Response to Reviewer 1 Comments

Dear Editor and Reviewer:

Thank you for your letter and for the reviewers' comments concerning our manuscript entitled "Does Green Finance Promote the Green Transformation of China's Manufacturing Industry? " (sustainability-2227997). Those comments are all valuable and very helpful for revising and improving our paper, as well as the important guiding significance to our researches. We have studied comments carefully and have made correction which we hope meet with approval. Revised portion are marked in red in the paper. The main corrections in the paper and the responds to the reviewer's comments are as flowing:

Responds to the Reviewer 1 comments:

Comment 1:

The abstract should be shortened to be more focused in certain places. But most importantly, the statements are extrapolating. The sample data should be stated and the findings and policy suggestions should be related to the analyzed country and data.

Response1: Thank you very much for your comment. We have simplified the abstract and added the time span, countries, and methods description of the study.

Comment 2:

Method is not stated in abstract. Similar to country and data. Please update.

Response2: Thank you very much for your comment. We have simplified the abstract and added the time span, countries, and methods description of the study. The revised summary is as follows:

Abstract: The green transformation of the manufacturing industry is related to the low-carbon and green development of the economy ~~and affects the human ecological environment and climate change. Green finance is an essential policy for environmental protection in China~~. ~~This paper discusses the impact mechanisms of the implementation of green finance on the green transformation of Chinese manufacturing industry from three aspects: fund formation and orientation, credit catalysis, integration & decentralization, and uses DID to conduct a quasi-natural experiment.~~ The study explored the impact mechanism of the implementation of green finance policy on the green transformation of China's manufacturing industry from 2013 to 2021 from three aspects of capital formation and incentive, credit catalysis, integration and decentralization, and conducted a quasi-natural experiment using DID model.~~This study~~Research finds that: (1) The implementation of green finance significantly promotes the green transformation of China's manufacturing industry and has good sustainability. The mechanisms of fund formation and orientation, credit catalysis, integration and decentralization are the primary mechanism of green finance to promote the green transformation of the manufacturing industry, and the

implementation effect of green finance has apparent heterogeneity; (2)The promoting effect of green finance on the green transformation of the manufacturing industry is only significant in state-owned industries but not significant in non-state-owned industries; (3)The influence of green finance on the green transformation efficiency of manufacturing industry with a better information environment is more significant than manufacturing industry with a worse information environment; (4) Faced with the pressure of investing in green industries, the coping strategies adopted by enterprises in different industries are quite different. The promoting effect of green finance on the green transformation of the manufacturing industry is significant in low-competition industries but insignificant in high-competition industries. This study has enriched the research on the effect of green finance policies, explored solutions based on quasi-nature, and provided policy references for the green transformation of the manufacturing industry.

Comment 3:

If data section is read, what is the sample size in the model? Not clear. Time range is stated. Company types are stated. How many? What are their descriptive statistics?

Response3: Thank you very much for your comment. We selected Chinese manufacturing listed companies with A-shares from 2013 to 2021 as the research object, and finally obtained 9994 sample observations from 1174 enterprises, including 3078 observations from 290 enterprises in the experimental group and 6916 observations from 884 enterprises in the control group. We have made correction according to the Reviewer's comments in the manuscript.

Comment 4:

I have suspicions if the dependent variable represents Efficiency of green transformation. Factors are listed by the authors for this variable are:

Total assets per dollar/yuan, Operating cost/yuan, Number of R&D personnel/person, R&D investment amount/yuan.

These factors are firm performance criteria, how are they related to green transformation or green efficiency? Only green factor among 8 factors listed for green efficiency is 1 out of 8, green patents. The rest are financial indicators.

Response4: Thank you very much for your advice. We are very sorry for the lack of consideration of the integrity of green indicators in the original indicator selection. In the revised manuscript, we re-selected the input and output indicators of green total factor productivity according to the requirements of the reviewers. In addition, expected output and unexpected output are also considered when calculating green total factor productivity.

Table 1. Variable table.

Variable properties	Variable name	Variable meaning	computingmethod
Input	Labor	Labor input	the number of on-the-job employees of each listed enterprise in each year
	Capital	Capital input	The net value of enterprise fixed assets (net value of enterprise fixed assets = original value of enterprise fixed assets - accumulated depreciation of enterprise fixed assets) is used as capital input
	Energy	Energy input	Weighted by the power consumption of manufacturing listed companies in the city where the listed company is located. As a proxy variable of energy after weighted processing
	GTI	Green technology innovation input	The ratio of the number of green patents applied by listed companies to the total number of patent applications（Ratio Green Pat) characterizes green technological innovation of enterprises.
Output	EP	Expected output	Total annual operating income of each enterprise
	UEP	Unexpected output	The weighted processing of carbon dioxide data of urban emissions and enterprise emissions is based on the correlation coefficient
Explained variable	GTFP	Green total factor productivity	Through the SBM model of non radial and non angle in DEA model and combined with ML index to calculate
Explanatory variables	Treat	Dummy variable	1 for the treatment group and 0 for the control group
	Post	Dummy variable	0 before 2017, otherwise 1
	Treat*Post	Net effect of policy	Treat*Post
Control variable	Size	Enterprise size	Logarithm of total assets of the enterprise
	Time	Business life	[current year - (Listing year +1)] take logarithm
	Cash	Corporate cash holdings	Monetary cash to assets ratio
	Cap	Asset-liability ratio	Ratio of total assets to total liabilities
	Jcap	Return on equity	Ratio of net profit to total assets
	Rev	Revenue growth rate	The ratio of the increase in the current year's operating Revenue to the total operating revenue of the previous year
	Tq	Tobin's Q value	The ratio of a firm's market price (share price) to its replacement cost

Variable setting

(1) Dependent variable

The dependent variable of this study is the green total factor productivity (GTFP) of Chinese manufacturing listed companies as the agent variable of green transformation. On the basis of traditional total factor productivity (TFP), green total factor productivity (GTFP) considers energy consumption and pollution emissions, and can objectively reflect the green development level of listed companies in China's manufacturing industry[49].

The SBM (Slack-Based Measure) model[50] allows the existence of inefficiency decision making units, and the

unexpected output is also considered. The Malmquist-Luenberger index[51] can measure the dynamic change of green total factor productivity in the presence of unexpected output. Therefore, the research adopts the non-radial SBM model in the DEA model and combines the ML index to measure the GTFP of manufacturing listed companies.

$$\rho = \frac{1-\frac{1}{m}\sum_{i=1}^{m}\frac{v_i^-}{d_{if}}}{1+\frac{1}{k_1+k_2}\left(\sum_{\tau=1}^{k_1}\frac{v_\tau^+}{p_{\tau f}}+\sum_{\theta=1}^{k_2}\frac{v_\theta^{z-}}{q_{\theta f}}\right)}$$

$$d_{if} = \sum_{j}^{n} d_{ij}\lambda_j + v_i^-;$$

$$p_{sf} = \sum_{j=1}^{n} p_{\tau j}\lambda_j - v_\tau^+;$$

$$q_{\theta f} = \sum_{j=1}^{n} q_{\theta j}\lambda_j + v_\theta^{z-} \quad (1)$$

d_{if} denotes the i-th input quantity for the f--th manufacturing listed companies, p_{if} denotes the i-th desired output for the f-th manufacturing listed companies and $q_{\theta f}$ denotes the i-th undesired output for the f-th manufacturing listed companies. λ ,, $v^-, v^+ \geq 0$; $i = 1,2,\ldots\ldots,m$; $\tau = 1,2,\ldots\ldots$, k_1; $\theta = 1,2,\ldots\ldots$, k_2; $j = 1,2,\ldots\ldots$, n . v_i^-, v_τ^+ and v_θ^{z-} denote inputs, desired outputs and non-desired outputs respectively, λ_j represents the weight of the decision unit, when $\rho = 1$, v_i^- = v_τ^+ = v_θ^{z-} = 0, it means that the decision unit inputs and outputs are fully efficient, when $0 < \rho < 1$, it represents the loss of efficiency of the decision unit. The GTFP index of the decision unit from period t to the next period t+1 is the ML index, which can also be decomposed into the Technology Change and Efficiency Change indices, which are decomposed as follows.

$$ML_t^{t+1}=\left[\frac{X_v^{t+1}\left(\alpha_i^{t+1},\beta_i^{t+1},\gamma_i^{t+1}\right)}{X_v^{t+1}\left(\alpha_i^{t},\beta_i^{t},\gamma_i^{t}\right)}\times\frac{X_v^{t}\left(\alpha_i^{t+1},\beta_i^{t+1},\gamma_i^{t+1}\right)}{X_v^{t}\left(\alpha_i^{t},\beta_i^{t},\gamma_i^{t}\right)}\right]^{\frac{1}{2}}$$
$$=\left[\frac{X_v^{t}\left(\alpha_i^{t+1},\beta_i^{t+1},\gamma_i^{t+1}\right)}{X_v^{t+1}\left(\alpha_i^{t+1},\beta_i^{t+1},\gamma_i^{t+1}\right)}\times\frac{X_v^{t}\left(\alpha_i^{t},\beta_i^{t},\gamma_i^{t}\right)}{X_v^{t+1}\left(\alpha_i^{t},\beta_i^{t},\gamma_i^{t}\right)}\right]^{\frac{1}{2}}\times\frac{X_v^{t+1}\left(\alpha_i^{t+1},\beta_i^{t+1},\gamma_i^{t+1}\right)}{X_v^{t}\left(\alpha_i^{t},\beta_i^{t},\gamma_i^{t}\right)} \quad (2)$$
$$=TC_t^{t+1}\times EC_t^{t+1}$$

ML_t^{t+1} denotes the GTFP index of the decision unit from period t to the next period t+1, α_i^t denotes the input of the manufacturing listed companies i in period t, β_i^t denotes the desired output of the manufacturing listed companies i in period t, γ_i^t denotes the non-desired output of the manufacturing listed companies i in period t, $X_v^t\left(\alpha_i^t,\beta_i^t,\gamma_i^t\right)$ denotes the manufacturing listed companies i in period t, TC_t^{t+1} denotes the technological progress index, i.e. the degree of movement of the firm from period t to the technological frontier in period t+1, and EC_t^{t+1} denotes the technical efficiency index, i.e. the extent to which the firm moves closer to the production possibility frontier from period t to period t+1.

This paper selected Chinese manufacturing listed companies in A shares from 2013 to 2021 as a sample. After a series of treatments, a total of 1,174 were treated. The input-output indicators were obtained from the annual reports of both the Shanghai and Shenzhen stock exchange, the official websites of the listed enterprises and the CSMAR database. The specific input-output indicators are as follows.

The specific input-output indicators are as follows.

① Labor input. Labor input uses the number of employees of listed enterprises in various companies in various years[52].

② Capital input. Capital input selects the net asset value of the enterprise at the corporate level (the net value of the enterprise fixed asset = the original value of the enterprise fixed asset-the cumulative depreciation of the enterprise fixed assets) as the alternative indicator of capital investment[53].

③ Energy input. Considering the availability of micro-level data, the power consumption of manufacturing enterprises in the city where the listed company is located is used to approximate the energy input. After weighting, it is used as the

proxy variable of energy[54].

④ Green technology innovation input. The ratio of the number of green patents applied by listed companies to the total number of patent applications（Ratio Green Pat) characterizes green technological innovation of enterprises[55].

⑤ Expected output. The expected output is expressed by the gross operating income of the manufacturing listed companies for each year[56].

⑥ Unexpected output. Since NO_2, SO_2, smoke, and CO_2 are the main pollutants for manufacturing listed companies, this paper selected industrial NO_2, SO_2, smoke and dust emissions, and CO_2 as non-expected output measures. The weighted processing of carbon dioxide data of urban emissions and enterprise emissions is based on the correlation coefficient[57].

(2) Key explanatory variables

The double difference model is used to investigate how the green financial policy set up in China in 2017 affects the green transformation of listed manufacturing companies. The model can use the double difference to mitigate the interference of other factors besides the policy on the estimated results. If the registered address of the manufacturing listed company is located in the green finance reform and innovation pilot zone, the value of this variable is 1, otherwise the value is 0[58-59]. Treat=1, otherwise Treat=0. At the same time, the policy time variable "post" is set according to the time node of the establishment of the green financial reform and innovation pilot zone[60]. When the sample observation value is in 2017 and after, the value of this variable is 1, otherwise the value is 0.

(3) Control variables

Referring to relevant studies [61-63], this paper selected firm size (Size), firm years (Time), cash holdings (Cash), asset-liability ratio (Cap), return on equity (Jcap), revenue growth rate (Rev) and Tobin's Q value as control variables. Refer to Table 1 for specific variable definitions.

Comment 5:

Explanatory variable green finance policy also leads to doubts regarding its representative power for the variable it should represent.

Other than these, the control variables have no problems, which are common and logical financial and economic ndicators.

Response5: Thank you very much for your comment. We re-explained and optimized the Key explanatory variable(Green Financial Policy), and revised it in the manuscript. The revised contents are as follows:

Key explanatory variables

In 2016, seven ministries and commissions including the People's Bank of China issued the Guidelines on Building a Green Finance System, which defined green finance as economic activities that support environmental improvement, climate change response, and efficient use of resources. It provides financial services for project investment and financing, project operation, and risk management in environmental protection, energy conservation, clean energy, green transportation, and green building. The green finance policy supports the development of green economy and serves the green transformation of enterprises. However, due to China's lack of experience in developing green finance, it is necessary to select some regions to carry out reform experiments. In 2017, the Chinese government issued the Overall Plan for the Construction of Green Finance Reform and Innovation Pilot Zone, which is a new attempt by the Chinese government to promote green finance by building green finance reform and innovation pilot zones in five provinces (Zhejiang, Jiangxi, Guangdong, Guizhou and Xinjiang) and providing support for the development of green finance through monetary and financial policies, fiscal and tax policies[58-59].

The double difference model is used to investigate how the green financial policy set up in China in 2017 affects the green transformation of listed manufacturing companies. The model can use the double difference to mitigate the interference of other factors besides the policy on the estimated results. Set the green finance policy grouping variable tree. If the registered address of the manufacturing listed company is located in the green finance reform and innovation pilot zone, the value of this variable is 1, otherwise the value is 0. Treat=1, otherwise Treat=0. At the same time, the policy time variable "post" is set according to the time node of the establishment of the green financial reform and innovation pilot zone[60]. When the sample observation value is in 2017 and after, the value of this variable is 1, otherwise the value is 0.

Comment 6:

The descriptive table gives overall results for both samples. The results could alter and also give important insights regarding the differences of the experiment group.

Response: Thank you very much for your comment. We have reanalyzed and carefully proofread the descriptive statistics. Table2 provides descriptive statistical analysis of the main variables. The observation value of the experimental group is 3078, and that of the control group is 6916, a total of 9994.

Table 2. Descriptive statistics of major variables.

Variable	Observed value	Average value	Standard deviation	Minimum value	Median	Maximum value
Gre	9994	0.36	0.21	0.05	0.32	1.00
Treat	9994	0.26	0.44	0.00	0.00	1.00
Post	9994	0.69	0.46	0.00	1.00	1.00
Size	9994	22.19	1.16	19.96	22.07	25.74
Cash	9994	0.17	0.11	0.02	0.14	0.57
Cap	9994	0.41	0.19	0.06	0.40	0.91
Jcap	9994	0.04	0.19	-1.24	0.06	0.32
Time	9994	10.91	6.98	0.00	9.00	27.00
Rev	9994	0.25	0.59	-0.68	0.13	3.79
Tq	9994	2.13	1.33	0.87	1.70	8.59

Comment 7:

Given the concerns regarding the representative power of explanatory variable and dependent variable of what they should represent, the findings seriously raise concerns for the empirics.

Response: Thank you very much for your advice. According to the suggestions of the reviewers, we supplemented and optimized the input and output indicators of the explained variable (green total factor productivity), redefined the explanatory variable, and made the research more scientific and rigorous. Due to the changes in the input and output indicators of the explained variables, we conducted a new empirical analysis on the original manuscript to test the effectiveness of the research results. Thank you again for your very valuable comments.

Comment 8:

Lastly, the similarity is asked from the reviewers. I checked it and it led to more than 30%. This is a very large score for a research paper to be considered. It should be reduced. I did not check sources however first three led to 3% similarity totaling to 8%. There are 1% similarities to some papers or sources but when checked, I see no reference is given. Example is, almost the whole parahraph under green finance (post) heading.

Response: Thank you very much for your advice. We corrected the original manuscript and reduced the repetition rate to below 15%, hoping to meet the requirements of publication.

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54. Zhu, J.H.; Wang, S.S. Evaluation and Influencing Factor Analysis of Sustainable Green Transformation Efficiency of Resource-Based Cities in Western China in the Post-COVID-19 Era. *Frontiers In Public Health* **2022**, *10*, 832904.
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56.Yang, Q.; Sun, Z.G.; Zhang, H.B.A. Assessment of Urban Green Development Efficiency Based on Three-Stage DEA: A Case Study from China's Yangtze River Delta. *Sustainability* **2022**, *14*, 12076.
57.Zhou, Z.; Ma, Z.C.; Lin, X.W. Carbon emissions trading policy and green transformation of China's manufacturing industry: Mechanism assessment and policy implications. *Frontiers In Environment Science* **2022**, *10*, 984612.
58.Dong, Z.; Xu, H.D.; Zhang, Z.F.; Lyu, Y.P.; Lu, Y.Q.; Duan, H.Y. Weather Green Finance Improves Green Innovation of Listed Companies Evidence from China. International Journal of Environmental Research and Pubic Health 2022, 19, 10882.
59.Huang, H.F.; Zhang, J. Research on the Environmental Effect of Green Finance Policy Based on the Analysis of Pilot Zones for Green Finance Reform and Innovations. Sustainability 2021, 13, 3754.
60.Lu, N.; Wu, J.H.; Liu, Z.M. How Does Green Finance Reform Affect Enterprises Green Technology Innovation? Evidence from China. Sustainability 2022, 14, 9865.
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62.Shen, L.; Fan, R.J.; Wang, Y.Y.; Yu, Z.Q.; Tang, R.Y. Impacts of Environmental Regulation on the Green Transformation and Upgrading Manufacturing Enterprises. *International Journal of Environmental Research and Public Health* **2020**, *17*, 7680.
63.Zhai, X.Q.; An, Y.F. Analyzing Influencing Factors of Green Transformation in China's Manufacturing Industry under Environmental Regulation: A Structural Equation Model. *Journal of Cleaner Production* **2020**, *251*, 119760.

We appreciate for Editor/Reviewers' warm work earnestly, and hope that the correction will meet with approval.

Once again, thank you very much for your comments and suggestions.

Sincerely

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