# Framing Effects on EV Policy Support in China Environmental Behavior and Support for Climate Policies

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**Abstract.** This study employs a randomized controlled trial with a 2×2 factorial design to examine how information framing (gain vs. loss) and policy incentive type (monetary vs. non-monetary) jointly influence Chinese consumers' purchase intentions toward new energy vehicles (NEVs). Grounded in prospect theory, we hypothesized that: (H1) loss framing would generate higher purchase intention than gain framing; (H2) monetary incentives would outperform non-monetary incentives; and (H3) monetary incentives would be especially effective under loss framing, producing a positive interaction effect. We distributed an online questionnaire to residents across multiple Chinese provinces and collected 198 valid responses. Policy conditions were randomly assigned across five groups: Gain & Monetary, Gain & Non-Monetary, Loss & Monetary, Loss & Non-Monetary, and a pure control group. Purchase intention was measured on a five-point Likert scale. OLS regression with robust standard errors yielded uniformly null results: none of the three hypotheses was supported at conventional significance levels. The null findings persisted after inclusion of demographic and attitudinal control variables. Government trust was the sole variable significantly associated with purchase intention. We interpret these results as reflecting a ceiling/familiarity effect among a highly educated urban sample, limited statistical power (≈40 per group), and the hypothetical nature of the survey instrument. These findings highlight important boundary conditions for the application of prospect theory in mature consumer markets with high policy awareness.

**Keywords:** green travel; information framing; prospect theory; NEV policy; randomized experiment; purchase intention

## 1 Introduction

China's push to scale new energy vehicles (NEVs) is central to its low-carbon transport strategy, and the country has become the world's largest NEV market. Over the past decade, the Chinese government has invested heavily in NEV promotion, combining direct financial subsidies with administrative conveniences such as preferential license plate policies [6,7]. Despite these efforts, the rate of NEV adoption varies substantially



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across regions and socioeconomic groups, indicating that the effectiveness of these policies is not simply a function of monetary generosity but also of how policy information is framed and communicated.

Behavioral economics research—particularly prospect theory [8]—provides a theoretical basis for expecting that the framing of identical policy content can produce systematically different behavioral responses. Because individuals respond more strongly to potential losses than to equivalent gains (loss aversion), presenting an NEV subsidy as a benefit forgone by not adopting should, in principle, be more motivating than presenting the same subsidy as a reward for adoption. Whether this logic extends to high-cost, high-deliberation consumer goods such as automobiles, however, is an open empirical question.

Policy instrument choice adds a further dimension. Direct fiscal incentives—such as purchase tax exemptions—offer immediately quantifiable monetary benefits and map cleanly onto consumers' upfront cost calculations [4]. Non-monetary incentives such as green license plate privileges provide procedural conveniences whose subjective value varies considerably across individuals and cities [7]. The comparative effectiveness of these instrument types, and especially their interaction with gain/loss framing, has rarely been tested in a controlled experimental design.

This paper addresses that gap. We designed a randomized controlled trial with a 2×2 factorial structure (framing × incentive type) plus a pure no-information control group. Contrary to expectations grounded in prospect theory, none of the three pre-registered hypotheses received empirical support. The null results are informative: they suggest that, in a market where NEV policies are already widely known, rhetorical repackaging is unlikely to shift well-formed purchase intentions—and that institutional credibility may be a more powerful lever than message design.

## 2 Background

### 2.1 China's NEV Policy Evolution

China's NEV support framework evolved from the 2009 "Ten Cities, Thousand Vehicles" pilot to nationwide purchase tax exemptions (formally introduced in 2014 and repeatedly extended) and urban green license plate schemes in cities with restricted plate issuance such as Beijing and Shanghai [6]. During 2022–2023, sharp sales fluctuations occurred as consumers rushed to purchase before anticipated subsidy reductions—then pulled back when policies were extended. This behavior confirms that NEV buyers are highly price-sensitive and closely monitor policy signals [4,7]. As the government gradually reduces direct subsidies, understanding how communication strategies can maintain purchase motivation becomes an increasingly urgent policy question.

### 2.2 Prospect Theory and Framing Effects

Kahneman and Tversky's prospect theory [8] identifies three regularities central to this study: (1) outcomes are evaluated relative to a reference point rather than in absolute terms; (2) losses loom larger than equivalent gains—the loss aversion principle; and (3)

value functions are concave in the gain domain and convex in the loss domain [1]. Together, these properties imply that framing an identical policy option as avoiding a loss should generate stronger behavioral motivation than framing it as obtaining a gain.

Applied to environmental policy communication, loss framing has shown persuasive advantages in studies of energy conservation and pro-environmental consumption [3,5]. Negative framing of information has also been found effective in motivating behavioral compliance in technology adoption contexts [2]. However, results in the vehicle purchase context are more ambiguous. High-cost, high-deliberation purchases involve extended search, price comparisons, and family discussion—conditions that may attenuate simple framing effects because consumers engage in more systematic information processing rather than relying on heuristic reactions to message valence [1,8].

### 2.3 Monetary vs. Non-Monetary Incentives

Fiscal incentives such as purchase tax reductions directly lower the transaction cost of NEV adoption in a manner that is immediately visible and calculable at point of decision. Research by Li et al. [4] using stated preference experiments in China found that personal carbon trading credits applicable to vehicle purchases—a monetary mechanism—significantly increased willingness to adopt battery electric vehicles compared to non-financial alternatives. This advantage is attributed to the concrete, easily quantifiable nature of monetary savings relative to the more diffuse benefits of non-monetary instruments.

Non-monetary incentives like green license plate privileges offer a fundamentally different type of benefit: procedural convenience and exemption from restrictive administrative burdens [7]. Their subjective value is highly context-dependent; in cities where winning a license plate lottery may take years, green plate eligibility constitutes a substantial incentive, while in unrestricted cities its value is negligible. This heterogeneity makes the aggregate effect of non-monetary incentives harder to detect. The present study tests both incentive types within the same experiment, enabling a direct comparison under controlled conditions.

## 3 Research Design and Hypotheses

### 3.1 Hypotheses

Drawing on prospect theory and the durable goods literature [1,4,8], we advance three hypotheses:

H1: Loss framing leads to higher NEV purchase intention than gain framing. This hypothesis follows directly from the loss aversion principle [8]: identical policy content presented as a forgone benefit should be more motivating than the same content presented as an attained benefit.

H2: Monetary incentives generate higher purchase intention than non-monetary incentives. Given consumers' high price sensitivity for large purchases, direct financial savings should offer more salient and calculable benefits than procedural conveniences.

H3: The positive effect of monetary incentives on purchase intention is stronger under loss framing than under gain framing. When a tax exemption is presented as money forfeited by choosing a gasoline vehicle, the combined salience of financial loss and monetary incentive should amplify policy effectiveness beyond either factor alone.

### 3.2 Experimental Design

We employed a 2 (framing: gain vs. loss) × 2 (incentive: monetary vs. non-monetary) factorial design plus a pure control group, yielding five conditions. Participants in the control group evaluated a standard vehicle choice scenario without policy information, establishing a no-treatment baseline. The four treatment groups received policy information about either (a) a purchase tax exemption of up to RMB 30,000 or (b) a green license plate policy, each presented under either a gain or a loss frame.

Gain-framed messages emphasized the positive benefits obtained by choosing an NEV (e.g., saving RMB 30,000 in taxes; gaining faster registration and exemption from lotteries). Loss-framed messages presented the same incentive as a benefit foregone by choosing a gasoline vehicle (e.g., forfeiting up to RMB 30,000 in tax exemptions; losing access to streamlined registration). The factual content of the policy information was identical across frames; only the evaluative valence differed.

An anonymous online questionnaire distributed via social media collected responses from residents across multiple Chinese provinces. After reading their assigned scenario, participants rated their likelihood of choosing an NEV as their next vehicle on a 5-point Likert scale (the dependent variable: 1 = very unlikely, 5 = very likely). Demographic and attitudinal control variables—including government trust, gender, education, income, environmental concern, EV familiarity, and perceived policy importance—were also collected.

## 4 Empirical Results

### 4.1 Descriptive Statistics and Randomization

198 valid responses were collected. Purchase intention averaged 3.34 (SD = 1.05) on the 5-point scale. The sample was 49.5% female, predominantly aged 18–34 (78.3%), and highly educated (46.5% bachelor's, 23.7% master's degree). Pre-treatment balance tests (Table 1) confirmed successful randomization: no significant baseline differences across the five groups were detected (joint F-test $p > 0.10$).

**Table 1.** Summary Statistics

| Variable | N | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| Purchase Intention | 198 | 3.343 | 1.054 | 1 | 5 |
| Government Trust | 198 | 3.505 | 0.955 | 1 | 5 |
| Environmental Concern | 198 | 3.384 | 0.947 | 1 | 5 |
| Policy Importance | 198 | 3.177 | 0.886 | 1 | 5 |

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|---|---|---|---|---|---|
| Gender (Female=1) | 198 | 0.495 | 0.501 | 0 | 1 |
| Education Level | 198 | 3.067 | 1.021 | 1 | 5 |
| Income Level | 198 | 2.931 | 1.624 | 1 | 8 |

### 4.2 Treatment vs. Control Analysis

OLS regressions (Table 2) comparing each treatment group against the control found no statistically significant treatment coefficients. Estimated differences ranged from −0.35 to −0.10 and were indistinguishable from zero at conventional levels. The joint F-test also failed to reject the null hypothesis of zero treatment effects, providing no support for a direct average treatment effect of either framing or incentive type.

**Table 2.** Treatment vs. Control

| | **Purchase Intention** |
|---|---|
| Gain & Monetary (1) | −0.103 (0.237) |
| Gain & Non-Monetary (2) | −0.144 (0.279) |
| Loss & Monetary (3) | −0.346 (0.267) |
| Loss & Non-Monetary (4) | −0.238 (0.230) |
| Constant | 3.513*** (0.197) |
| N / $R^2$ | 198 / 0.013 |

*Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01*

### 4.3 2×2 Mechanism Analysis

**Table 3.** 2×2 Factorial Model (Treatment Groups Only)

| | **Purchase Intention** |
|---|---|
| Loss framing | 0.093 (0.230) |
| Monetary incentive | −0.108 (0.216) |
| Loss × Monetary | 0.150 (0.320) |
| Constant | 3.275*** (0.119) |
| N / $R^2$ | 159 / 0.009 |

*Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01*

Restricting the sample to the four treatment groups and estimating a full factorial model (Table 3) confirmed the null pattern. The framing coefficient was positive but insignificant; the monetary incentive coefficient was negative and insignificant; the framing × monetary interaction was also insignificant. Predicted marginal means ranged from 3.17 to 3.41 with fully overlapping confidence intervals. These results indicate that neither framing manipulation, incentive type, nor their combination produced a measurable change in purchase intention.

### 4.4 Robustness: OLS with Control Variables

Adding government trust, gender, education, and income as controls did not materially alter the treatment coefficients (Table 4). Framing, incentive type, and their interaction remained insignificant. Government trust was the only variable significantly associated with purchase intention ($\beta \approx 0.17$, $p < 0.10$), indicating that institutional credibility—not message framing—is the primary driver of NEV policy acceptance in this sample.

**Table 4.** OLS with Control Variables (Selected Coefficients)

| Variable | Coef. (SE) |
|---|---|
| Gain & Monetary (1) | −0.164 (0.255) |
| Gain & Non-Monetary (2) | −0.016 (0.298) |
| Loss & Monetary (3) | −0.372 (0.279) |
| Loss & Non-Monetary (4) | −0.262 (0.243) |
| Government Trust | 0.172* (0.095) |
| Female | −0.258 (0.160) |
| N / $R^2$ | 196 / 0.132 |

*Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01*

## 5 Discussion

### 5.1 Why Null Results?

Three mechanisms likely account for the absence of significant framing or incentive effects. First, a ceiling/familiarity effect: approximately 70% of respondents held a bachelor's degree or higher, and the majority were aged 18–34—a cohort already well-acquainted with China's NEV subsidy regime. When policy information lacks novelty, reframing it cannot shift attitudes that are already well-formed. This is consistent with the finding in [3] that framing interventions are most effective among low-knowledge consumers; in a high-knowledge sample, the marginal informational value of any single policy message approaches zero.

Second, statistical power constraints: with approximately 40 participants per group, the experiment was underpowered to detect small-to-moderate effects. A minimum detectable effect analysis suggests the study could reliably identify effects of Cohen's $d \geq 0.45$—larger than the true population effects may actually be in this context. Third, ecological validity: a brief hypothetical questionnaire cannot replicate the complex, months-long deliberation that precedes vehicle purchases. The attitudinal response to a survey item may be only loosely coupled with actual purchase behavior, and brief text framing may have minimal impact on such a loosely coupled measure.

### 5.2 Policy and Theoretical Implications

For policymakers, the finding that government trust is the sole significant predictor suggests that transparent, credible, and consistent policy communication yields greater returns than rhetorical packaging. Consumers who trust the government to honor its commitments respond more favorably to NEV policies regardless of how those policies are framed. Building and maintaining institutional credibility is therefore a foundational prerequisite for behavioral interventions to work.

In a market where subsidy information is already widely diffused, substantive improvements—expanding charging infrastructure, reducing vehicle prices through extended tax exemptions, stabilizing incentive frameworks to minimize policy uncertainty—are likely more effective than message-level adjustments. The implication is not that communication does not matter, but that communication strategies must be matched to audience sophistication: for policy-familiar audiences, only genuinely novel information or substantive policy changes will shift behavior.

Theoretically, the null results contribute important boundary conditions to the prospect theory literature. Framing effects robust in controlled laboratory settings with simple choices may attenuate substantially in real-world consumer markets characterized by high stakes, high familiarity, and extended deliberation [3,5]. These findings join a growing body of evidence documenting the conditions under which behavioral nudges fail to generalize from laboratory to field.

### 5.3 Limitations and Future Research

The sample's demographic skew—young, highly educated, urban, predominantly recruited via social media—limits generalizability to the broader Chinese car-buying population. Future studies should: (1) recruit demographically diverse samples including middle-aged, lower-educated, and rural consumers who may exhibit stronger framing effects due to lower policy familiarity; (2) use larger samples ($\geq$100 per cell) to achieve adequate statistical power for detecting modest effects; (3) employ more ecologically valid designs such as dealership-based experiments or conjoint analyses with realistic purchase scenarios; and (4) measure individual-level loss aversion directly to test whether framing effects emerge specifically among high-loss-aversion respondents, as prospect theory predicts.

## 6 Conclusion

This study used a 2×2 randomized controlled trial to test whether information framing (gain vs. loss) and incentive type (monetary vs. non-monetary) jointly shape Chinese consumers' NEV purchase intentions. Three hypotheses grounded in prospect theory—that loss framing outperforms gain framing (H1), that monetary incentives outperform non-monetary ones (H2), and that these factors interact positively (H3)—received no empirical support. Treatment coefficients were uniformly small and statistically insignificant, and this null pattern persisted after inclusion of demographic and attitudinal controls.

Government trust was the only variable significantly associated with purchase intention, highlighting that institutional credibility, not message design, is the primary mechanism through which NEV policy communication shapes consumer decisions. For policymakers in mature NEV markets with high policy awareness, this means that transparent and consistent policy governance will outperform rhetorical repackaging of existing incentives.

The findings contribute to understanding the boundary conditions of behavioral framing interventions. In high-familiarity, high-deliberation contexts such as vehicle purchases, the persuasive advantage of loss framing may not materialize. Future research addressing the power, sampling, and ecological validity limitations of this study—particularly by targeting policy-naive consumer subgroups and employing field experimental designs—will be essential for establishing the conditions under which behavioral communication strategies can effectively promote green consumption in China and beyond.

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