

Can Economy and Environment Develop at the Same Time? A Mixed-method Study based on the Case of Yibin, China

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Abstract

It is commonly known that developing countries typically develop their economy at the cost of the environment. However, it is evident that Yibin, a Chinese city, has been rapidly developing its economy while improving its environmental conditions in the past five years. This study aims to identify the factors contributing to Yibin's unique situation. Using a mixed-method approach-documentary analysis, Qualitative Comparative Analysis Matrix, and process tracing-we identified three factors causing the dual-improvement for Yibin's case. The three explanations are: Yibin is a less-developed economy, compared to the Chinese average; Yibin focuses on the secondary sector in terms of industrial structure; and Yibin allocates a larger proportion of its government spending to public goods. Since the economic conditions and focus on industrial structure are inherent factors, we suggest referencing the transition to green energy and the emphasis on public good funding for achieving similar environmental success. For further studies, we propose an expansion on the timeframe or the perspective for factors that we did not cover, analyzing Yibin beyond a five-year scope and incorporating cultural and political factors.

Keywords

Economy; Environment Develop; Mixed-method Study; Yibin.

1. Introduction

As the Environmental Kuznets Curve (EKC), a fundamental model in environmental economics, suggests, economic development and environmental preservation are usually inversely related in developing countries [1].

China, as a developing country by definition, also demonstrates this law as it develops economically, having a worsening environment over the years. From 2019 to 2023, China's HDI, an indicator for economic development, grew from 0.768 to 0.788 [2], while China's footprint, an indicator for air pollution, increased from 3.6 global hectares (gha) per person to 3.7 gha per person from 2018 to 2022 [3].

Yibin, a Chinese city located in Sichuan province, is named "the first city on the Yangtze River." However, in the past, Yibin was greatly criticized for its preservation of the Yangtze River [4], which is not surprising as a city in a developing country. Is Yibin another demonstration of the inverse relationship between economic development and environmental preservation?

In the past five years, Yibin had a rapidly growing economy. It is even far above average growth in China, with its GDP growing at a Compound Annual Growth Rate (CAGR) of approximately 9.3% [5], while the national CAGR at the same timeframe is approximately 5.5% [6]. Surprisingly, in the past five years, Yibin's environmental condition is also improving in several aspects, including air quality and forest coverage rate. PM_{2.5} (air quality indicator, lower the better) decreased from 30 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) in 2020 to 27.6 $\mu\text{g}/\text{m}^3$ in 2023 [7]. In 2020, the forest coverage rate was 46.2%, and this number increased to 47.02% by the

end of 2023 [8]. Various government reports and media articles also support the point that Yibin has improved in both economy and environment [9] [10].

This abnormal phenomenon leads us to the preliminary question of this paper: why is Yibin different nowadays compared to the past? Specifically, this paper aims to find the factors that caused Yibin's dual-improvement in environmental preservation and economic development.

By reviewing literature, we consider our research aim significant. Though China is one of the main geological focuses in some fields of environmental economics, such as decoupling [10], we find that in other fields, such as green infrastructure, Asian countries, including China, remain understudied [11]. Moreover, the study of BC Chaffin et al. (2016) on transformative environmental governance, suggested that the question of how and why some regions are able to overcome barriers that other regions cannot should be further studied [12]. The literature review in the field of green growth [13] also indicates a gap in how industrial policies and national innovation systems can be combined to enable the developing world to achieve economic development and a low-carbon trajectory at the same time. We believe that by studying the factors that enabled Yibin to achieve the dual-improvement, in the timeframe of 2020 to 2025, can be able to fill these gaps.

We took three steps to confirm the causal factors for Yibin's condition. Firstly, we did a document analysis. We started by establishing three broad categories for factors according to our review of fundamental environmental economics concepts; then, we find 12 common factors that are known to influence environment-economy balance. Secondly, we used Qualitative Comparative Analysis (QCA) Matrix to find the causal factors among the 11 potential candidates found in document analysis (we merged two of them to one). Lastly, we utilized process tracing to build a detailed causal relationship between factors and the outcome, confirming the causal relationship.

2. Literature Review

2.1. Establishing Research Gaps

We focused on the existing research gaps mentioned in systematic literature reviews in the main aspects of environmental economics, including decoupling [10], EKC [14], green infrastructure [11], green growth [13], and transformative environmental governance [12]. We find that China has received a significant amount of research attention in both decoupling and EKC. In the review about EKC by Lin-Sea Lau et al., table 9 shows that China is the most popular country that is studied in the field, ranked in the first place in both publication numbers and citation numbers (table. 1) [14]. At the same time, the literature review concerning decoupling done by Dominik Wiedenhofer et al. also shows that China has overwhelmingly more research compared to other countries, as shown in figure 2(c) of the research (table. 2) [10]. That said, some fields in environmental economics, such as green infrastructure [11], still have a knowledge gap in studies about green infrastructure in Asian countries, including China.

Both the literature review of green growth and transformative environmental governance prove the purpose of this paper as having great significance.

Kyle S. Herman [13] states that, in the field of green growth, it is important to find how a combination of industrial policies and national innovation systems can enable the developing world to achieve both economic development and a low-carbon trajectory. This paper examines and not only examines governmental policies and innovation systems, but also economic factors that may contribute to the "win-win" situation of Yibin. Our research also does not focus on carbon emission alone but on the holistic picture of Yibin's environment preservation.

In the respected review about transformative environmental governance cited approximately 500 times, Brian C. Chaffin suggests future studies focus specifically on how certain social-

ecology systems (SES, which is basically a region) are able to overcome environmental challenges while others cannot, and whether certain policies are able to achieve desired SES transformations (achieve green growth or decoupling). This directly imposes significance on our focus on the governmental category for our factor filtering (see Understanding Environmental Economics).

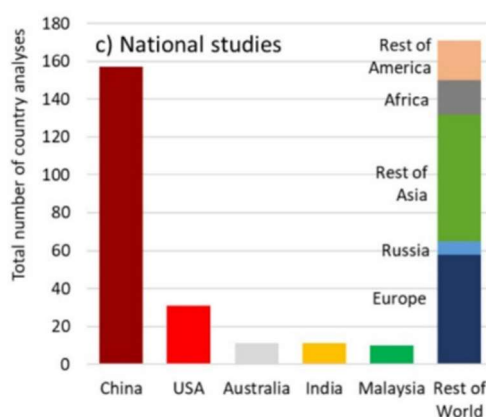
Table 1. The most popular countries studie in field of EKC

Table 9. Top 20 most popular countries.

Rank	Country	Publications	Rank	Country	Citations
1	China	1288	1	China	28,330
2	USA	587	2	USA	27,695
3	Turkey	431	3	Turkey	18,189
4	Pakistan	346	4	Australia	11,292
5	Australia	199	5	France	8699
6	England	192	6	Pakistan	7904
7	France	178	7	Malaysia	7560
8	India	170	8	England	6650
9	Malaysia	163	9	Spain	6580
10	Spain	153	10	Tunisia	4854
11	Italy	145	11	India	4541
12	Japan	117	12	Japan	3558
13	Tunisia	101	13	Taiwan	3519
14	Saudi Arabia	93	14	Italy	3518
15	Nigeria	90	15	Germany	3454
16	Germany	89	16	Canada	2812
17	Taiwan	86	17	Greece	2570
18	Canada	83	18	Netherlands	2382
19	Greece	71	19	Iran	1731
20	Netherlands	63	20	Nigeria	1643

Notes: A minimum of 20 documents of a country and 50 citations of a country, which led to 44 countries.

Table 2. The most popular countries in field of decoupling



2.2. Understanding Environmental Economics

We reviewed literature about some of the fundamental concepts in environmental economics, which are market failure, decoupling, and the Environmental Kuznets Curve. Correspondingly, we established the following categories according to our takeaways related to each concept: governmental factors, technological factors, and developmental factors.

2.2.1. Market Failure and Externality

Environmental economics is strongly linked to the concept of market failure in traditional economics [15]. Specifically, it is related to externality. An externality is the phenomenon that a third party will have an extra cost or benefit from an economic activity [16]. In optimized conditions, neither producers nor consumers, or the market, can recover the inefficient

externalities by themselves, so this is called market failure. Industrial productions and other human development that worsen the condition of the environment are examples of negative externalities. In this case, the operation of the company or the industry causes extra costs to the third party-the environment. As we mentioned before, the free market cannot recover by itself, so one common solution to these externalities is for the government to intervene. For the costs caused by overproduction, the government will impose taxes on the producer; heavy industry factories are an example of this. For the costs caused by underproduction, the government will provide subsidies to the producer; eco-friendly vehicles are one example that demonstrates this. Using taxes to control and subsidies to stimulate are simplified situations that are used in order to develop the underlying theories under desired conditions, but the role of government in market failures is undeniably crucial. Considering the connection between environment and externality and the importance of government interventions in market failures, we will include “governmental” as one category for the potential factors in our methodology.

2.2.2. Decoupling

Decoupling, in environmental economics, is the phenomenon that either the rate of economic development is more rapid than environmental degradation (relative decoupling) or the environment improves as the economy develops (absolute decoupling) [17]. Obviously, Yibin’s case seems to be an absolute decoupling in the past 5 years, so we consider the ways to achieve decoupling are likely to contribute to our factor analysis. We find that the most cited driver for decoupling is technological innovation [18]. Advanced technological developments can mitigate the degradation of the environment while ensuring economic process. Thus, we included technological and innovation as one of our categories.

While discovering decoupling, we also find that transition in economy structures, specifically, changing to a less resource-intensive service-based economy, is another significant driver for decoupling. It is worth noticing that transitioning to the next sector often indicates the development of the economy [19]. With this in mind, we delved deeper into whether a country’s overall development level can influence decoupling or environment-economy balance.

2.2.3. Environmental Kuznets Curve

The Environmental Kuznets Curve (EKC) is another basic concept in environmental economics. It has environmental degradation as its dependent variable on the y-axis and the independent variable economic development on the x-axis. The graph shows inverted-U-shaped relationship between the two variables [20].

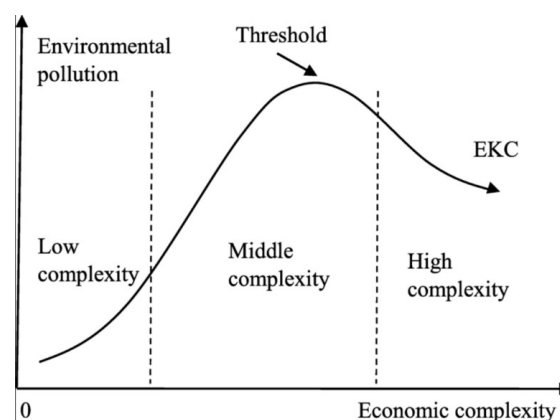


Figure 1. Environmental Kuznets Curve

There have been many interpretations of the specific unit of the independent variable in the EKC, including: income per capita [21], Human Development Index [22], degree of urbanization [23], and economic complexity from the graph [20]. Nevertheless, according to our literature

review, the independent variable is consistently measuring the level of development for an economy. Therefore, since EKC confirms that this variable has an irrefutable relationship with environmental condition, we will include the indicators of economic development in this research.

To clarify, though our purpose is to find the factors causing Yibin to improve in both economy and environment, this category is not the same as economic improvement. The factors and data under this category are constant values, such as GDP per capita in total, not the vectors, such as GDP growth rate and change in environmental condition, in our research question.

2.3. Potential Factors

2.3.1. Obtaining Potential Factors

By looking at existing environmental economics studies, we identified 12 factors that can be potential drivers for Yibin's condition.

In terms of government, we identified five factors. According to Metcalf [24], carbon tax has a primary effect on environmental preservation. Therefore, we consider Price-Based Instruments as one factor. In the study by Auffhammer and Ryan [25], regulations such as emission standards are examined; we will also take Command & Control Regulations into account. Moreover, Newell and Iler [26] show that public investment and subsidies play a crucial role in driving renewable energy, so we included Public Investment in our factor pool. Panayotou [27] argues that the EKC is shaped not by income alone but by the quality of government policies and institutions. Thus, we included Institutional Quality, defined as the effectiveness and reliability of governance, as a potential factor. According to Popp et al. [28], public funding for green infrastructure and public goods is essential, so we include Public Investment for public goods and services as the fifth factor.

In terms of technology, we identified three factors. Popp et al. [28] also emphasize that innovation in renewable energy is key to addressing environmental problems. Therefore, we include Energy Generation Innovation as one possible factor. The highly cited article by Geissdoerfer et al. [29] shows that the circular economy contributes to sustainability. Building on this, we considered Industrial Process Efficiency as one of our factors. Sovacool [30] analyzes the environmental impact of electric vehicles. Since a direct and considerable impact exists, we include the factor Eco-Friendly Technology.

We identified four factors related to the development level of an economy. According to the foundational paper by Grossman and Krueger [19], GDP per capita is a primary indicator of income level used to construct the EKC. Thus, we include Income Level, measured by GDP per capita. In addition, as mentioned before [16], Economic Structure is a crucial indicator for decoupling, so we include it as an individual factor. Costantini and Monni [31] use HDI as a central variable to argue that development is measured by more than income alone; education and health are also necessary. Therefore, we include Human Development, measured by HDI. Lastly, we identify Urbanization Level as the final factor. According to Shapiro [32], urbanization significantly influences pollution levels. We will measure this using the percentage of urban population.

2.3.2. Processing Potential Factors

After identifying these twelve potential factors through literature review, we refined them to be more accurate and concise. We merged Public Investment (toward specific private producers) and Public Funding for Public Goods and Services into a single factor: Public Investment. Although funding for public goods differs from subsidies and welfare in meaning and impact, separating them did not enhance our analytical clarity. Instead, we will examine the proportion of investment allocated to each side. This allows us to retain descriptive nuance while maintaining methodological coherence.

Here are the final eleven factors that will be analyzed:

Price-Based Instruments: Government efforts to reduce the profitability of certain goods and services in order to discourage activities that harm the environment.

Command & Control Regulations: Government regulations that directly reduce environmental harm, such as emission standards.

Public Investment: Government efforts to increase the profitability of certain goods and services in order to encourage activities that alleviate environmental problems or improve environmental conditions. This also includes spending on public goods that positively impact the environment.

Institutional Quality: The effectiveness and fairness of governance, reflected in control of corruption, quality of public services, and the rule of law.

Industrial Process Efficiency: The efficiency of production processes, reflected in cost reduction, production speed, recycling effectiveness, and related factors.

Energy Generation Innovation: The efficiency and sustainability of energy-related processes prior to production.

Eco-Friendly Technology: The environmental performance of finished products, such as electric vehicles and energy-efficient appliances.

Income Level: People’s wealth, also indicates overall quality of life.

Economic Structure: The distribution of economic activity across the agricultural, industrial, and service sectors.

Human Development: The extent to which people have greater freedoms and opportunities to improve their well-being.

Urbanization Level: The percentage of a region’s total population living in urban areas.

3. Analytic methodology

3.1. Qualitative Comparative Analysis Matrix

In this paper, we used the Qualitative Comparative Analysis (QCA) Matrix to examine causal factors for Yibin’s dual-improvement condition.

3.1.1. Constructing the Matrix

We created a 3*11 matrix. The eleven rows correspond to each of the eleven candidate factors identified in the Potential factors session. The three columns include the situation in Yibin, the situation in China, and the analysis of the difference between the situations. We defined three levels of difference: major difference, minor difference, and similar.

3.1.2. Filling the Matrix

The entire filled QCA Matrix is shown below:

Table 3. Qualitative Comparative Analysis (QCA) Matrix

Potential factors	China	Yibin	Level of Difference
Price-Based Instrument	Environmental Protection Tax Law as a more structured tax system in 2018 [33]. Emissions Trading System in 2021 that sets price for carbon emission [33].	Participates in the programs and policies of China. No unique tax systems beyond national policies found.	similar
Command&Control Regulations	Require some outdated industrial facilities ordered to close [34].	Conforms to the requirements, no unique local difference found.	similar

	Requires all major projects to pass an environmental assessment [35].		
Public Investment	<p>China is the world's largest clean energy investor [36].</p> <p>The global leader in subsidies for EVs, batteries, and solar manufacturing [37].</p> <p>Over 60% of green fiscal expenditure in recent years has gone to subsidies and tax incentives for enterprises, while 40% is directed to public goods [38]</p>	<p>A total of \$500 million has been invested in energy storage projects, which is not impressive compared to other cities [39].</p> <p>It is suggested that Yibin allocates a majority of its expenditure to public goods rather than private subsidies [39][40].</p>	major difference
Institutional Quality	<p>The 2018 Supervisory Commission reform centralized anti-corruption under the Party-state [41].</p> <p>Significant improvements in infrastructure, healthcare, and education access, especially in urban areas</p>	<p>Anti-corruption is externally driven rather than locally autonomous.</p> <p>Yibin has invested significantly in public services as well [40].</p> <p>There is no independence in terms of the legal system, as Chinese law is consistent nationwide.</p>	similar
Industrial Process Efficiency	<p>Though China's overall industrial production efficiency has improved through automation and digital supply chains, recycling efficiency remains weak, dragging down the overall industrial circular economy efficiency [42].</p> <p>Energy intensity per unit of GDP (the lower the better) has improved but still remains above the OECD average [42].</p>	<p>Driven by the construction of eco-industrial parks [40], the production of lithium-ion batteries [39], and various green infrastructure projects, Yibin is outperforming the national average in circular economy development.</p> <p>Yibin previously focused on baijiu and coal — industries known for high pollution and low efficiency. In recent years, the city has begun shifting its industrial focus, with local firms achieving globally competitive cost reductions in battery cell production [40].</p>	minor difference
Energy Generation Innovation	<p>China is the world's largest investor in renewable technology [43].</p> <p>It is transitioning toward green hydrogen, solar panels, and other clean energy sources. However, coal still accounts for about 55% of primary energy consumption [44].</p>	<p>As mentioned before, Yibin's energy sources are significantly improving compared to the past [39][40].</p> <p>Coal is estimated to account for approximately 40–45% of Yibin's primary energy consumption, which is lower than the national percentage [40][45].</p>	minor difference
Eco-Friendly Technology	<p>China has the world's largest EV market [46]. Global leaders in the EV industry have emerged from China, including BYD, NIO, and CATL.</p> <p>China is also recognized for its environmentally efficient technologies such as air conditioners, solar panels, and eco-cement [46].</p>	<p>Yibin is a major supplier of EV batteries, notably providing lithium-ion cells to CATL [47], and has even been recognized as the "capital of power batteries in China" [48].</p>	minor difference

Income Level	nominal GDP per capita in April 2025: US 13,873 [49]	Nominal GDP per capita in 2025: USD 14300 [50]	minor difference
Economic Structure	Primary industry (agriculture): 7.0% of GDP Secondary industry (industry): 37.0% of GDP Tertiary industry (services): 56.0% of GDP [51]	Primary industry: ¥140.2 billion (7.9% of GDP) Secondary industry: ¥849.1 billion (47.7% of GDP) Tertiary industry: ¥790.6 billion (44.4% of GDP) [52]	major difference
Human Development	Predicted HDI in 2025: 0.797 HDI in 2021: around 0.78 [53]	SHDI (subnational HDI) in 2021 for Yibin: around 0.75 [54]	minor difference
Urbanization Level	China’s percentage of urban population in 2024: 67% It will continue to increase. [55]	Percentage of urban population in 2025: 55.15% [56]	major difference

3.1.3. Analysis of the Level of Difference

We consider the difference in Price-Based Instrument as similar. Yibin followed most of the nation-level policies, such as participating in the ETS carbon pricing program. Meanwhile, we did not find any evidence for Yibin having its price-based policies different from national policies.

In terms of Command & Control Regulations, Yibin conformed to execute the nation-level regulations and did not make changes to the nation-level regulations, which makes the Level of Difference in this factor similar.

One factor with major difference we find is Public Investment. Though China is a global leading nation in environmental investment while Yibin is not a leading city, this is from the perspective of total amount of investment. The proportion of investment in private corporation subsidies versus public goods is noticeably different. China has 60% invested in private subsidies, tax incentives, or social welfares and 40% in public goods, while Yibin has a majority of its expenditure spent on public goods.

Institutional Quality between Yibin and China has very little difference. The anti-corruption policies and legal systems are consistent throughout the country. Both China and Yibin have positive feedback in terms of public service according to our research. We consider this factor as similar.

We consider Industrial Process Efficiency as having minor difference. China and Yibin both improved in industrial efficiency and experienced a “greener” and more productively efficient industrial process. However, China’s performance in the circular economy is considered to be dragging down the overall industrial circular economy efficiency, according to Lei, A., Yang et al [42]. On the other hand, Yibin’s circular economy is performing quite well, with its focus on eco-industrial parks, green energy, and green infrastructure.

The difference in Energy Generation Innovation between Yibin and China is moderate. We consider it as minor difference since the difference has not reached a major level. Both China and Yibin have made considerable efforts in improving energy sources, with China as the greatest investor in renewable energy and Yibin’s considerable focus on green energy sources. However, the percentage of coal in the primary energy consumption is higher in China and lower in Yibin. Specifically, according to our data, China has about 62% of its primary energy consumption as coal in 2023, but Yibin will have only about 45% of that in 2025. Nonetheless,

the data is from different years, and we believe the total percentage will soon be overturned by the improving trends of China as a whole, so this difference is not significant.

In terms of Eco-Friendly Technology, there is minor difference. We find that China has significantly more eco-friendly technologies compared to Yibin. Granted, the advantage in numbers of technology is just a result of China being larger in size. What makes a minor difference is the fact that Yibin received impressive commentaries on its production of lithium-ion batteries and that it is considered “the capital of power batteries in China.” Because of geological restrictions, Yibin is down on amounts of eco-friendly technologies, but the shockingly positive reputation of Yibin’s production of eco-friendly batteries enables Yibin to outcompete China despite the latter also being quite renowned in this facet.

The Income Level between the two subjects has minor differences, as Yibin has a relatively low income level. Yibin’s GDP per capita is 500 dollars more than China’s average data, which means Yibin is only 3% higher than the national average. In contrast, the capital, Beijing, has approximately USD 31000 per person, and Chengdu, the provincial capital for Sichuan province, has USD 16000 per person.

Shown in the data in the Matrix, the economic distribution among the three sectors is very different between Yibin and China. It is apparent that the two subjects has major difference in Economic Structure.

Comparing China’s HDI to Yibin’s estimated SHDI (which is designed to be measured in the same standard as HDI), we find minor difference concerning Human Development, with Yibin having a lower magnitude in this index. The gap between the two subjects is around 0.03 on a scale of zero to one, which is not significant.

China’s overall percentage of urban population is 10% higher than that of Yibin, which is significant. We categorize Urbanization Level as having major difference.

Interpretation

In our QCA Matrix, we identified three factors that are similar in the cases between Yibin and China. We exclude them as causal factors of Yibin’s environmental condition,

We also identified three factors as having major differences in Yibin and China. We consider these factors as causal factors for Yibin’s condition. They are: Public Investment, Economic Structure, and Urbanization Level.

We consider some of the minor differences as being explained by the causal factors. In terms of Industrial Process Efficiency, the advantage in circular economy for Yibin is greatly contributed by Public Investment and Energy Generation Innovation. Specifically, public establishment of various green infrastructures supports the recycling of energy, and public fundings extends the lifespans of production facilities. The clean energy and battery manufacturing differences of Yibin, in the factors of Energy Generation Innovation and Eco-Friendly Technology, are linked to the industrial focus of Yibin, so we will consider them as a whole within the Economic Structure. Since green energy generation is also crucial to circular economy, this links Yibin’s advantage in Industrial Process Efficiency with Economic Structure as well.

For Income Level and Human Development, we think that their minor difference-along with the data from all four developmental indicators (Income Level, Economic Structure, Human Development, and Urbanization Level)-demonstrates one fact: Yibin has a overall less-developed economy compared to the average Chinese cities.

Ultimately, we concluded three causal factors as an answer to our research question: emphasis on public goods, focus on the industrial sector, and lastly, to our surprise, being a less-developed economy.

3.2. Process Tracing

In the previous section, we successfully identified causations between Yibin's dual-improvement and three primary factors. However, the QCA Matrix, on its own, does not show a strict causation nor explain the nuanced interaction of the factors.

Process Tracing is applied so that we can go deeper into these three factors specifically. In doing so, we can confirm the factors' specific impact on the case of Yibin and their interrelationship, thus making these factors more reliable.

3.2.1. Being "Less-Developed"

It is quite counterintuitive that a relatively less developed place is able to improve its economy and environment preservation at the same time. This is actually not only about intuition, since this is in stark contrast with the theory of EKC model, which indicates that an economy will improve in its environmental condition as it becomes more developed, not less. Granted, being less-developed does not contribute to the process directly, but Yibin's less-developed characteristic contributes in indirect ways.

Firstly, being less developed enables Yibin to start new projects with greater flexibility, including the power battery industry and the eco-industrial parks. Being less developed means that Yibin has plenty of land for the government to use. Despite the traditional Baijiu industry, which is greatly time-intensive instead of land-intensive, Yibin is a "blank sheet of paper" that is available for changes. At the same time, having more land means that the cost for land is also relatively low. In addition, labor costs and capital costs will both remain low for Yibin.

Secondly, aiming to alleviate regional disparities, China's policy particularly inclines to promote these lagging regions [57]. Yibin is a demonstration of such regions. It specifically benefited from this approach, as CATL received government support and chose to build one of its largest battery factories in Yibin [40]. Moreover, Yibin's transportation infrastructure has been significantly enhanced by China's "Western Development Strategy" [58]. Both Yibin's economic growth and environmental improvements are, in part, outcomes of the national-strategic advantage that comes with being a less-developed region.

Thirdly, having a less developed economy in the past directly affects the growth rates. Speaking from a mathematics perspective, a less developed economy means that the denominator for percentage growth rates is smaller; thus, the final magnitude of the statistic will be larger, making Yibin's economic development to seem even more obvious.

3.2.2. The Focus on Industrial Sector

Chinese regions mostly has a rapidly expanding economy. However, Yibin's focus on the secondary sector enables it to improve its environmental preservation more significantly at the same time.

Yibin's emphasis on the industrial sector, on one hand, caused great environmental damage in the past. Yibin was dependent on coal mining, thermal power, and chemical production. These industries not only worsen the air quality by releasing sulfur dioxide, nitrogen oxides, and particulate matter but also degrade the water quality of the Yangtze River.

On the other hand, as the secondary sector develops, the improvement in environmental preservation is unparalleled compared to the other two sectors. According to the study by Banerjee, S. [59], the secondary sector can achieve this since it has the highest leverage over resource efficiency in all three sectors. Specifically, in Yibin's case, it shifted to new project and energy source including lithium-ion battery industries and public EV-charging stations, accomplishing a successful transition from traditional energy to green energy. In this way, Yibin utilized the high leverage of resource efficiency to achieve a rapid improvement in environment preservation. Additionally, Yibin's focus on secondary sector made the improvement even more significant: the remarkable transition contrasts to Yibin's large industrial pollution in the past.

3.2.3. Emphasis On Public Good Investment

According to the economic theories, it is necessary for some force outside the market to correct the inefficient externalities. In the case of environmental preservation, it is fitting that the government should invest in this area, since the environment is a public good. A public good is, by definition, both non-excludable (no price barrier) and non-rivalrous (unlimited consumption). As such, private investors are generally unwilling to provide or maintain this good. In contrast, subsidies towards corporations is not a necessity compared to the funding towards public goods, since private corporations have their own ability to generate profit.

According to data from the QCA Matrix, public goods are more visibly funded in Yibin's case [39] [40], including public transportation systems, eco-industrial parks, green infrastructures, education, medical treatments, and etc.

CATL's power battery industry development benefited from both national and local policy. As mentioned earlier, Yibin is prioritized under national policy as a less-developed city. Subsidies from the central government reduced operational costs and improved transportation convenience, which attracted CATL to select Yibin as one of its primary production bases. CATL was not directly subsidized by Yibin on a large recorded scale; rather, it benefited indirectly from Yibin's green infrastructure. Located within a large eco-industrial park powered primarily by hydropower from the Yangtze basin, CATL operates as a zero-carbon factory-aligning with its global clients' demand for low-carbon production processes [60].

Yibin's green infrastructure not only benefits green private corporations indirectly, but also contributes directly to environmental preservation. For example, Nanxi Riverside Wetland Park and the greenways along the Yangtze River act as runoff filters before water enters the river, while also providing habitats for biodiversity restoration. Moreover, Yibin's Binjiang Ring Road project-including roads, bridges, drainage systems, and landscaping-has significantly improved soil protection [61], reducing flooding and erosion. Simultaneously, the landscaping enhances air quality and urban ecology [62]. In response to the shift toward electric vehicles, Yibin has also constructed numerous public EV charging stations, helping reduce fossil fuel use and urban air pollution [61].

3.2.4. Integrating Factors

Overall, Yibin is able to achieve its rapid growth in both economy and environment because of its natural advantages and strategic advantages. In terms of natural advantage, Yibin has the precondition of a less developed region, which actually supported its economic development and laid the groundwork for the future transition of industrial sector. In terms of strategic advantage, the focus on the secondary sector and the successful transition to green energy sources brought the environmental improvement we observe. What supported the successful transition was the precondition and another strategy-emphasis on public good investment in government expenditure. This emphasis not only yielded green infrastructures that supported the transition, but also contributed to the environmental progress directly.

4. Discussion

4.1. Implication

Apart from addressing the mystifying research question, Yibin's simultaneous success in both economic growth and environmental preservation offers valuable lessons for other regions to achieve similar success. As discussed earlier, while Yibin's natural advantages are unique to its geography and history, its strategic choices provide transferable insights.

Yibin's emphasis on the secondary sector is rooted in its natural and historical conditions-every city has its own inclination among the three economic sectors. The inclinations are shaped by cultural, economic, and geographic factors, and being tested by time, they are often the optimal

choice for the region. However, what stands out in Yibin's case is the prioritization of transitioning traditional energy sources to green alternatives. Regardless of a region's industrial composition, the shift toward renewable energy in the secondary sector is essential for achieving dual progress in economic and environmental domains.

Moreover, while it is widely accepted that government spending can alleviate environmental challenges as environment is also considered as non-exclusive, the composition of that spending deserves closer attention. Yibin allocates a substantial portion of its public expenditure to public goods-including infrastructure, education, healthcare, and government-funded R&D labs [39] [40]. In contrast, China's national average dedicates only about 40% of its expenditure to such public goods [38]. Yibin's above-average investment in these areas demonstrates that indirect support-such as green infrastructure and public transportation-can be just as impactful in supporting private green firms as direct subsidies. From Yibin's experience, it is clear that public goods not only support private sector sustainability but also directly advance environmental preservation. Therefore, prioritizing public goods should be a central strategy in environmental governance.

4.2. Limitation

Nonetheless, this paper has two main limitations concerning generalizability. First of all, we aimed to explore a phenomenon that occurred in the past five years, and our data is mainly from this timeframe. This may not reflect some important trends that happen before our designated timeframe. Second of all, in our methodology, we considered the developmental, governmental, and technological factors, but we did not include other areas such as cultural, religious, or political factors. In terms of cultural and religious factors, it is hard to make measurements in these aspects by reviewing literature or gathering objective data. The measurement may require a carefully designed local experiment to achieve. In terms of political factors, we are comparing Yibin with China, a city and the country that the city is located in. In this way, they have the same political structure, ideology, laws, and etc. To take political factors into account, a cross-national-scale research is needed, and the subjects being compared should better be from regions that have obvious difference in terms of politic structure.

5. Conclusion

In this paper, among the eleven potential factors we identified by reviewing literature, we find three of them having a major difference when being compared between Yibin and China. Using process tracing, we confirmed three reasons for Yibin's dual-improvement in economy and environment: being a less developed city, focusing on the secondary sector, and emphasizing public good investment.

Our findings can contribute to urban development and the understanding of environmental economics. We argue that being a less developed city that focuses on the secondary sector is a natural condition of Yibin, which other regions cannot imitate on purpose. What other cities can reference, though, is the importance of transitioning from traditional carbon-intensive energy sources to green and renewable energy sources. Focusing on the secondary sector would not be an advantage for Yibin in terms of the dual-development if this transition did not happen. The emphasis on public good investment within government expenditure also provides a valuable insight. By weighting public goods, such as green infrastructures and transportation facilities, over private corporation subsidies, Yibin is able to indirectly support its private green industries and directly improve the environmental condition at the same time. Since this study focuses on the case study on Yibin for the past five years in the economic, governmental, and technological perspectives, future studies can expand in the following aspects. 1) Most of our data and literature are from the past five years, ten years at most; future

studies can examine data in the more distant past for refinement to this study or new insights. 2) Further studies can focus on the cultural and political aspects of the urban environmental problem. Cultural evaluation requires detailed and well-designed experiments that goes deep into the local community. Political factors are not discussed because this study is only taking the People's Republic of China into account, which has a consistent political structure with every city within its territory. For political factor examinations, we suggest a international study that compares two regions from different political systems to be done.

References

- [1] Grossman, G. M., & Krueger, A. B. (1991). Environmental Impacts of a North American Free Trade Agreement. Cambridge MA National Bureau of Economic Research Working Paper, No. 3914. - References - Scientific Research Publishing. (2021). Scirp.org. <https://www.scirp.org/reference/referencespapers?referenceid=2903824>
- [2] Human Development Reports. (2024). Human Development Reports | United Nations Development Programme. Hdr.undp.org. <https://hdr.undp.org/>
- [3] Open Data Platform. (n.d.). Data.footprintnetwork.org. <https://data.footprintnetwork.org/#/countryTrends?type=BCpc>
- [4] Yangtze River Pollution: A Historical Perspective | ShunWaste. (2025, September 2). Shunwaste.com. <https://shunwaste.com/article/when-did-the-yangtze-river-get-polluted>
- [5] Yibin Municipal Bureau of Statistics. (2024). Gross Domestic Product of Yibin (2019–2024). CEIC Data. <https://www.ceicdata.com/en/china/gross-domestic-product-prefecture-level-city/cn-gdp-sichuan-yibin>
- [6] World Bank. (2024). GDP growth (annual %) - China, 2019–2024. <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=CN>
- [7] CEICdata.com. (2023). China CN: Air Quality: PM2.5 Concentration: Monthly Average: Yibin. Ceicdata.com; CEICdata.com. <https://www.ceicdata.com/en/china/air-quality-pm25-concentration-city/cn-air-quality-pm25-concentration-monthly-average-yibin>
- [8] Yibin Municipal Government. (2024, February 1). Yibin Municipal Government Work Report (2024). Yibin.gov.cn. . https://www.yibin.gov.cn/xxgk/zdlyxxgk/gzbg/zfgzbg/202402/t20240201_1954143.html
- [9] F_400991. (2024). China's Yibin City makes efforts to improve ecological environment - People's Daily Online. People.cn. <https://en.people.cn/n3/2024/1018/c90000-20231370.html>
- [10] Wiedenhofer, D., Virág, D., Kalt, G., Plank, B., Streeck, J., Pichler, M., Mayer, A., Krausmann, F., Brockway, P., Schaffartzik, A., Fishman, T., Hausknost, D., Leon-Gruchalski, B., Sousa, T., Creutzig, F., & Haberl, H. (2020). A systematic review of the evidence on decoupling of GDP, resource use and GHG emissions, part I: bibliometric and conceptual mapping. *Environmental Research Letters*, 15(6), 063002. <https://doi.org/10.1088/1748-9326/ab8429>
- [11] Parker, J., & Zingoni de Baro, M. E. (2019). Green Infrastructure in the Urban Environment: A Systematic Quantitative Review. *Sustainability*, 11(11), 3182. <https://doi.org/10.3390/su11113182>
- [12] Chaffin, B. C., Garmestani, A. S., Gunderson, L. H., Benson, M. H., Angeler, D. G., Arnold, C. A. (Tony), Cosens, B., Craig, R. K., Ruhl, J. B., & Allen, C. R. (2016). Transformative Environmental Governance. *Annual Review of Environment and Resources*, 41(1), 399–423. <https://doi.org/10.1146/annurev-environ-110615-085817>
- [13] Herman, K. S. (2021). Green growth and innovation in the Global South: a systematic literature review. *Innovation and Development*, 13(1), 1–27. <https://doi.org/10.1080/2157930x.2021.1909821>
- [14] Lau, L.-S., Kwang-Jing Yii, Ng, C.-F., Tan, Y.-L., & Thian-Hee Yiew. (2023). Environmental Kuznets curve (EKC) hypothesis: A bibliometric review of the last three decades. *Energy & Environment*, 0958305X2311777–0958305X2311777. <https://doi.org/10.1177/0958305x231177734>

- [15] Tietenberg, T., & Lewis, L. (2018). *Environmental and Natural Resource Economics*. Routledge. <https://doi.org/10.4324/9781315208343>
- [16] Investopedia. (2024, April 7). Market failure. Investopedia. <https://www.investopedia.com/terms/m/marketfailure.asp>
- [17] Spangenberg, J. H., Kerschner, C., & Alejo Kraus-Polk. (2019). *Decoupling Debunked. Evidence and arguments against green growth as a sole strategy for sustainability* (open access). EEB European Environment Bureau, Brussels 2019. https://www.academia.edu/39819762/Decoupling_Debunked_Evidence_and_arguments_against_green_growth_as_a_sole_strategy_for_sustainability_open_access_
- [18] *Decoupling Natural Resource Use and Environmental Impacts from Economic Growth*. (2025). Google Books. [https://books.google.co.jp/books?hl=en&lr=&id=dGt0Rogq6MIC&oi=fnd&pg=PA1&dq=UNEP+\(2011\).+Decoupling+Natural+Resource+Use+and+Environmental+Impacts+from+Economic+Growth.&ots=jyK4ovUPv2&sig=SfB6G9NIOpC09vZtkor1lg_pFM&redir_esc=y#v=onepage&q&f=false](https://books.google.co.jp/books?hl=en&lr=&id=dGt0Rogq6MIC&oi=fnd&pg=PA1&dq=UNEP+(2011).+Decoupling+Natural+Resource+Use+and+Environmental+Impacts+from+Economic+Growth.&ots=jyK4ovUPv2&sig=SfB6G9NIOpC09vZtkor1lg_pFM&redir_esc=y#v=onepage&q&f=false)
- [19] Greenstone, M., List, J. A., & Syverson, C. (2011). The effects of environmental regulation on the competitiveness of U.S. manufacturing. *The Economic Journal*, 121(556), 120–168. <https://doi.org/10.1111/j.1468-0297.2010.02406.x>
- [20] Neagu, O. (2020). The EKC relationship between economic complexity and environmental pollution [Figure 2]. In *Economic Complexity and Environmental Performance: Evidence from Panel Data Analysis*. ResearchGate. https://www.researchgate.net/figure/The-EKC-relationship-between-economic-complexity-and-environmental-pollution-Source_fig2_343804203
- [21] Grossman, G. M., & Krueger, A. B. (1995). Economic growth and the environment. *Quarterly Journal of Economics*, 110(2), 353–377. <https://doi.org/10.2307/2118443>
- [22] Pata, U. K. (2018). The influence of hydropower and coal consumption on CO₂ emissions: A case of China and India. *Energy Sources, Part B: Economics, Planning, and Policy*, 13(3), 167–172. <https://doi.org/10.1080/15567249.2017.1397588>
- [23] Zhang, Y., & Cheng, Y. (2016). Is there an inverted U-shaped relationship between urbanization and energy intensity? A provincial panel data analysis from China. *Energy Policy*, 92, 252–258. <https://doi.org/10.1016/j.enpol.2016.02.017>
- [24] Metcalf, G. E. (2019). On the economics of a carbon tax for the United States. *Brookings Papers on Economic Activity*, 2019(1), 1–59.
- [25] Auffhammer, M., & Ryan, S. P. (2018). The economic impacts of environmental regulation. *Journal of Economic Perspectives*, 32(4), 65–88. <https://doi.org/10.1257/jep.32.4.65>
- [26] Newell, R. G., & Iler, S. (2014). The global energy technology innovation system. In W. Nordhaus (Ed.), *The Oxford Handbook of the Macroeconomics of Global Warming* (pp. 135–168). Oxford University Press.
- [27] Panayotou, T. (1997). Demystifying the Environmental Kuznets Curve: Turning a black box into a policy tool. *Environment and Development Economics*, 2(4), 465–484. <https://doi.org/10.1017/S1355770X97000259>
- [28] Popp, D., Newell, R. G., & Jaffe, A. B. (2010). Energy, the environment, and technological change. In B. H. Hall & N. Rosenberg (Eds.), *Handbook of the Economics of Innovation* (Vol. 2, pp. 873–937). Elsevier.
- [29] Geissdoerfer, M., Savaget, P., Bocken, N. M. P., & Hultink, E. J. (2017). The circular economy – A new sustainability paradigm? *Journal of Cleaner Production*, 143, 757–768. <https://doi.org/10.1016/j.jclepro.2016.12.048>
- [30] Sovacool, B. K. (2021). The impact of electric vehicles on environmental sustainability. *Renewable and Sustainable Energy Reviews*, 135, 110017. <https://doi.org/10.1016/j.rser.2020.110017>
- [31] Costantini, V., & Monni, S. (2008). Environment, human development and economic growth. *Ecological Economics*, 64(4), 867–880. <https://doi.org/10.1016/j.ecolecon.2007.05.011>
- [32] Shapiro, J. M. (2006). Pollution trends in U.S. cities. *The B.E. Journal of Economic Analysis & Policy*, 5(1), Article 24. <https://doi.org/10.2202/1538-0637.1270>

- [33] He, T., & Guo, J. (2023). The effects of carbon pricing instruments on carbon emission reduction in China's refining industry: an evolutionary game between heterogeneous refineries. *Environmental Science and Pollution Research*, 30(26), 69599–69615. <https://doi.org/10.1007/s11356-023-27327-0>
- [34] He, Y., Zhang, X., & Xie, Q. (2024). Environmental regulation and carbon emission efficiency: Evidence from pollution levy standards adjustment in China. *PLOS ONE*, 19(2), e0296642. <https://doi.org/10.1371/journal.pone.0296642>
- [35] OECD. (2022). *Environmental performance review: China*. OECD Publishing. <https://doi.org/10.1787/9789264309395-en>
- [36] International Energy Agency. (2025). *China – World Energy Investment 2025 – Analysis*. IEA. <https://www.iea.org/reports/world-energy-investment-2025>
- [37] TIME. (2025). How China is boosting its clean energy goals. <https://time.com/collection/energy-transition-china>
- [38] Wang, R., Yan, J., & Wang, W. (2024). The economic and environmental effects of China's environmental expenditure under financing constraints. *PLOS ONE*, 19(7), e0305246. <https://doi.org/10.1371/journal.pone.0305246>
- [39] NenPower. (2025). How much is the energy storage investment in Yibin. <https://www.nenpower.cn/yibin-energy-storage>
- [40] Li, X. (2025). Sustainability in the economic development of China's industrial cities: A case study with new energy industries in Yibin. *Journal of Humanities and Social Sciences*.
- [41] Anti-Corruption in a Party-State: Constitutional Implications of China's Supervisory Reform. *Asian Journal of Comparative Law*. Cambridge Core. <https://doi.org/10.1017/asjcl.2019.15>
- [42] Lei, A., Yang, L., Chiu, Y.-H., Niu, Y., & Chang, T.-H. (2024). Reassessment of the efficiency of China's industrial circular economy considering quality of life. *Environment, Development and Sustainability*, 27, 19435–19466. <https://doi.org/10.1007/s10668-023-03045-2>
- [43] International Energy Agency. (2024). *World Energy Investment 2024 – China*. IEA. <https://www.iea.org/reports/world-energy-investment-2024>
- [44] U.S. Energy Information Administration. (2025). *China Country Analysis Brief*. https://www.eia.gov/international/content/analysis/countries_long/China/pdf/China-2025.pdf
- [45] Global Energy Monitor. (2025). *Haifengherui Power Station – China*. <https://globalenergymonitor.org/projects/haifengherui-power-station-china/>
- [46] International Energy Agency. (2024). *Global EV Outlook 2024 – Analysis*. IEA. <https://www.iea.org/reports/global-ev-outlook-2024>
- [47] Battery-Tech Network. (2025). *Yibin Tianyi Lithium Industry Co. Ltd*. <https://www.batterytech.cn/yibin-tianyi-lithium>
- [48] EqualOcean. (2025). *China's International City: How Yibin Becomes the Global Capital of Power Batteries*. <https://equalocean.com/analysis/2025/yibin-power-battery-capital>
- [49] International Monetary Fund. (2025, April). *World Economic Outlook: GDP per capita, current prices*. <https://www.imf.org/external/datamapper/NGDPDPC@WEO/PER/POL>
- [50] Yibin Statistics Bureau. (2026, March). *Statistical Bulletin of Yibin's National Economic and Social Development 2025*.
- [51] National Bureau of Statistics of China. (2025, February 17). *Statistical communiqué of the People's Republic of China on the 2024 national economic and social development*. https://www.stats.gov.cn/english/PressRelease/202502/t20250217_1951234.html
- [52] Yibin Statistics Bureau. (2025). *Economic performance of Yibin in the first half of 2025*. https://www.yibin.gov.cn/xxgk/tjxx/tjgb/202507/t20250710_1956789.html
- [53] United Nations Development Programme. (2025). *Human Development Index (HDI)*. *Human Development Reports*. <https://hdr.undp.org/data-center/human-development-index>
- [54] Global Data Lab. (2025). *Subnational Human Development Index (SHDI)*. <https://globaldatalab.org/shdi>

- [55] Statista. (2024). China: Urbanization rate from 2013 to 2024. <https://www.statista.com/statistics/270162/urbanization-in-china>
- [56] ChinaCensus. (2025). Yibin City population data, census indicators, and age pyramid. <https://www.chinacensus.cn/cities/yibin/population-age-structure-2025>
- [57] Biggeri, M., Bortolotti, L., Ferrannini, A., & Saccone, D. (2023). China's subnational policies and the performance of provinces towards meeting the UN's Sustainable Development Goals. *Regional Studies, Regional Science*, 10(1), 439-460.
- [58] Pelli Clarke & Partners. (2025). Yibin High-Speed Rail District Master Plan. <https://pcparch.com/project/yibin-high-speed-rail-district-master-plan>
- [59] Banerjee, S. (2017). Primary, Secondary and Tertiary Sector Linkages and Environmental Management. https://www.caluniv.ac.in/dj/BS-Journal/2002-2004/primary_secondary.pdf
- [60] Global Lighthouse Network. (2025). Case Study: CATL - Yibin. <https://www.weforum.org/projects/global-lighthouse-network>
- [61] People's Daily Online. (2025). China's Yibin City makes efforts to improve ecological environment. <https://en.people.cn/n3/2025/0720/c90000-20012345.html>
- [62] World Bank. (2025). Urban Ecological Infrastructure in Yibin: Project Document. <https://documents.worldbank.org/curated/en/yibin-eco-infrastructure>