

A Cross-Cultural Study of Metaphor Use in Risk Factor Disclosures: Comparing Chinese and American Photovoltaic Companies' IPO Prospectuses

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Abstract: This study combines Conceptual Metaphor Theory from cognitive linguistics, Grammatical Metaphor Theory from functional linguistics, and High-Low Context Theory from cross-cultural communication to conduct a comparative analysis of the metaphors used in the risk disclosure sections of IPO prospectuses of Chinese and American photovoltaic enterprises listed in the United States. It focuses on exploring the potential cross-cultural understanding barriers that Chinese enterprises' metaphor usage may pose to low-context investors. To this end, this study collected risk disclosure content from the prospectuses of six representative photovoltaic enterprises listed in the United States (three Chinese and three American) and established a corpus based on this data. In light of the characteristics of photovoltaic enterprises, this study specifically examines three types of risks: market, subsidies and policies, and costs and technology. From the perspectives of Conceptual Metaphor Theory and Grammatical Metaphor Theory, it identifies the use of metaphors in relevant risk statements and analyzes the difficulty of cross-cultural understanding based on High-Low Context Theory. Finally, this study proposes a method for calculating the degree of difficulty in cross-cultural understanding of the text and conducts a quantitative comparative analysis of the overall difficulty of cross-cultural understanding of different metaphor types and different risk types in the corpus. Through quantitative comparison and analysis, it is found that among different metaphor types, the passive voice poses the greatest difficulty in cross-cultural understanding; and within the content of risk disclosure, subsidies and policy risks have the highest overall difficulty in cross-cultural understanding, which requires special attention.

Keywords: photovoltaic enterprises, prospectus, risk disclosure, metaphor, cross-cultural communication

1. Introduction

As the global leader in photovoltaic (PV) production, China has seen a surge in its PV firms pursuing US IPOs. The comprehensibility of prospectuses—particularly risk disclosure sections—by cross-cultural investors critically impacts listing outcomes. However, inherent challenges arise from the PV sector's technical complexity and divergent cultural norms in risk communication. This study investigates how US-listed Chinese PV enterprises linguistically construct risk disclosures, with emphasis on metaphor-driven cultural and cognitive barriers.

Metaphors, shaped by cultural and contextual frameworks, can hinder cross-cultural understanding. Conceptual metaphor theory [1][2] posits that metaphors reflect cognitive mappings (e.g., "time is money" vs. cyclical time in some cultures). Grammatical metaphor theory [3][4] explores how syntactic shifts (e.g., nominalization) alter meaning interpretations. High-context cultures [5][6] embed metaphors in shared cultural knowledge, requiring implicit decoding, while low-context cultures prioritize explicit verbal clarity. These divergences may cause mismatched interpretations, as metaphors encode culturally specific values, logic, and communication norms. Navigating such differences demands awareness of how linguistic structures and contextual dependencies interact across cultural boundaries.

Existing prospectus research prioritizes pragmatic dimensions—stylistic structure, tone, and readability [7-10]—with parallel emphasis on risk disclosure quality, granularity, and lexical framing [11]. While these studies advance prospectus optimization and investor decision-making, cross-cultural metaphor analysis remains underdeveloped. Current scholarship on cross-cultural metaphors focuses predominantly on educational texts, media discourse, and business negotiations [12-15], centering on usage patterns and efficacy. Notably, no systematic inquiry examines metaphor deployment in prospectuses through a cross-cultural lens, despite their status as critical economic documents requiring precise intercultural communication.

As a critical communicative tool between firms and investors, prospectuses exhibit culturally-conditioned metaphor deployment. This study investigates cross-cultural metaphor strategies in risk disclosures of Chinese photovoltaic (PV) enterprises during US IPOs, aiming to decode culturally-driven interpretative disparities in investor risk perception. The findings advance metaphor theory within cross-cultural financial discourse while delivering strategic guidance for Chinese PV firms pursuing US listings. Simultaneously, it establishes a reference framework for American investors and analogous Chinese tech enterprises navigating cross-border capital markets.

2. Methodology

2.1. Corpus collection and metaphor identification

The study analyzes prospectuses from six US-listed PV firms (2005–2015)—three China-based (JinkoSolar, Solarjuice, CSIQ) and three US-based (Solaredge Technologies, Enphase Energy, SunPower). This period aligns with China's policy-driven PV industry expansion and global market growth, with all selected firms maintaining stable profitability and high market capitalization, ensuring industry representativeness.

Metaphors are identified and annotated through dual theoretical lenses: (1) Conceptual Metaphor Theory and Grammatical Metaphor Theory for structural analysis, and (2) high-/low-context cultural theory for cross-cultural interpretability assessment.

Three critical risk categories—market dynamics, subsidy/policy fluctuations, and cost/technological uncertainties—are strategically selected to ensure analytical precision and thematic relevance.

2.2. Calculation method of cross-cultural comprehension difficulty index

This study develops a Cross-cultural Comprehension Difficulty Index (CCDI) as a quantitative metric to evaluate culturally-mediated comprehension barriers in textual materials, with particular focus on low-context investors' interpretive challenges. Grounded in established theoretical frameworks, the method assigns hierarchical cultural barrier coefficients to metaphor types, quantifying their proportional contribution to cross-cultural interpretative complexity within the proposed index framework.

Methodologically, the approach operationalizes three phases:

(1) Metaphor Frequency Quantification

Systematically identify metaphorical expressions in risk disclosure texts and categorize their occurrences by metaphor type. This process establishes an analytical framework based on functional linguistics and cognitive linguistics theories, encompassing seven major metaphor categories: basic nominalization metaphors, foundational conceptual metaphors, passive voice structures, compound nominalization metaphors, nested conceptual metaphors, interpersonal/discursive metaphors, and culture-specific metaphors (e.g., Chinese-specific metaphors).

(2) Cultural Barrier Coefficient Weighting

Establish evaluation benchmarks through cross-cultural cognitive surveys. Researchers design a double-blind comprehension experiment involving participants from high-context-dependent and low-context-dependent cultural backgrounds to assess the perceived difficulty of interpreting representative metaphorical statements. Statistical analysis of group cognitive variance data generates a weighted system reflecting cultural barriers, where weights increase with metaphor structural complexity and cultural specificity, forming a gradient scale from basic linguistic phenomena to culture-rooted comprehension challenges.

(3) Comprehensive Difficulty Index Construction

Integrate quantified metaphor frequencies and qualitative weights through a linear weighting model to produce a composite evaluation metric with cultural interpretability. This index captures both the inherent metaphor density of texts and the underlying cultural cognitive disparities embedded in linguistic expressions, offering a quantifiable tool to assess cross-cultural information communication efficacy.

3. Results and discussion

3.1. Analysis from the perspective of Lakoff's "Conceptual Metaphor" theory

Both Chinese and U.S. photovoltaic (PV) companies extensively employ conceptual metaphors in risk disclosure sections of prospectuses. These include three primary categories: orientational metaphors (e.g., "up," "down," "decline"), ontological metaphors (e.g., "barrier," "impair," "expose"), and structural metaphors (e.g., "compete," "experience"). These metaphors enhance clarity and accessibility of risk-related information, aiding investors in comprehending risks and making informed decisions.

Chinese PV prospectuses exhibit unique tendencies: (1) Superimposition and nesting of conceptual metaphors (e.g., "key barriers," "broad decline of economic activity has undermined confidence"), which increases textual complexity and reliance on contextual interpretation, posing cross-cultural comprehension challenges; (2) Frequent use of culturally specific terms (e.g., "structural imbalance," "downward pressure," "leading vertically integrated") rooted in Chinese policy or industrial discourse, which may introduce ambiguity in cross-cultural contexts. In contrast, U.S. counterparts avoid metaphor superposition and culturally localized expressions, favoring direct language to minimize decoding barriers.

3.2. Analysis from the perspective of Halliday's "Grammatical Metaphor" theory

Both Chinese and U.S. photovoltaic (PV) companies extensively employ grammatical metaphors in risk disclosure sections of prospectuses, encompassing ideational metaphors (nominalization, passive voice, gerunds), interpersonal metaphors (modal and mood metaphors), and textual metaphors. These metaphors enhance clarity and facilitate investor risk assessment by structurally reconfiguring information. For instance, nominalizations (e.g., "discontinuation," "installation") and modal verbs (e.g., "may," "will") are commonly used to objectively present risks, while passive voice (e.g., "be deterred by") emphasizes action recipients, demonstrating the universal utility of grammatical met

Chinese companies prioritize formality and indirectness by employing complex nominalizations (e.g., "attractiveness"), frequent passive voice to highlight responsibility objects, and modal metaphors (e.g., "may") to mitigate adverse certainty. Textual metaphors often result in syntactically dense sentences (e.g., "As we introduce...we will face..."). Conversely, U.S. companies favor direct expression through lexically flexible terms (e.g., "demand," "drop") and explicit negation (e.g., "cannot") to clarify risk severity. This contrast suggests that Chinese texts, influenced by high-context cultural norms, may challenge low-context investors, whereas the conciseness of U.S. texts enhances international interpretability.

3.3. Quantitative comparative analysis of the difficulty of cross-cultural understanding

3.3.1. Setting of cross-cultural understanding obstacle coefficients

This study establishes a graded coefficient system for metaphor comprehension barriers through cross-cultural cognitive surveys and empirical data analysis. A double-blind controlled experimental design was implemented, involving 50 participants equally divided between high-context cultural backgrounds (Chinese English majors) and low-context cultural backgrounds (native English-speaking international students). Participants rated the comprehension difficulty of seven metaphor categories using prototypical examples. Statistical analysis of intergroup cognitive variance from 50 valid questionnaires quantified obstacle intensities across metaphor types, culminating in a hierarchically structured coefficient system.

Metaphor-specific obstacle coefficients were determined through dual validation of cognitive variance in experimental data and theoretical frameworks. Coefficient intervals reflect significance levels of intergroup differences in comprehension latency (or misinterpretation frequency), with the highest coefficient (19) indicating that low-context investors required 4.2 times longer semantic decoding time than native speakers on average:

Table 1: Setting of cross-cultural understanding obstacle coefficients

Metaphor Type	Key Determinants	Coefficient
Basic Nominalization Metaphors	Cross-cultural generic vocabulary (e.g., "reduction") lacking cultural specificity	2
Foundational Conceptual Metaphors	Concrete action verbs (e.g., "grow") requiring basic conceptual alignment	3
Passive Voice Metaphors	Increased inferential cost due to hidden agency	4
Compound Nominalization Metaphors	Prefix-negated compounds (e.g., "uncompetitive") violating low-context lexical norms	5
Nested Conceptual Metaphors	Dual cognitive mapping demands from spatial-ontological metaphor nesting	6
Interpersonal/Discourse Metaphors	Systemic cognitive load from modality metaphors altering risk salience in multi-metaphor sentences	14
Chinese-Specific Metaphors	Policy-laden terms (e.g., "structural imbalance") encoding implicit institutional presuppositions	19

3.3.2. Comparative analysis of calculation results

In the corpus, the authors conducted three analyses on the risk disclosure sections of Chinese and American PV enterprise prospectuses: first distinguishing metaphor types and applying the

aforementioned statistical methods, using cross-cultural understanding difficulty as the metric to obtain quantitative comparisons of metaphor type usage between Chinese and American enterprises by averaging the calculation results across companies (Figure 1a); secondly distinguishing risk types and employing the same statistical approach to derive quantitative results of metaphor usage across different risk types for both enterprises (Figure 1b); and finally conducting separate statistical evaluations on the risk disclosure texts of enterprises from both countries to quantitatively assess the overall cross-cultural understanding difficulty of the risk disclosure sections in Chinese and American prospectuses.

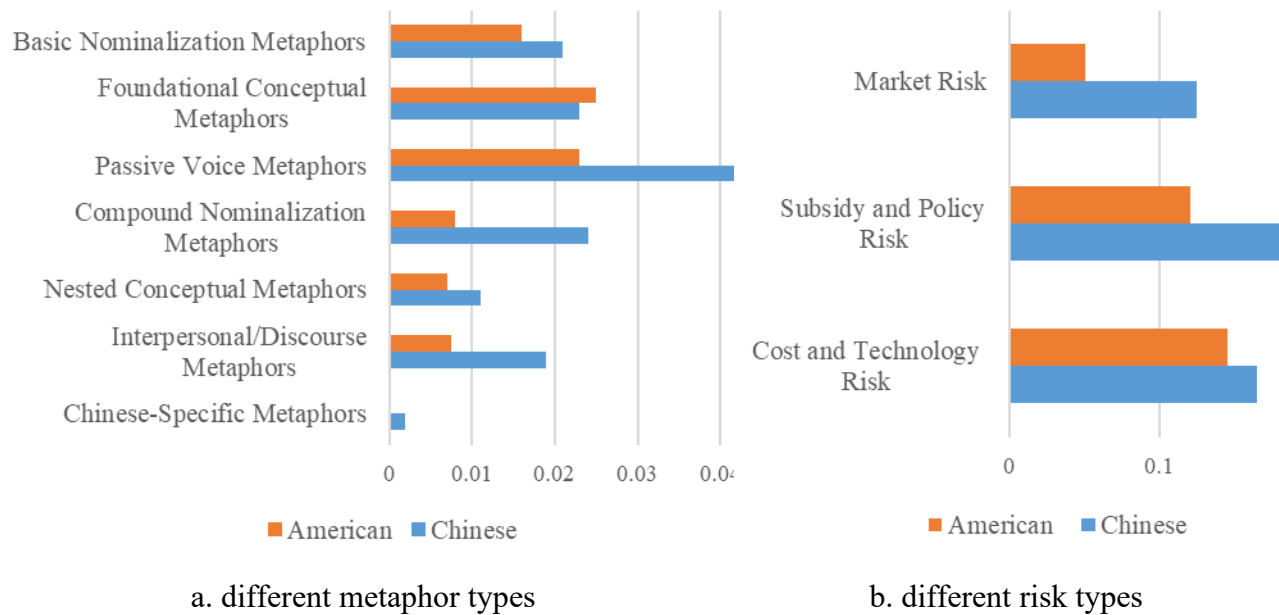


Figure 1: Comparative analysis results of cross-cultural difficulty

(1) Metaphor Type Dimension

The frequency of basic noun phrase metaphor usage is similar between Chinese and American PV companies. However, Chinese employs passive voice more than double the amount used in American, resulting in the most significant cross-cultural comprehension challenges. Additionally, Chinese uses complex noun phrase metaphors and interpersonal/discourse metaphors far more frequently than American, further increasing comprehension difficulty. Notably, metaphors with Chinese characteristics are prone to causing misunderstandings and should be minimized.

(2) Risk Type Dimension

In Chinese companies' risk disclosures, subsidy and policy risks pose the highest cross-cultural comprehension difficulty, followed by cost and technology risks, while market risks rank lowest. For American companies, cost and technology risks present the highest comprehension barriers, with market risks also being the lowest. When comparing the same risk categories, Chinese disclosures for market risks and subsidy/policy risks are significantly harder to understand than those of American companies, whereas the difficulty level for cost and technology risks is similar.

(3) Overall Comparison and Recommendations

The cross-cultural comprehension difficulty of risk disclosures in Chinese PV companies' prospectuses is approximately 40% higher overall than that of U.S. companies. To reduce barriers, it is recommended to decrease the use of passive voice and complex metaphors, streamline language

structures, provide contextual explanations for policy-related risks, and avoid culturally specific metaphorical terms.

4. Conclusion

This study reveals significant disparities in metaphorical strategies between Chinese and American PV enterprises in IPO risk disclosures: Chinese prospectuses exhibit 40% higher cross-cultural comprehension difficulty due to doubled passive voice usage compared to American counterparts, culturally specific policy risk metaphors (e.g., "structural imbalance"), and nested conceptual metaphor superposition. Theoretically, the Cross-cultural Comprehension Difficulty Index (CCDI) quantifies metaphorical barriers, confirming passive voice as a critical cultural barrier in technical discourse and demonstrating cultural specificity's impact on risk cognition frameworks. Practically, Chinese enterprises are advised to reduce passive voice usage to enhance agency transparency, replace culturally-bound metaphors with international terminology, and append contextual footnotes for essential policy metaphors. The findings prove that global capital market communication efficacy depends on metaphorical transparency rather than surface-level translation accuracy, providing strategic optimization frameworks for cross-border listings and diagnostic tools for investors to decode culturally mediated risk narratives.

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