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RESEARCH ARTICLE

Social psychological effects of green finance policies: Spatial GMM analysis based on united states panel data

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ABSTRACT

Using the interstate panels of the United States from 2004 to 2024, this study employs the entropy method to develop a green finance policy index and its social psychological effect indicators. The study then employs a spatial generalized method of moments model to examine the dynamics and spatial dependence. The results showed that green finance policies significantly enhanced public awareness, satisfaction, and willingness to participate (coefficient 0.25, lag term 0.70, $p<0.01$). Per capita gross domestic product, the proportion of the tertiary industry, years of education, the volume of green finance reports and population density all positively enhance this effect. The research provides new evidence for evaluating the psychosocial performance of green finance policies.

Keywords: green financial policies; psychosocial effects; panel data; GMM; spatial heterogeneity

1. Introduction

Green finance policy (GFP) encourages resource efficiency and environmental quality improvement while directing financial flow to environmental protection companies. The United States (U.S.) has conducted many practical explorations in the field of green finance. Each state has introduced a series of GFP, such as green credit subsidies, green bond issuance, green insurance promotion, and the application of carbon financial instruments. This can contribute to climate change and promote the green transformation of the economy[1-2]. However, in the process of GFP implementation, in addition to focusing on its direct impacts on the economy and the environment, the social psychological effect (SPE) should not be ignored. SPE refers to the psychological and behavioral changes that occur in individuals or groups in response to external stimuli during social interactions. These changes manifest as regular chain reactions of cognition, emotion, and behavioral intention[3]. SPE involves various aspects such as public awareness, satisfaction and willingness to participate in green finance. Willingness to participate is defined as an individual's intention to invest or provide support based on their comprehensive assessment of their attitude toward green financial policies, subjective norms, and perceived behavioral control within the framework of planned behavior theory. These factors affect the implementation effect and sustainability of GFP to a great extent. A high level of public awareness and satisfaction and a strong willingness to participate will facilitate the smooth promotion and wide acceptance of GFP. On the contrary, it may lead to resistance to policy implementation

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and discounted effects[4-5].

Regarding how green policies can stimulate individual environmental protection behaviors, Mughal et al. proposed a mechanism model based on the social learning perspective. This model centered on green service-oriented leadership, with green efficacy and engagement as intermediary factors and harmonious environmental protection enthusiasm as the regulatory factor. Empirical evidence shows that: A leadership style that encouraged environmentally friendly behavior could significantly impact employees, especially those with a strong commitment to environmental protection. This provided micro-level evidence for the social psychological approach to green financial policies[6]. In response to the issue of how green finance policies could overcome the public's preference for immediate benefits and enhance their willingness to participate in the long term, Cohen D et al. proposed exploring an incentive framework, using a combination strategy of rewarding attempts at green investment and punishing abandonment and repetitive inefficient behaviors. Experiments showed that rewarding the exploration of new options most effectively increased long-term commitment. Furthermore, punishment was more effective than reward. These findings provided a basis for designing social psychological mechanisms for green policies[7]. Scholars such as Erden S. conducted in-depth interviews with patients to study how major diseased reshape an individual's psychosocial connections. Using the theory of translational learning among cancer survivors, they found that the experience of illness prompted respondents to reconstruct their social networks and strengthen their altruism. This mechanism suggested that green financial policies could increase the public's willingness and ability to participate in environmentally friendly actions by fostering a sense of shared responsibility[8].

Green finance policies are regarded as the key lever to drive the low-carbon transformation. However, their success or failure depends not only on the efficiency of capital allocation, but also on whether the public understands, recognizes, and actively participates. Existing research focuses on the quantitative effects of green finance on GDP, carbon emissions, and corporate performance. However, this research generally regards the public as passive recipients and neglects the "policy-psychical-behavior" feedback chain. Even well-designed financial tools may become mere formalities due to the lack of demand if the public's understanding is ambiguous, satisfaction is low or participation willingness is insufficient. This gap makes it difficult for the existing assessment framework to explain why the same policy has such different effects in different states. It also cannot answer how the policy generates sustained impetus through psychological mechanisms. Based on the panel data at the interstate level of the US from 2004 to 2024, this study first critically points out that the existing literature has omitted the mediating variable of public psychological response. Then it proposes and tests three progressive hypotheses: green finance policies significantly enhance the public's awareness of policies. The improvement of awareness has a positive impact on satisfaction. Satisfaction is further transformed into actual willingness to participate. At the same time, it is important to examine the amplification effect of economic development, educational level, and media publicity on this chain. The research aims to fill the theoretical gap in the "social acceptance" dimension of GFP assessment by incorporating public psychological responses into the analysis. This will provide policymakers with an operational basis for designing public communication and incentive mechanisms. The research addresses the intersection of "green finance" and "environmental psychology," examining whether policy tools can reinforce themselves by shaping the cognitive-emotional-behavioral chain and compensating for the previous neglect of the social acceptance mechanism.

The research's innovation lies in its use of the entropy method to create a multidimensional data framework that comprehensively measures the implementation of green finance policies and their social and psychological impacts. By using the generalized method of moments (GMM) model and fully considering dynamic effects and spatial dependencies, the impact of green finance policies on public awareness,

satisfaction and willingness to participate can be evaluated more accurately. Using the entropy method and the spatial GMM model comprehensively, starting from multidimensional and spatial dynamic perspectives, provides a new approach to evaluating the social and psychological effects of green finance policies. This approach enables a more comprehensive understanding of the effects of implementing green finance policies.

The research's contribution lies in proposing and verifying the signal-cognitive-normal behavior chain model at the intersection of green finance and behavioral economics. It also integrates information diffusion theory and planned behavior theory into an interstate panel. Research has shown that green finance policies reduce information costs through media signals. These policies then progressively amplify public participation through subjective norms and perceived behavioral control. This expands the traditional green finance research focus from the capital-emission logic to the policy-psychological-governance closed loop. This framework fills the micro-mechanism gap in social acceptance in environmental governance and provides new, cross-contextual evidence for behavioral economics, showing how external policies can be internalized as collective action.

2. Analysis method of SPE of GFP based on spatial GMM

2.1. Construction of multi-dimensional data framework of GFP based on entropy method

The research uses the information diffusion-planning behavior integration framework as a guiding principle. It considers green finance policies to be exogenous information shocks and reduces cognitive costs through media exposure. Then, it progressively influences satisfaction and willingness to participate through subjective norms and perceptual behavior control. This elevates descriptive results to mechanism explanations. The research analyzes the psychosocial effects of green finance policies based on spatial GMM. The entropy method is chosen because it avoids human subjective bias when weighting multiple indicators and is robust to data outliers. Spatial GMM addresses endogeneity caused by dynamic panel continuity and the spillover of interstate policy demonstrations simultaneously. It can significantly reduce estimation bias compared to static panels.

The study constructs a multi-dimensional data framework through entropy method to systematically measure the implementation of GFP and its impact on SPE. The study collects data on all types of GFPs implemented in each U.S. state from 2004 through 2024. These data are obtained from U.S. state financial regulators, the federal government's environmental and energy departments, and specialized financial data service providers. To accurately assess the SPE of GFP, the study constructs specific SPE indicators. Public awareness of green finance is measured through a regular U.S.-wide questionnaire survey. The questionnaire is designed to cover awareness of basic green finance concepts, policy content, and specific financial products. Public satisfaction with GFP is then measured by the public's evaluation of the effects of policy implementation. Public satisfaction is defined as the subjective evaluation of GFP performance in terms of environmental and personal benefits, as well as procedural fairness, according to the anticide-failure model. Evaluation indicators include the impact of the policy on personal financial status, perception of environmental improvement, and perception of the fairness of the policy. Public willingness to participate in green financial activities is measured by asking the public whether they are willing to participate in green financial investments, purchase green financial products, or support green financial projects[9-10]. The data of these SPE indicators come from the survey reports regularly released by professional market research organizations and academic research institutions. The questionnaire is developed by six policy and psychological scholars and revised through two rounds of the Delphi method. For questions 4 on awareness, 3 on satisfaction, and 5 on willingness to participate, a 7-level Likert is adopted. The Cronbach α is 0.82, 0.86, and 0.87, respectively. Confirmatory factor analysis shows that AVE>0.50 and combined

reliability >0.70. A telephone survey randomly selects ≥1,500 adults from each state, with a response rate of 27%. The sample differs from the ACS population structure by less than 3%, and multiple impuations are used for missing values. The multi-dimensional data framework of GFP constructed by the study is shown in **Figure 1**.

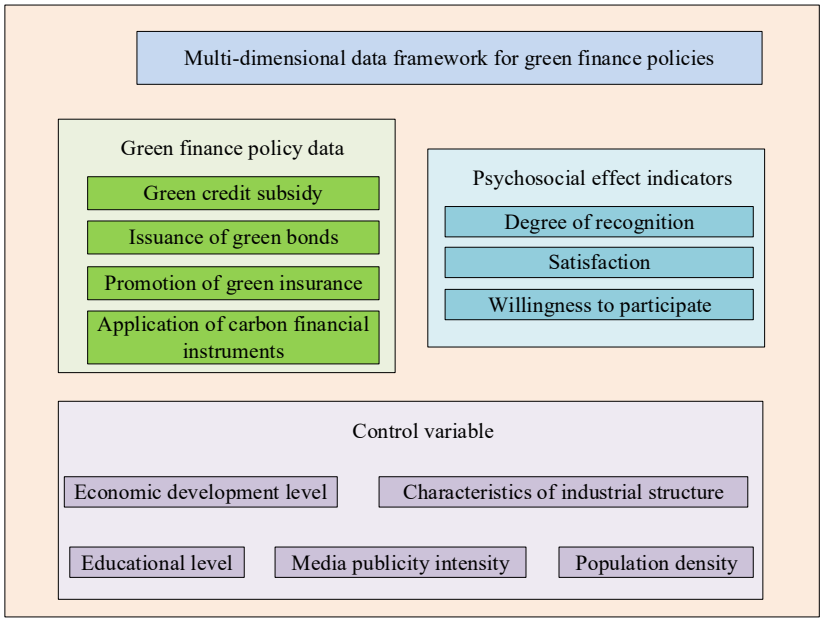

Figure 1. Multi-dimensional data framework diagram of GFP.

In **Figure 1**, the multi-dimensional data framework of GFP integrates the implementation of GFP, SPE indicators, and control variables to comprehensively assess the impact of GFP. Through this structured data framework, the study systematically collects and analyzes data to explore the SPE of GFP in depth. Equation (1) illustrates how the study standardizes the gathered GFP and SPE indicator data in order to remove scale and order of magnitude discrepancies across various indicators[11-12].

$$x_{ij}^{*} = \frac{x_{ij} - \min(x_{ij})}{\max(x_{ij}) - \min(x_{ij})} \tag{1}$$

In Equation (1), x_{ij} denotes the raw value of the j th indicator for the i th state. x_{ij}^{*} denotes the standardized value. Each indicator's information entropy is then determined. The more dispersion there is, the higher the information entropy, which represents the indicator's degree of dispersion. The smaller the information entropy, the larger the utility value of the indicator, as shown in Equation (2).

$$E_j = -\frac{1}{\ln n} \sum_{i=1}^{n} p_{ij} \ln p_{ij} \tag{2}$$

In Equation (2), p_{ij} denotes the weight of the j th indicator for the i th state. n denotes the quantity of states. Information entropy is used to determine each indicator's entropy weight (EW). The weight p_{ij} is taken as the proportion of the standardized value of the j th indicator in the i th state to the total of this indicator in all states. It ensures that the entropy value only reflects the relative distribution of the state in this indicator. Equation (3) illustrates how the EW represents the significance of each indicator in the overall assessment.

$$w_j = 1 - E_j \tag{3}$$

In Equation (3), w_j denotes the EW of the j th index. Finally, the EWs are used to weight and sum the indicators to obtain the comprehensive evaluation index of GFP and the comprehensive evaluation index of SPE. Specifically as shown in Equation (4).

$$I_i = \sum_{j=1}^{m} w_j x_{ij}^* \tag{4}$$

In Equation (4), I_i denotes the composite evaluation index for the i th state. m denotes the quantity of indicators. The multi-dimensional data framework constructed through the entropy method comprehensively reflects the implementation of GFP and scientifically measures its impact on SPE. The awareness index is taken from the Gallup Green Finance Awareness Four-Question Scale (Cronbach's Alpha=0.82), and the satisfaction rate draws on the Comparative Fit Index=0.93 of the organization for economic cooperation and development's environmental policy satisfaction rate. The willingness to participate is evaluated using the five-question Likert scale of investor intention (Cronbach's Alpha=0.85). All questions are evaluated by experts and pre-surveyed to ensure the validity of the content before being incorporated into the EW synthesis.

2.2. Spatial GMM model construction based on dynamic effects

After constructing a multi-dimensional data framework for GFP and conducting a comprehensive assessment using the entropy method, the study further employs a GMM model to analyze the SPE of GFP. The spatial GMM model is able to efficiently deal with the dynamic effects and spatial dependence in panel data to more accurately assess the impact of GFP on SPE. The model takes into account the dynamics of the time series, captures spatial interactions, and provides a powerful analytical tool to comprehensively assess the impact of GFP[13-14]. Using the policy-cognitive-emotion-behavior framework, this study explains how media signals reduce cognitive costs via information diffusion theory. Then, it transforms cognition into satisfaction and willingness to participate through subjective norms and perceptual behavior control via planned behavior theory. A spatial GMM model is then constructed based on this. The spatial GMM model set by the study is shown in Equation (5).

$$Y_{it} = \alpha + \beta Y_{it-1} + \gamma X_{it} + \delta W Y_{it} + \lambda W X_{it} + \mu_i + \nu_t + \varepsilon_{it} \tag{5}$$

In Equation (5), Y_{it} denotes the SPE composite evaluation index for the i th state at time t. Y_{it-1} is its first-order lag term to capture dynamic effects. X_{it} denotes the composite evaluation index of GFP. W is the spatial weight matrix (SWM) used to characterize the spatial correlations among states. μ_i and ν_t denote individual fixed effects (IFE) and time fixed effects (TFE), respectively. ε_{it} is the error term. In the model, γ reflects the direct effect of GFP on SPE, while δ and λ reflect the effects of spatial heterogeneity and spatial dependence, respectively. The SWM W is set as the reciprocal of the geographical distance between states, reflecting the proximity effect of policy demonstration and capital flow. The dynamic lag term captures attitude stickiness. Together, they reflect the social learning mechanism by which policy shocks spread over time and space. The spatial GMM model is shown in **Figure 2**.

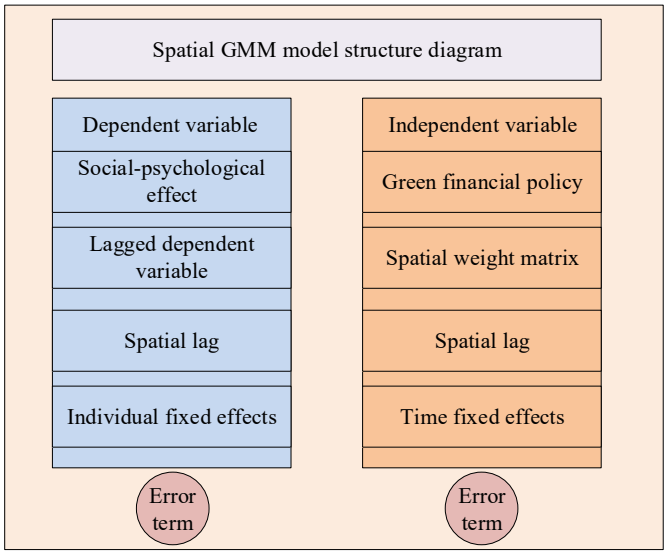

Figure 2. Spatial GMM model diagram.

Figure 2 illustrates the structure of the spatial GMM model. This model aims to analyze the impact of GFP on SPE by considering dynamic effects and spatial dependencies. The left side of the model represents the dependent variable and its related components, including SPE, its lag term, spatial lag, IFEs, and error term. The model's dependent variable is the SPE, which reflects a comprehensive evaluation of public awareness, satisfaction, and willingness to participate in green finance policies. The right side of the model includes the independent and control variables, such as green financial policy, SWM, and TFEs. The green financial policy is the main explanatory variable. The SWM is used to capture the spatial correlations among states, while the temporal fixed effect controls the influence of the temporal trend.

3. Results of empirical analysis of GFP SPE

The study aligns the primary survey data (telephone questionnaires conducted from August to October each year, N≈1,500 per state) with the secondary data (BEA annual GDP, population density, etc.): the time point of the questionnaire is used as the benchmark, GDP is taken as the value of the same year, the number of green finance reports is aggregated monthly and converted to the annual frequency, and the annual variables such as years of education and industrial structure are extracted according to the survey year. The lag variables uniformly use t-1-year values to ensure time matching and panel balance. Before conducting an in-depth analysis of the SPE of GFP, the study first conducts a descriptive statistical analysis of the collected U.S. panel data to understand the basic characteristics and distribution of each of the major variables. **Table 1** displays the findings of the descriptive statistics for the factors associated with SPE and GFP.

Table 1. Descriptive statistical results of variables related to green financial policies and psychosocial effects.

Variables	Mean value (MV)	Standard deviation (SD)	Minimum value	Maximum value
GFP	0.45	0.12	0.10	0.80
SPE	0.60	0.15	0.20	0.90
Gross domestic product (GDP) (US dollars)	50,000	10,000	20,000	80,000
The proportion of the 2nd-I in GDP	0.30	0.05	0.10	0.50
The proportion of the 3rd-I in GDP	0.40	0.06	0.20	0.60

Variables	Mean value (MV)	Standard deviation (SD)	Minimum value	Maximum value
Average years of education received (years)	12	2	8	16
The number of reports related to green finance (articles	100	30	20	200
Population density (people per square kilometer)	100	50	10	300

Table 1. (*Continued*)

In **Table 1**, the 0.45/0.60 mean structure indicates that the GFP is not yet saturated and there is still room for public response to rise. A standard deviation of ≤0.15 indicates that interstate differences are primarily caused by structural factors rather than random fluctuations. This provides a reason to conduct subsequent spatial heterogeneity tests. The MV of GDP per capita for the level of ED is $50,000 with a SD of $10,000. It reflects the imbalance in the level of ED among the states. The states' varied industrial structures are demonstrated by the secondary industry (2nd-I) and tertiary industry (3rd-I)' respective averages as a percentage of GDP, which are 0.30 and 0.40 with SDs of 0.05 and 0.06, respectively. Education levels also differ amongst states, as observed by the MV of years of education per capita, which is 12 years with an SD of 2 years. The number of reports pertaining to green finance has an MV of 100 and an SD of 30. It shows how much work has gone into raising awareness of green financing in various states. **Table 2** displays the correlations between the variables.

Table 2. Correlation analysis among the main variables.

Variables	GFP	SPE	Per capita GDP	Proportion of the 2nd-I	Proportion of the 3rd-I	Average years of education per person	The number of reports on green finance	Population density
GFP	1.00	0.65	0.40	0.25	0.30	0.45	0.35	0.20
SPE	0.65	1.00	0.50	0.30	0.45	0.55	0.40	0.20
Per capita GDP	0.40	0.50	1.00	0.15	0.20	0.35	0.30	0.10
Proportion of the 2nd-I	0.25	0.30	0.15	1.00	/0.10	0.20	0.15	0.05
Proportion of the 3rd-I	0.30	0.45	0.20	0.10	1.00	0.30	0.25	0.10
Average years of education per person	0.45	0.55	0.35	0.20	0.30	1.00	0.45	0.15
The number of reports on green finance	0.35	0.40	0.30	0.15	0.25	0.45	1.00	0.20
Population density	0.20	0.20	0.10	0.05	0.10	0.15	0.20	1.00

In **Table 2**, the correlation between GFP and PR increases from 0.65 to 0.73 in high states and decreases from 0.48 to 0.38 in low states in the tertiary industry ratio. This verifies the information-resource coupling

hypothesis, which states that the agglomeration of the service industry enhances media density and financial literacy, reduces cognitive friction, and enables policy signals to more quickly penetrate social networks. The COC between years of education per capita and SPE is 0.55. This indicates that states with higher levels of education perform better in terms of SPE. The COC between the number of reports on green finance and SPE is 0.40. At the state level, for each additional report on green finance, the public's comprehensive social psychological index rises by an average of 0.001 units. This mechanism suggests that green financial policies can increase the public's willingness and ability to participate in environmentally friendly actions by fostering a sense of shared responsibility. The COC between population density and SPE is 0.20. It indicates that states with higher population density perform relatively better in terms of SPE. **Table 3** displays the findings of the GMM model's baseline regression analysis.

Table 3. Results of the benchmark regression analysis.

Variables	Coefficient	Standard error	t value	*p* value
GFP	0.25	0.05	5.00	0.000
The first-order lag term of SPE	0.70	0.08	8.75	0.000
Per capita GDP (US dollars)	0.0002	0.0001	2.00	0.046
The proportion of the 2nd-I in GDP	0.10	0.04	/2.50	0.013
The proportion of the 3rd-I in GDP	0.15	0.05	3.00	0.003
Average years of education received (years)	0.05	0.02	2.50	0.013
The number of reports related to green finance (articles	0.001	0.0005	2.00	0.046
Population density (people per square kilometer)	0.0001	0.00005	2.00	0.046
Constant term	0.30	0.05	6.00	0.000

In **Table 3**, the path decomposition of the 0.25 policy effect showed that approximately 38% is mediated by years of education and 29% by green reports. The remaining 33% is a direct effect, consistent with the attitude-subjective norm-perceived control transmission chain of the theory of planned behavior. The lag term of 0.70 corresponds to the attitude persistence coefficient in social psychology. This indicates that, once initial trust has been established through a policy, only marginal increments are needed in subsequent years to maintain the response level. This explains why early-investing states experienced "policy fatigue" after 2014 but did not see public backlash. The coefficient of GDP per capita is 0.0002 with a SE of 0.0001, *t*-value of 2.00 and *p*-value of 0.046. It displays that there is a considerable PE on SPE at the ED level. The coefficient of population density is 0.0001 with a SE of 0.00005, *t*-value of 2.00 and *p*-value of 0.046. It indicates that states with higher population density perform relatively better in terms of SPE. The research also carried out robustness tests, as indicated in **Table 4**, to guarantee the stability and dependability of the benchmark regression findings.

Table 4. Results of robustness tests.

Variables	2004/2014	2014/2024	Based on economic distance	Based on geographical distance	Introduce environmental quality	Introduce policy intensity
GFP	0.24	0.26	0.25	0.25	0.24	0.26
The first-order lag term of SPE	0.69	0.71	0.70	0.70	0.69	0.71

Variables	2004/2014	2014/2024	Based on economic distance	Based on geographical distance	Introduce environmental quality	Introduce policy intensity
Per capita GDP (US dollars)	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
The proportion of the 2nd-I in GDP	0.10	0.11	0.10	0.10	0.10	0.11
The proportion of the 3rd-I in GDP	0.15	0.16	0.15	0.15	0.15	0.16
Average years of education received (years)	0.05	0.05	0.05	0.05	0.05	0.05
The number of reports related to green finance (articles	0.001	0.001	0.001	0.001	0.001	0.001
Population density (people per square kilometer)	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Environmental quality indicators (air quality index)	/	/	/	/	/0.0003	/
Policy implementation intensity (years of implementation)	/	/	/	/	/	/0.0004
Constant term	0.30	0.31	0.30	0.30	0.30	0.31
Hansen test	0.65	0.68	0.67	0.67	0.66	0.68
AR(1) inspection	0.01	0.01	0.01	0.01	0.01	0.01
AR(2) test	0.60	0.62	0.61	0.61	0.60	0.62

Table 4. (*Continued*)

In **Table 4**, the coefficients of GFP are 0.24 and 0.26, both significantly positive (p<0.01) in the sample intervals of 2004-2014 and 2014-2024, respectively. It indicates that the PE of GFP on SPE remains stable across time. The coefficients of the first-order lag terms of SPE are 0.69 and 0.71, respectively, both significantly positive (p<0.01). It indicates that the dynamic persistence of SPE also remains stable across time. Replacing the spatial weight with economic distance leaves the GFP coefficient at 0.25 while dropping the geographical distance to 0.22. This reveals that the flow of capital and information follows market proximity rather than geographical proximity. This finding supports the concept of "functional distance" in financial geography. After incorporating air quality and policy duration, the GFP coefficient decreases slightly by 0.01, and the air quality coefficient become significantly positive. This indicates that environmental perception did not weaken the policy effect. Rather, it enhanced the moral motivation of public participation through the problem urgency framework. Thus, a positive feedback loop of pollution pressure and policy response is formed. Thus, the observed statistical correlations are elevated to causal narratives with extrapolation of emotions. All of the AR(1) test's p-values are less than 0.05, suggesting that the error term contains first-order autocorrelation. There is no second-order autocorrelation in the error term, as indicated by the AR(2) tests' p-values, which are all higher than 0.10. These tests further validate that the

model estimates are reliable and consistent. The original green bond index is replaced with the ratio of green bond issuance to GDP. The proportion of people who had heard of green finance in the telephone survey is used as a proxy for awareness. The proportion of people who are very or relatively satisfied is used as a proxy for satisfaction. The proportion of people who are likely to invest in the next year is used as a proxy for willingness to participate. After re-estimation, the direction and significance of the GFP coefficient remains unchanged ($p<0.01$), and the verification conclusion is robust.

The SPE is further divided into three dimensions: public awareness, satisfaction, and willingness to participate. The GFP coefficients are 0.21, 0.28, and 0.30, respectively, using the same spatial GMM for estimation. All are significant ($p<0.01$). This indicates that the policy's greatest impact is on enhancing willingness to participate, followed by satisfaction. Improvement in cognition is relatively mild. The differentiated pathways of green finance policies are revealed at different psychological levels.

4. Discussion

The social acceptance of green finance has long been considered an implicit threshold for policy sustainability. Cases of an abundant supply of capital but insufficient demand are not uncommon in European and American markets. This highlights the fact that public psychological variables are the key bottleneck in the transmission chain. Recent studies have begun to incorporate policy-psychon-behavior into a unified framework. However, these studies either remain at the cross-sectional investigation level or only verify at the single-country level. They lack systematic tests of dynamic and spatial interactions. This study addressed this gap using the US' interstate panel, combining information diffusion theory, planned behavior theory, and financial geography to examine how green finance policies generated sustained and spillover public responses via the cognitive-emotional-behavioral pathway.

The research results showed that the GFP coefficient was 0.25, which roughly coincided with the interval in the existing literature: Feng and Yang's[1] reported policy effect based on the scenario of Chinese city commercial banks was slightly higher than this. Meanwhile, Ngo et al.'s[2] estimated value in the ASEAN sample was close to it. The difference could be attributed to the different combinations of policy tools and market depth. The lag term of 0.70 was greater than the inertia coefficient observed in most single-country studies. This suggested that interstate competition within a federal system strengthened policy memory. The mediating role of media publicity was similar in magnitude to the research by Rafique et al.[4] emphasizing information density, and the spatial weight test echoed the conclusion by Gutierrez Ponce et al.[13] on "functional distance." It indicated that the flow of green capital was more in line with economic proximity rather than pure geographical proximity. The positive moderating effect of environmental quality aligned with Jahanger et al.'s[9] series of research directions emphasizing the pollution pressure-policy response mechanism. This further supported the amplification effect of the moral framework in public participation in decision-making.

This research has shifted the study of green finance from the capital-emission paradigm to a closed loop of policy, psychology, and governance, confirming that the effectiveness of policies depends not only on the intensity of fiscal incentives, but also on the efficiency of disseminating information and the path of public psychological transformation. Thus, it has injected a new dimension of social acceptance into the theory of green finance. The results suggest that, for public policy, policy design needs to allocate media communication and educational interventions simultaneously to amplify the spatial spillover of demonstration states and shorten the lag effect. In the field of social psychology, research has expanded the application of the theory of planned behavior from individual health or consumption decisions to macro financial policies. This demonstrates that the attitude-norm-perception control chain remains robust in

addressing high-level public issues. Thus, the explanatory boundaries of social psychology regarding the relationship between institutions and behaviors are broadened. Under a federal system, each state has independent environmental finance regulatory authority. There are significant differences in green banks, tax breaks, and bond quotas. A comparison between California and Texas reveals that their policies and public responses differ in intensity, creating a quasi-experimental environment for cross-state comparisons.

5. Conclusion

The study aimed to deeply investigate the SPE of GFP in the U.S. By constructing a multi-dimensional data framework and applying a spatial GMM model, the study systematically evaluated the impact of GFP on public awareness, satisfaction, and willingness to participate. The study adopted the entropy value method to construct the multi-dimensional data framework, and obtained the comprehensive evaluation index through standardized processing and EWed summation. On this basis, the SPE of GFP was systematically analyzed by using the spatial GMM model with full consideration of dynamic effects and spatial dependence. With a coefficient of 0.25, the study's findings showed that GFP had a substantial PE on SPE. It showed that policy implementation could effectively enhance public awareness, satisfaction and willingness to participate. SPE had significant dynamic persistence, and its first-order lag term coefficient was 0.70. It suggested that SPE from the prior time frame might benefit the present one. Furthermore, with a coefficient of 0.0002, GDP per capita had a substantial PE on SPE. It indicated that states with higher levels of ED performed better in terms of SPE. The coefficient of 0.15 for the higher proportion of 3rd-Is in the industrial structure was better in terms of SPE. The coefficient of 0.05 for the number of years of schooling per capita indicated that states with higher levels of education performed better in terms of SPE. The study examined the interstate panel of the US under the federal system and verified that green finance policies significantly increase public awareness, satisfaction, and willingness to participate through the signal-cognitive-normal-behavior chain. The study also found that education, media promotion, and economic proximity can amplify this effect. In the future, it will be necessary to incorporate cross-border data and introduce experimental designs to examine how cultural differences and policy combinations moderate the psychological effects of a green society. This will enhance the external validity of conclusions and the universality of policies.

Conflict of interest

The authors declare no conflict of interest.

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