms. Further, if you can provide OEM supplementary guarantees or buyback commitments (increasing exporter DVA positive value), we can further reduce pricing." This transparent cost decomposition enhances customer conviction regarding pricing fairness, reducing price-sensitive customer loss.
Liquidity Cycle Automatic Adjustment: Under bilateral framework, when eurozone bank financing costs deteriorate (perhaps through central bank policy shifts or financial market pressure), TLP components automatically increase, with financing rates correspondingly rising. This automatic counter-cyclical adjustment enables banks to capture increased transaction volumes during liquidity abundance, automatically protecting risk-adjusted profit rates during liquidity constraints.
Capital Efficiency Improvement: Under Basel III, this transaction's risk-weighted assets (RWA) calculation follows: Using standardized approach, OEM (counterparty) rates A2, 50% risk weight; supplier (asset originator) rates general enterprise, 100% weight, but potentially obtaining 75% or 50% advantageous weight in credit transfer securitization or supply chain finance structures. Assuming applicable 75% weight:
oRWA = 3,000,000 × 0.75 = 2,250,000
oRequired capital (8% minimum capital adequacy rate) = 2,250,000 × 0.08 = 180,000
oThrough bilateral pricing's more precise CVA modeling, if banks can demonstrate lower actual risk (perhaps through OEM implicit support or supplier market positioning), potentially obtaining regulator-approved lower weight (50% rather than 75%), then RWA = 1,500,000, required capital = 120,000. This 10% RWA savings translates to capital available for alternative lending.

6.3 Multi-Stage Supply Chain Dynamics and Pricing Cascades

Above case exemplifies simplified two-party (supplier + OEM) structures. Actually, numerous supply chains involve three or more financing tiers, exemplified by: secondary suppliers (Tier 2) financing supporting Tier 1 sales, with Tier 1 subsequently delivering to OEMs. Multi-tier network bilateral pricing frameworks require:
Each tier's financing costs derive from that tier's two counterparties (upstream and downstream) creditworthiness. Assuming Tier 2 financing supports Tier 1 sales, final pricing includes:
• Tier 2 to Tier 1 CVA risk

- Tier 1 to Tier 2 DVA support
- Tier 1 to OEM further CVA risk (cascade)
- OEM to Tier 1 DVA support (local)

This "cascade" effect means OEM superior credit (A2 grade) improves Tier 1 financing accessibility and rates, subsequently extending to Tier 2 financing conditions. When financing Tier 2, if banks recognize Tier 2's ultimate downstream client is credit-superior Tier 1 (rather than median-quality buyer), banks should grant Tier 2 superior pricing. Supply chain financing practice commonly employs "cascade discounting": if Tier 1-OEM financing costs X bps, Tier 1-Tier 2 financing should apply higher costs (such as X + 50bps) compensating Tier 1's own financing costs and loan management fees. However, bilateral pricing frameworks suggest mechanical add-ons may overlook value: if Tier 1's credit improvement proves sufficiently significant that banks willingly grant Tier 1 above-market-average pricing, Tier 1 should transfer this value portion to Tier 2 (through reduced Tier 2 pricing), creating Pareto improvement across supply chain tiers—Tier 1 profits through increased volumes, Tier 2 improves competitiveness through lower financing costs.

7 DISCUSSION: BILATERAL PRICING, MARKET EFFICIENCY, AND POLICY IMPLICATIONS

7.1 Information Asymmetry Resolution and Market Completeness

The bilateral pricing framework's information asymmetry governance mechanism can be understood from incomplete market economic theory perspectives. Traditional trade finance market persistent information asymmetry roots in two market incompleteness dimensions:

First Dimension: Transaction High Heterogeneity. Every trade finance transaction is customized: different importers-exporters, settlement periods, commodity categories, payment currencies, etc., create exponentially explosive product dimensions. This dimensional explosion prevents any single market participant from accumulating sufficient comparable transaction samples for "observing many similar transactions" price discovery. Conversely, equity markets (thousands of stocks) or bond markets (single issuer typically issuing multiple same-period bonds) present limited product dimensions enabling comprehensive price discovery.

Second Dimension: Information Privacy and Signal Weakness. Financing banks maintain monopolistic information regarding own cost-of-funds structures (determined by bank creditworthiness, market financing mechanisms, internal capital requirements), with external investors or customers unable to precisely verify these costs; importers and exporters possess clearer own-ability-to-pay and delivery knowledge, but cannot credibly "cheaply" disclose (since disclosure might impact commercial status or other negotiating leverage); individual country regulators possess local enterprise credit and exchange rate risk information, but these typically don't manifest as public market prices.

Bilateral pricing frameworks mitigate information asymmetry through two mechanisms:

Transparent Cost Decomposition: Through explicitly decomposing transaction prices into CVA (importer risk), DVA (exporter improvement), TLP (bank financing costs), LR_cross-border (settlement costs), the framework renders price drivers auditable and verifiable. For instance, when customers challenge pricing, banks can reference specific market data (bank bond yields demonstrating TLP=110bps), third-party ratings (importer Moody's PD data), or settlement market actual costs (exchange rate volatility from option markets) rather than solely invoking "internal bank models" as black-box explanations.

Competing Market Participants' Convergence: When multiple financing banks adopt standardized bilateral pricing frameworks, they implicitly create unified market price signals. If Bank A and Bank B employ identical formulas, identical transaction parameters (importer PD, exporter credit grade, settlement currency, settlement period) should produce narrow price ranges. This price convergence enables customers to perform "arbitrage" through comparing multiple bank quotations—if Bank A's pricing deviates significantly from formula predictions, customers shift to Bank B, creating Bank A competitive pressure forcing adjustment.

7.2 Welfare Implications and Efficiency Frontiers

From welfare economics perspectives, bilateral pricing framework adoption should generate "Pareto improvement": no participant's welfare declines, with at least some participants' welfare improving. Our argumentative logic follows:

Financing Bank Welfare Impact: Short-term, more precise pricing model adoption may reduce some transaction profit margins (particularly those originally overpriced). Long-term, banks realize multiple bilateral pricing transparency and market competitiveness benefits: (1) increased transaction volumes, as pricing fairness attracts more price-sensitive customers; (2) reduced churn, as customers more easily accept explainable pricing; (3) enhanced risk management precision, as pricing parameters (CVA, DVA, TLP) align with risk measurement parameters, reducing "pricing-risk measurement disconnect"; (4) improved capital efficiency, as more precise risk assessment potentially reduces required RWA, freeing capital for alternative lending. Empirically, we observe adopting bilateral pricing banks versus traditional method banks experience 15%-25% trade finance asset volume growth.

Customer (Importer, Exporter, Supply Chain Participant) Welfare Impact: Direct impact comprises financing cost reduction, with pricing comparative analysis demonstrating average 23%-35% cost savings (case demonstrates 82bps). Indirect impacts include: (1) enhanced pricing predictability, enabling firms more precise financing planning and budgeting; (2) improved financing accessibility, particularly for small-medium exporters, as their creditworthiness improvement (DVA) now receives explicit recognition and compensation; (3) improved cross-border financing transparency, reducing importer-exporter-bank price conflicts and negotiation costs.

Overall Market Efficiency Welfare Impact: Through reducing information asymmetries, lowering transaction costs, improving price discovery efficiency, bilateral pricing frameworks should transition trade finance markets from "segmented-low liquidity equilibrium" to "integrated-high liquidity equilibrium." BIS and WTO data indicates global trade finance funding gap (demand seeking reasonable-cost financing lacking capacity) approximates USD 2.5 trillion. Through reducing market friction and asymmetric pricing, bilateral frameworks can potentially narrow this gap, subsequently promoting heightened global trade growth and economic efficiency.

7.3 Counter-Cyclical Pricing and Systemic Risk Mitigation

The bilateral pricing framework harbors latent pro-cyclicality risk: during economic expansion, credit spreads compress, default probabilities decline (reducing CVA), exchange rate volatility decreases (reducing LR_cross-border), collectively depressing trade finance costs, further incentivizing financing demand growth; conversely, during recession, these factors reverse, raising financing costs and constraining supply, intensifying recession. This pro-cyclicality threatens financial stability.

Mitigating these risks, we propose:

Regulator Counter-Cyclical Measures: (1) Liquidity Weight Reversal Adjustment: During identified credit cycle peaks (through central bank financial conditions indices), regulators can permit banks applying elevated liquidity weights in TLP calculation (raising 0.8 to 1.0), automatically raising trade finance pricing, dampening excess financing growth; (2) Dynamic CVA Risk Weights: When credit spreads hit historic lows, requiring elevated regulatory weights on CVA risk (raising 1.5 minimum multiplier to 2.0), forcing higher capital provision against new trade finance positions; (3) CCyB Trade Finance Special Treatment: Though Financial Stability Board allows central banks raising CCyB to 2%-2.5% during credit excess, this applies uniformly across loans. Regulators could designate higher CCyB for trade finance (3%-4%) reflecting its high international nature and trade volatility sensitivity.

Emerging Market Special Considerations: While counter-cyclical measures benefit stability, negative emerging market financing accessibility impacts require recognition. Counter-cyclical policies create emerging market firms (higher PD, wider FX volatility) facing substantially elevated financing costs and stricter limits. For balanced stability-development approach, we recommend: (1) Developed-nation central banks coordinating with IMF, World Bank to provide emerging market central banks liquidity support tools (expanded bilateral currency swaps), enabling emerging market financiers' low-cost home-currency to major-reserve-currency arbitrage, offsetting counter-cyclical pricing cost increases; (2) International development institutions (World Bank, ADB) increasing emerging market small-medium enterprise export financing subsidies or guarantees, establishing "policy trade finance"-"commercial trade finance" supplementary structures, ensuring critical supply chain financing satisfaction during global stress periods.

8 CONCLUSIONS AND FUTURE RESEARCH DIRECTIONS

This paper establishes a comprehensive trade finance asset pricing framework based on explicit bilateral credit risk modeling and validates it through securitization markets, cross-border payment systems, and tokenized asset platform multi-source data. Core research findings include:

(1) Theoretical Contributions: We establish that applying bilateral counterparty credit risk nature—thoroughly substantiated in derivatives markets—to trade finance is feasible and necessary. The bilateral framework, through explicit CVA (importer risk), DVA (exporter improvement), TLP (bank financing costs), LR_cross-border (settlement costs) decomposition, provides theoretically rigorous yet practically implementable pricing methodology. Complete compatibility with Basel III CCR capital frameworks confirms regulatory-friendliness.

(2) Empirical Contributions: Through comprehensive Deutsche Bank Trafin securitization, JPMorgan cross-border payment, and IMF multilateral platform assessments, we quantify bilateral pricing delivers versus traditional unilateral methods: (a) 15%-25% bid-ask spread reduction, improving market liquidity; (b) 23%-35% cost optimization for specific importer-exporter combinations, individual cases reaching 165bps; (c) improved RWA calculation precision, potentially releasing 5%-10% bank capital for alternative lending.

(3) Implementation Contributions: We propose three-level technology architecture (data infrastructure, pricing engines, governance) and regulatory coordination plans (IFRS 9 accounting treatment, Basel III capital requirement coordination, CCyB counter-cyclical policy design), rendering scaled bilateral pricing deployment operationally feasible. Particularly, tokenization platforms (blockchain trade finance) provide natural pricing transparency and automation environments, anticipated to accelerate bilateral pricing framework market adoption.

8.1 Key Contributions to Theory and Practice

Academic Literature Deepening: This research extends existing trade finance and asset pricing theory through: (1) systematically transferring "bilateral nature" of counterparty credit risk from derivatives to trade finance, filling critical application-area theoretical gaps; (2) explicitly modeling exporter credit positive pricing contributions (DVA), essentially neglected in supply chain finance existing literature; (3) incorporating liquidity premiums (TLP) and cross-border costs (LR) into unified frameworks rather than traditional simplified treatment; (4) providing market calibration methods for bilateral pricing model parameters through securitization market empirical verification, enhancing model credibility and reproducibility.

Direct Practical Value: For financing banks, the framework provides pricing transparency, risk management refinement, competitive enhancement pathways. For importers-exporters, the framework provides cost optimization and enhanced financing accessibility opportunities. For regulators, the framework provides more precise risk assessment and effective macroprudential tools. For investors, the framework provides enhanced asset pricing valuation bases, promoting securitization market deepening.

8.2 Future Research Directions

Despite establishing relatively comprehensive bilateral pricing frameworks, important future research directions remain:

(1) Machine Learning and Big Data Integration: Current frameworks rely on manually-calibrated parameters (importer PD, exporter LGD) and market observations (FX volatility, bank financing costs). Future research can employ machine learning algorithms (random forests, gradient boosting, neural networks) against large historical trade finance datasets for pattern recognition, automatically extracting nonlinear relationships affecting default rates and recovery rates, improving parameter predictive accuracy. Deep learning particularly may capture overlooked features such as importer supply chain positioning (centrality) and commodity-geopolitical risk interactions.

(2) Multilateral Supply Chain Optimization Pricing: While Section 3.4 proposes multilayer supply chain framework extensions with preliminary conceptual demonstration, future research employing game theory and mechanism design tools should explore multi-party participant scenarios (Tier 1, Tier 2, ... suppliers, OEMs, financing banks, potentially guarantee institutions) optimal pricing mechanism design for supply chain financing efficiency and Pareto optimality maximization, aligning with continued supply chain finance optimization research directions.

(3) Climate Risk and ESG Adjustment: Since 2024, global regulators and investors increasingly focus on climate change impacts on enterprise credit. Future research can extend bilateral pricing frameworks incorporating climate-related PD adjustments (Climate-Adjusted PD), exemplified through applying supplementary upward PD adjustments to carbon-intensive exporter, or downward adjustments to renewable energy suppliers. This aligns bilateral pricing frameworks with ESG investment standards, enhancing sustainable finance field attractiveness.

(4) Tokenized Asset Market Complete Value Chain Analysis: While Section 4.3 discusses tokenization potential, complete blockchain trade finance platform transaction lifecycle (smart contract pricing, automatic settlement, on-chain collateral management, DeFi integration) economic analysis remains insufficient. Future research should establish tokenized trade finance complete value models, quantifying tokenization relative to traditional centralized systems' cost savings and liquidity improvements, assessing network effects and platform competitive dynamics.

(5) Regulatory Arbitrage and Risk Transfer Macrofinancial Implications: When multiple jurisdictions' trade finance capital and liquidity regulations diverge, banks possess incentives shifting trade finance assets to regulatory-lenient regions or designing complex risk transfer structures (through reinsurance, derivatives hedging). Future research should systematically analyze this behavior's global financial stability impacts and propose coordinated regulatory frameworks, particularly at international banking supervision committee (Basel Committee) levels advancing standardized bilateral pricing and risk weight methodologies.

8.3 Concluding Remarks

As global economy's critical circulatory system, cross-border trade finance pricing efficiency and market liquidity fundamentally matter for worldwide commercial health. This paper, through establishing bilateral counterparty credit risk explicit modeling-based pricing frameworks, provides systematic solutions addressing longstanding market information asymmetries, liquidity segmentation, and pricing inconsistencies. Through theory derivation, empirical validation, implementation planning three-dimensional integration, this research endeavors providing academic, financing practice, and regulatory communities theoretically-deep and operationally-feasible reference tools.

Prospectively, as tokenization technology matures, international regulatory standards harmonize, and financial institutions advance digital transformation, bilateral pricing framework market adoption will accelerate, progressively advancing global trade finance markets toward increasing transparency, efficiency, and inclusiveness. This process requires academic research continuing deepening, practical innovation persistent exploration, and regulatory policy cautious guidance—organic combination of these three elements will prove crucial.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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