

Negative externalities in the sharing economy: sources, paths and recommendations

Sharing
economy

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Abstract

Purpose – This paper aims to clarify the complex path of negative externalities in the sharing economy and proposes corresponding policy recommendations.

Design/methodology/approach – This paper aims to establish an analytical framework for the negative externalities of the sharing economy and to extract the main factors that produce negative externalities, and then, through qualitative comparative analysis method find out how these factors interact to form a negative externality.

Findings – Negative externalities in the sharing economy come from the joint effect of the sharing degree of the product or service and constraint mechanism, and the current main modes of the shared economy increase the possibility of negative externalities.

Originality/value – The paper proposes a complex path resulting from negative externalities in the shared economy.

Keywords Negative externalities, Qualitative comparative analysis, Sharing economy

Paper type Research paper

1. Introduction

The global success of business models represented by Airbnb and Uber have opened various resources for sharing, influencing the rise of sharing economy. The sharing economy has been generated under the background of overcapacity, referring to a new model in which internet companies use algorithms and data to mobilize redundant resources in the market, solve asymmetric market information and improve transaction efficiency. Globally, tens of thousands of various types of sharing economy enterprises exist, affecting people's lives and consumption patterns in various fields. The 2017 Sharing Economy Development Report released by the China Electronic Commerce Research Center pointed out that in 2017, China's sharing economy was more than 5tn, with a growth rate of more than 40 per cent since 2016. The sharing economy has played an important role in improving the allocation efficiency and user value of social resources. However, it has also



brought some negative effects, such as shared bikes occupying sidewalks, drivers violating regulations, price increases and tenants destroying homes in short-term rentals.

Recently, countries around the world have begun to actively respond to the negative effects of the sharing economy. For example, in terms of sharing trips, Singapore and other countries recognize the legitimacy of vehicles such as Uber, but under strict regulations; France and others investigate online car rental services as illegal businesses; in California and Colorado in the USA and Washington, DC the legalization of online car rental services has already been achieved. Many studies have begun to focus on governance issues regarding the sharing economy and have proposed various suggested governance methods such as multiple governance (People's Forum questionnaire survey center, 2017), collaborative governance (Tang, 2017), mixed supervision (Tang, 2015), response-type regulation (Peng, 2016) and so on. However, traditional governance methods produce difficulties for sharing economy as a new, effective economic form. Main reasons for this include the lack of a clear understanding of the emergence of various problems in the sharing economy and the weak pertinence of proposed governance methods. The relative lag in theoretical research has also caused difficulties for relevant departments in the actual governance of the industry.

The sharing economy situation fits well with the externality theory. Pigou (1962) believes that externality is the inevitable result of market operations. When externalities exist, the allocation of resources cannot reach Pareto optimality. Therefore, identifying sources of negative externality may be effective in determining entry points for governance of the sharing economy. Based on the aforementioned, this article discusses the source of negative externalities in the sharing economy to explore which economic features constitute the source of negative externalities and whether specific patterns exacerbate these negative externalities. We further propose corresponding governance strategy.

2. Literature review

The discussion of externalities has been around for a long time, but the concept is still controversial. Historically, the point of view on externalities can be divided into three major nodes. Currently, the general awareness in the academic world attributes the external economy, which was first proposed by Marshall (Zhang, 2012). The external economy, or the changes in business efficiency caused by changes in industry scale, is considered the predecessor of externality. Originally, however, the concept of externality was first put forward by Pigou (1912). In his book, *Welfare Economics*, the externalities are explained by analyzing the deviation between the marginal private net output value and the marginal social net output value. Pigou believes that externality is actually the inconsistency between marginal private cost and marginal social cost and marginal private income and marginal social income. However, the concept of externality discussed by Coase in the later period was different from Pigou. He proposed that externality is the direct influence of economic activities of the actor on other economic entities in his paper "Problem of Social Cost." The negative externalities of the sharing economy discussed in this paper are conceptually closer to Coase's research.

The existence of externalities has been widely accepted; numerous scholars, in addition to discussing the mechanisms, classifications, etc., have also discussed external phenomena of externalities and their appearances (Scitovsky, 1954; Bator, 1958). Externalities have been studied in the banking sector (Su, 2000; Zhang, 2016), insurance (Zhou, 2014), coal mining (Liu, 2014) and other specific industries. Despite the in-depth exploration of externality, it is still a vague concept. In the narrative definition, externality is generally defined as the influence the implementer has on other people in a particular economic activity. For

example, the New Palgrave Dictionary of Economics defines external economies as an effect of a producer's output or input on the nonpayment of another producer. Buchanan and Stubblebine (1962) gave a mathematical representation of externalities: the so-called externality is the independent variable of the welfare function of an economic entity, producing a function that shows if an economic welfare task is affected by other factors not controlled by oneself, there is an externality. Similar definitions include Ping (2006) and Xu (2006). In this type of definition, the subject is clear, but economic activity is ambiguous. The influence of the implementer on other people is an overly broad term. Therefore, key content in the definition is unclear therefore confusing the sources, process of influence and extensions of externalities.

Although the aforementioned representative studies by Marshall, Pigou, Coase and others have greatly improved people's understanding of externality issues, they actually provide inconsistent discussions of externalities. Marshall's externality refers to the impact from activities of other economies, with the typical example the tragedy of the commons. Pigou's externalities refer to the influence of actors on society and the natural environment, such as global warming and intergenerational equity in sustainable development theory. Coase's externality advocates the influence of actors on direct participants, such as the impact of factory sewage on fish farms. The aforementioned studies were also conducted at different levels in terms of extension, which has exacerbated the ambiguity of the concept of externality. Many economists, such as Tibor Scitovsky, Zhang, Yang and others, believe that the definition of externality is a rather vague concept. Hu [Shiqing and Wu Jiawei \(2011\)](#) summed up the research on externalities by Marshall, Pigou, Coase and other scholars and provided two essential features of externalities: that the affected party has "non-participatory decision-making" and "has lacked an effective feedback mechanism." Based on this, a more comprehensive definition can be given: in a particular economic activity, externalities are the effects on parties that have not participated in the decision and lack an effective feedback mechanism to compensate. The externality is generated and exists in this way.

Despite the unclear definition of externality, current research on the externalities of an industry often does not consider the ambiguity of the concept. Research situations on the topic more common in traditional industries and have provided some inspiring conclusions. However, it is undeniable that traditional industries are relatively simple and their economic activities are relatively stable. For emerging economies which are sharing economies, new resource allocation methods, transaction circulation modes, diversified needs and business types may be impossible under vague framework for comprehensive and accurate analysis. It is too easy to catch only a few details and conduct incomplete study under the current environment.

The ambiguity of the externality concept creates difficulties for quantitative analysis of the presence and origin of externalities. Existing quantitative or empirical studies have focused on the FDI industry and often examine externalities through the spillover effect of technology or knowledge (Aitken and Harrison, 1999; [Wen and Liang, 2011](#)). Another type of study is the discussion of the endogenous nature of externalities ([Mitchell and Skrzypacz, 2006](#)). The empirical approach of the former is generally to reflect the marginal effects of variables through regression coefficients; the latter is usually derived through mathematical model derivation. However, the aforementioned research methods cannot explain the source of externalities well. First, the basic idea in the regression method is weak in explaining the cause and effect relationship. Second, the complexity of the concept of externalities makes it difficult to abstract a reasonable mathematical expression. Finally, the sharing economy studied in this paper is a new economic form.

At present, there are no mature technical means or models that can be used to describe the external effects of an activity, and it is impossible to explore the sources of externalities. Based on the three aforementioned points, we need to adopt a new method to explore the sources of negative externality in the sharing economy. Qualitative comparative analysis (QCA) provides useful ideas for this study. This paper believes that the QCA method is more suitable for the study than the traditional statistical methods, with the main reason that QCA has a significant advantage in explaining the causality.

At present, research on the sharing economy has focused primarily on the drivers (Shirky, 2009), impact assessments (European Parliament, 2015; Greenwood and Wattal, 2015), business model characteristics (Henten and Windekilde, 2015), effective management (Zhang, 2016; Chen, 2016; Liu and Wang, 2016) and so on. However, mature studies on externalities of the sharing economy are rare. At present, there are no professional papers or authoritative reports concerning the externalities of the sharing economy, with references to the negative externalities of the sharing economy often found in Web news reports. The reasons for the separation of realistic and theoretical research may include that the sharing economy has appeared recently, and its understanding is still deepening. Also, as aforementioned, externality is a relatively vague concept, and therefore, although we can recognize its existence, it is difficult to analyze with mature methods. The over-innovation of research objects has also made it difficult to find effective research methods. On the other hand, there has been an endless stream of research on the sharing of economic supervision and governance. In fact, these studies have illustrated that the sharing economy has brought a series of benefits to society, while simultaneously producing certain negative consequences. A large part of these consequences can be summarized and interpreted with negative externalities. However, the existing research neglects analysis of problem causes and discusses the governance methods directly, lacking innovative conclusions.

Therefore, in the discussion of the negative externalities of the sharing economy, we first need to establish a normative framework to study the scope of externalities, the production mechanisms and the extension of performance. The aforementioned definitions have not been widely recognized, but inspiration can be drawn from these studies. First, externalities are related to human behavior; Marshall, Pigou and Coase all involved this aspect in the definition. Therefore, the behavior of the economic subject can be used as the starting point of externality study. Second, economic entities can be divided rationally as the generator and the receiver of externality. This division can better determine whether the externality exists. Finally, on the basis of this judgment, to explain the causes or mechanisms of externalities, it is possible to start by distinguishing the behaviors that generate externalities and examining what factors have caused these behaviors.

3. Analysis framework

Positive externalities in the sharing economy can be clearly defined and reflected in the reduction of transaction costs and improvement of transaction efficiency. This is determined by the original intention of the sharing economy. Negative externalities, however, have a variety of expressions, for example, man-made destruction of shared resources (such as bicycles and rooms), indiscriminate use of shared bicycles affecting traffic operation and security problems arising from online car rental. The aforementioned issues have different performances and involve different levels of interpretation. Man-made destruction of shared resources involves the issue of public goods, the illegal parking of shared bicycles involves the issue of property rights separation and the security problem caused by online car rentals is mainly from the assumption of reasonable persons who act as profitable agents.

It can be seen that the sources of negative externalities in the sharing economy are mainly related to participant behaviors. Immoral behavior means that “self-interested individuals are affected by certain factors and violate general principles such as honesty and reliability because the environment allows him to do so with impunity” (Pang, 2004). Therefore, the focus of research on the negative externalities of the sharing economy lies in the analysis of conditions for immoral behaviors. On the other hand, the Mandeville Paradox points out that private evil can be transformed into public interest. This can reveal that some deterrence is not necessarily the source of diseconomy; on the contrary, it is possible that strong self-interest promotes public interest. This kind of thinking is also reflected in the first theorem of welfare economics. That is, if companies pursue interests and every individual pursues his/her own maximization of benefits, market resource allocation can reach Pareto optimality.

Therefore, in the analysis of negative externalities, it is not possible to consider only the subjective behavior of the sharing economy as an independent variable, but other variables must also be included. In addition to the costs and benefits of self-interested behavior, some new issues arising from the sharing economic business model should also be considered, including property rights separation, public goods issues and information asymmetry.

4. Research methods and processes

4.1 *New idea: qualitative comparative analysis*

4.1.1 *The origin and application of qualitative comparative analysis.* QCA is an analysis method for small and medium-sized samples of case studies, first proposed in social science research in the 1980s by Charles Ragin. This method is based on case studies and can systematically analyze small data samples. It combines the strengths of both qualitative and quantitative analysis methods, treating each case of the study as a whole and analyzing the interpretation conditions and configurations in the case. In the early use of the method, a clear set qualitative comparative analysis (csQCA) technique was mainly used. However, this technique can only deal with binary variables, that is, the causality condition of the analysis, and the result value must be calibrated to 0 or 1, facilitating the loss of variable information and production of contradictory configurations and increasing the difficulty and challenge of analysis (Cronqvist and Berg-Schlosser, 2009). To overcome this defect, Ragin (2008) proposed the fuzzy set qualitative comparative analysis (fsQCA) technology, adopting a fuzzy set to indicate the degree of occurrence of results and the interpretation conditions. In principle, any value between 0 and 1 can be assigned. The loss of information in the process of data transformation can be avoided, and the actual case situation can be more accurately reflected. Therefore, this paper chose the fuzzy set QCA method.

4.1.2 *The principle of qualitative comparative analysis.* The core logic of QCA is derived from set theory. If a problem or phenomenon to be studied is viewed as a set, the preconditions causing the phenomenon are subsets. For example, when analyzing the source of negative externalities in the sharing economy, “negative externalities in the sharing economy” is a set, and the subsets of preexisting conditions can be “gains from immoral behavior,” “products or services with the nature of public goods,” “limited industry constraints” and so on. On the technical level, the QCA method uses a Boolean algebra algorithm to find certain affiliation relationships that exist among the collections through a certain number of multi-case comparisons. As there are equivalent multiple paths or solutions in research (Ragin, 2000, 2014; Rihoux and Ragin, 2009; Fiss, 2011), the QCA method may explore multiple relationships between combinations of condition variables.

Compared with the general regression method, the QCA method is more helpful in identifying the multiple concurrency causes of the results. The configuration theory and

model (three interactions) have higher explanatory power than the contingency theory and model (binomial interaction), which has already formed consensus in the academic community (Dess *et al.*, 1997). Traditional contingency methods only analyze the relationship between a certain independent variable and a dependent variable. The QCA method with the configuration perspective can handle the multi-dimensional and multi-causal conditions of interdependence, configuration equivalency, causal asymmetry and other causal complexity issues (Fiss, 2007). Differences between using the general regression method and the QCA method to study “the source of negative externalities in the sharing economy” can be more intuitively represented by Figures 1 and 2, respectively.

From Figures 1 and 2, we can see that the general regression analysis focuses on the marginal net effect of the independent variable on the dependent variable; therefore, the complex causal relationship between independent variables cannot be explained. The QCA method adopts a configuration perspective and reflects how the condition variables (corresponding to the independent variables) cause the result variables (dependent variables) to occur in different combinations.

The calculation principle of QCA is based on Boolean algebra. A variable of 1 indicates that a certain condition occurs, and 0 indicates that a certain condition does not occur. A value of 0 is represented by “~”. The logical operator “*” means “and,” and “+” means “or.” The symbols “=” or “→” mean “cause.” For example: “A*B + C*~D → Y” indicates that conditions where A and B coexist, or C occurs and D does not occur, may cause Y to occur.

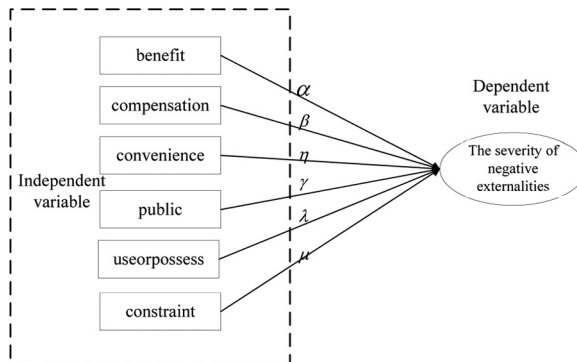


Figure 1.
Schematic diagram of the general regression method

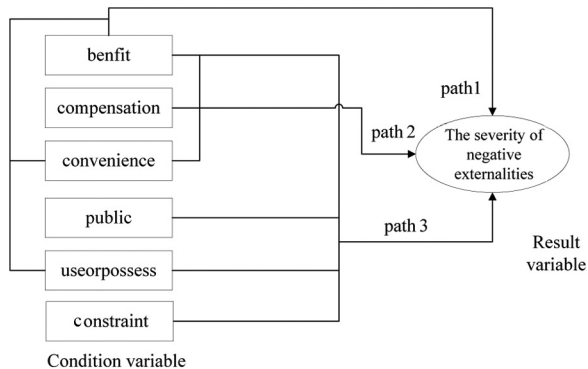


Figure 2.
Schematic diagram of QCA[1]

Measuring the reliability of QCA results can be performed through two indicators: coverage and consistency, calculated as follows:

$$\text{Coverage}(X_i \leq Y_i) = \sum (\min(X_i, Y_i)) / \sum Y_i \quad (1)$$

$$\text{Consistency}(X_i \leq Y_i) = \sum (\min(X_i, Y_i)) / \sum X_i \quad (2)$$

In the formula, X_i represents a set of certain condition variable combinations, and Y_i represents a case result set. The coverage rate examines the extent to which X_i can form the necessary conditions for Y_i ; consistency examines how much X_i can deduce the outcome of the Y_i set.

4.1.3 General steps for qualitative comparative analysis. QCA begins with the selection of cases based on research questions. This is a process of constant interaction between theory and experience. As QCA analyzes conditional combinations rather than cases, conditional variables need to be determined according to various strategies and corresponding theories. The purpose is to derive the data combination of condition and result variables then build a truth table to reflect all combinations of condition variables and result variables. In this process, contradictory conditional combinations may be encountered, requiring calibration. Finally, the truth tables are simplified according to Boolean algebra to obtain various combinations of conditions that lead to the occurrence of result variables.

4.2 Case selection

Case selection is the basis for OCA. As the sharing economy is a new kind of economic model, internet news reports can fully reflect its characteristics, and research results may be in touch with reality. This article searched keyword “sharing economy” to extract typical negative cases of the sharing economy that have occurred in the past two years. To ensure research quality, cases were screened in two rounds. In the first round, cases that met the following conditions were selected: cases listed on mainstream media and cases described in detail to ensure that relevant information could be obtained. In the first round, 39 cases were selected. In the second round of screening, cases with the same event attributes were removed. For example, only one case of privatization of shared bicycles was retained. Finally, 15 cases were coded (refer [Table I](#) for details).

4.3 Truth table construction

The construction of a truth table is a key step in QCA. Based on the analysis framework proposed in the previous section, this article focuses on the condition variables that result from negative externalities in the shared economy. This includes the loss of gains, expected compensation, convenience of defeat and degree of public goods. There are six aspects to the degree of separation of property rights and the restraint mechanism of failure. The outcome variable chosen is the severity of negative externalities. Based on the aforementioned variables, a truth table was formed. The specific assignment method is as follows.

4.3.1 The severity of negative externalities (R1). The severity of negative externalities was the outcome variable, using a three-value assignment scheme with 0 as the lowest severity, 0.5 moderately severe and 1 the highest. Assignment rules were based on the actual damage caused in the case. Inflicting harm to others, causing serious loss of property or spirituality to others, or repeatedly behaving in a highly unpromising manner resulting in strong social adverse effects, etc., were assigned a value of 1. The variable was set to 0 for scenarios that did not directly harm others. The remaining cases were assigned 0.5. For

Case no.	Case title	Source website
1	Exposure to a student of Shanghai Theater Academy who destroyed my entire home with Airbnb	Sohu Tourism
2	Master stole bike and sprayed the bike into black	Sina Shanghai
3	The two guys throw the ofo sharing bike into the river and broadcast it	NetEase Digital
4	Because the sharing of bicycles affected the business, the electric tricycle driver burned the bicycle and was detained	Sina News Center
5	Needles appear on shared bicycle seats!	Beijing Time
6	Nanning: villages in the city where the bicycles are trapped in and changed to children's toys	Guangxi news site
7	Sharing bicycles near Beijing East Station piled up into hills	Beijing Youth Daily (electronic version)
8	A woman was called to the crematorium by Didi's driver, every day for half a month	Sohu.com
9	Traffic control big data disclosure about online car rental's security short board, Didi mode is a safety "dead end"	Sohu.com
10	Didi's driver harassed female clients and have been detained by the Public Security Bureau	Oriental headlines ce.cn
11	Driver of Didi arrives late and causes passengers to miss flights. Who will pay ¥2,400?	Tencent
12	Didi driver fascinated into a female passenger and claimed to use an Apple 6S to change her boyfriend to him	Tencent
13	Didi booking design scam, and old driver was also cheated ¥680	NetEase Finance
14	Shared bicycle was posted "Stolen Money QR Code" 360 exposure three scan code scam	Sina Finance
15	Retirement of the shared bicycle deposit was plunged and many people have been deceived! The cheated people have done this . . .	Tencent Weibo

Table I.
Case table

example, Case 9 mentioned "Didi's driver escaping after hitting someone" causing harm to the life of others and was assigned the value of 1. Case 7: sharing bicycles near Beijing East Station piled up into hills, a group of irregular behaviors, was assign 0. It is noteworthy that the severity of negative externalities in some cases did not have a distinct degree of differentiation, so the authors discussed in detail during the assignment process until a consensus was reached. Subsequent variables that involved segmented assignments follow the same approach.

4.3.2 Immoral behavioral benefits (Benefit – C1). Immoral behavioral benefits are an important part of the traditional analysis perspective of cost–benefit analysis. The assignment is more complicated because some benefits are material gains, while some are psychological satisfaction. To better characterize these differences, a four-value valuation scheme was used for the return factor, which was assigned to 0, 0.33, 0.67 and 1 based on low or high returns. The assignment rules were divided according to the physical or psychological gains of the immoral subject, for example, the behavior of obtaining economic benefits directly by replacing the shared bicycle's QR code was assigned a value of 1 (Case 15).

4.3.3 Expected compensation (Compensation – C2). Immoral behavioral benefit and expected compensation serve as important components of traditional analytical perspectives. Expected compensation mainly reflects the cost aspect. According to the expected level of compensation, values were assigned 0, 0.5 or 1, from low to high. The assignment rules referred to the value of damage to physical objects and the behavioral characteristics of the participants. For example, Didi's driver made a collision and escaped the scene (Case 9); "escape" was used to determine that the driver's expected

compensation for the event was high, so the value was assigned 1. In Case 8, a woman was called to the crematorium by the drip driver every day for half a month only because of bad feedback to the driver. The behavior in this case exhibits a continuous process, indicating that the participant's expected compensation for the matter was extremely low, so the value was set to 0. Other cases, such as the destruction of shared bicycles or housing, were set to 0.5.

4.3.4 Convenience of immoral behavior (Convenience – C3). The foregoing reveals that the sources of negative externalities are largely related to behavior. Therefore, the convenience of immoral behavior reflects the possibility of negative externalities. According to the degree of convenience, values of 0, 0.5 and 1 were assigned, from low to high. For example, parking shared bicycles randomly as a habit is highly convenient, and the assigned value was 1; it is less convenient to throw a shared bicycle into the river or burn a shared bicycle, so the assigned value was 0.

4.3.5 Nature of public goods (Public – C4). Characteristics of public goods are a prominent aspect of products and services in the sharing economy. Public goods refer to goods and services provided by the public sector to meet the public needs of society. Public goods have the characteristics of indivisibility, non-competitiveness and non-excludability. Obviously, these characteristics in sharing bicycles is significantly higher than cars, such as rental services represented by Didi, and homes, such as rental services represented by Airbnb. Therefore, cases involving a shared bicycle were assigned a value of 1, and the remaining cases were assigned a value 0.

4.3.6 Separation of property rights (Use or possess – C5). The separation of property rights is an important feature of the sharing economy. The method used to measure the separation of property rights in this paper was whether in each case the participating entity had the right to use the product or service. In cases when there was only the right to use, we believe that the degree of separation of property rights is relatively high. Cases with this condition were assigned to a value of 1 and the rest of the cases 0.

4.3.7 Constraint mechanism (Constrainsm – C6). To restrict the negative externalities that arise from sharing of products or services and reduce the unnecessary costs to enterprises or society, entities in the sharing economy have established a certain constraint

Case no.	C1	C2	C3	C4	C5	C6	R1
1	0.33	0.5	1	0	1	0	0.5
2	0.67	0.5	0	1	1	1	0.5
3	0.67	0.5	0	1	0	1	1
4	0.67	0.5	0	1	0	1	1
5	0	0	0.5	1	0	1	1
6	0.67	0	0	1	1	1	0.5
7	0.33	0	1	1	1	1	0
8	0.33	0	0.5	0	0	0	1
9	0	1	1	0	1	0	1
10	0.67	0	0.5	0	0	0	0.5
11	0	0.5	1	0	1	0	0.5
12	0.33	0	1	0	0	0	0.5
13	1	0	0.5	0	0	0	1
14	1	0	0	1	1	1	1
15	1	0	0	1	1	1	1

Table II.
Truth table

mechanism. The two most common mechanisms are the deposit mode and the evaluation mode. This article sets the deposit mode to 1 and the comment mode to 0.

From this, we obtained the truth table for this article, shown in [Table II](#).

5. Result analysis

5.1 Single factor discussion

First, we examined the relationship between single conditional variables and negative externalities. The results are shown in [Table III](#). None of the six conditional variables satisfied the conditions shown in [equation \(1\)](#) from the point of view of consistency. From the perspective of coverage, only the variable of expected compensation met the conditions of [equation \(2\)](#). Therefore, a single conditional variable cannot explain the formation of negative externalities in the sharing economy. The results in [Table III](#) also indirectly illustrate the necessity of QCA.

5.2 Traditional perspective discussion

Of the six conditional variables selected in this paper, the traditional perspective of cost-benefit analysis identified three which form negative externalities – immoral behavioral benefits, expected costs and convenience of immoral behavior. The purpose of the traditional QCA method is to identify the role of sharing economic characteristics in the negative externalities. Using fs/QCA2.0 software, case codes with continuity of less than 0.8 were deleted, and standard analysis was selected. The output results are shown in [Table IV](#).

In [Table IV](#), coverage (or raw coverage) represents the effect of each factor in each condition combination on the results and is generally not analyzed. The value of unique coverage indicates which combinations are more able to achieve the result, and consistency reflects the number of cases that the condition combination can explain. On the whole, the consistency was higher, exceeding 0.97, which meets the requirements. The overall coverage was low, which may be constrained by the sample size.

[Table IV](#) shows two paths of negative externality formation in the sharing economy from the traditional perspective:

Table III.
Single factor analysis results

Conditional variable	Consistency	Coverage
Benefit	0.620909	0.890482
Compensation	0.318182	1.000000
Convenience	0.409091	0.642857
Public	0.545455	0.750000
Use or possess	0.454545	0.625000
Constraint	0.545455	0.750000

Table IV.
Negative externalities of the sharing economy from the traditional perspective

Solution	Combination of conditions	Raw coverage	Unique coverage	Consistency
Intermediate solution	benefit*~compensation*~convenience	0.484545	0.484545	0.969091
(Complex solution)	~benefit*compensation*convenience	0.181818	0.181818	1.000000
Solution coverage		0.666364		
Solution consistency		0.977333		

- (1) *Traditional Path 1*: Source of negative externalities in the sharing economy = (high immoral behavioral benefits) * (low expected compensation) * (inconvenience of immoral behavior); and
- (2) *Traditional Path 2*: Source of negative externalities in the sharing economy = (low immoral behavioral benefits) * (high expected compensation) * (convenience of immoral behavior).

The two aforementioned paths are in line with experience. That is to say, when immoral behavior has high benefits and low cost, negative externalities will still be generated, even with lack of convenience. On the other hand, if it is convenient to exercise the immoral behavior, then even if the gap between the benefits and costs is not particularly large, negative externalities are also likely to arise. From the size of the raw coverage, it can be seen that the Traditional Path 1 is more likely to occur. However, the aforementioned results do not portray the characteristics of the sharing economy. The question of whether a special model such as the sharing economy has exacerbated negative externalities cannot be explained well. Therefore, the path to negative externalities in the sharing economy should be studied further.

5.3 Comprehensive discussion

In the same way, the aforementioned six conditional variables were put into the same analysis framework. The output is shown in Table V.

The solution consistency in Table V is greater than 0.9, falling within the acceptable range. Table V gives three paths to negative externalities in the sharing economy:

- (1) *Path 1*: Source of negative externalities in the sharing economy = (low immoral behavioral benefits) * (low expected compensation) * (convenience of immoral behavior) * (low level of public goods) * (low level of separation of property rights) * (evaluation constraints);
- (2) *Path 2*: Source of negative externalities in the sharing economy = (low immoral behavioral benefits) * (high expected compensation) * (convenience of immoral behavior) * (low level of public goods) * (high level of separation of property rights) * (evaluation constraints); and
- (3) *Path 3*: (high immoral behavioral benefits) * (low expected compensation) * (inconvenience of immoral behavior) * (high level of public goods) * (high level of separation of property rights) * (deposit constraints).

Of the aforementioned three paths, Paths 2 and 3 complement the traditional path under the sharing economy environment. Among them, Path 2 shows that when there is high convenience in immoral behavior, higher degrees of separation of property rights and impacts of evaluation constraints and lower levels of public goods will reduce negative externalities. On the other hand, Path 3 reveals another economic model that promotes negative externalities: high level of public nature of goods, high level of separation of property rights and the deposit constraint mechanism, similar to shared bicycles.

In addition, Paths 1 and 3 illustrate that the negative externality of the sharing economy is related to specific business models. Specifically, Path 1 illustrates that negative externalities in the sharing economy can result from the following circumstances: a low level of public goods, property rights that are not completely separated and the evaluation constraint mechanism. These characteristics are in line with the characteristics of online car rentals and other short-term rental services. In this kind of environment, the levels of

Table V.
Formation path of
negative externalities
in the sharing
economy

Solutions	Combination of conditions	Raw coverage	Unique coverage	Consistency
Intermediate solution (Complex solution)	\sim benefit * \sim compensation * convenience * \sim public * \sim useorpossess * \sim constraint \sim benefit * compensation * convenience * \sim public * useorpossess * \sim constraint benefit * \sim compensation * \sim convenience * public * useorpossess * constraint	0.120909 0.181818 0.272727 0.575455 0.949025	0.120909 0.181818 0.272727	0.886667 1.000000 0.946372
Solution coverage				
Solution consistency				

benefits and costs of immoral behaviors have the same effect on negative externalities. The lower the two, the more likely negative externalities will arise. In this environment, the Traditional Path 1 is more likely to form negative externalities. Comparing Path 1 and Path 3 can further determine that increases in the degree of sharing of products or services (high level of public goods and high level of separation of property rights) and more stringent constraint models (deposit constraint) contribute to negative externalities in the sharing economy. This actually forms a kind of paradox. From an empirical point of view, the higher the degree of sharing, the more stringent the constraint mechanisms are generally required to be. However, research in this paper shows that it is precisely this kind of strict constraint mechanism that causes higher degrees of sharing to form negative externality.

6. Recommendations

The aforementioned conclusions indicate that the common business models in the current sharing economy cannot spontaneously avoid negative externalities but instead have the potential to promote negative externalities. Therefore, the corresponding governance model is needed to ensure a sound development of the sharing economy. This paper proposes the following recommendations.

First, highlight the platform corporate responsibility. The sharing economy makes economic activities not only show the characteristics of happening at any time and everywhere. Moreover, the patterns, groups and fields in which they occur are also expanding. In this case, it is impossible to achieve effective governance of the sharing economy through a top-down perfect system. Therefore, it is necessary for the platform enterprises to assume certain social responsibilities and supervise the main participants of the sharing economy. The key is to determine the degree of shared services by the platform enterprises to adapt to the corresponding constraint mechanism.

Second, establish a multi-subject governance framework. The sharing economy is a platform for sharing, co-constructing and co-governing in which the whole society participates. Therefore, in addition to the government and enterprises, there should also be public participation. Therefore, it is necessary to establish a multi-governance system including the government, enterprises and public. The multi-governance system needs to clarify the governance boundaries, scientific division of labor and efficient cooperation among the various entities. Guiding the public to participate in governance actively, making it not only a participant in the sharing economy but also a manager of the sharing economy.

Finally, build a multi-level safeguard and constraint mechanism. This part includes two aspects, one is to establish and improve industry norms and laws; the other is to use new technologies such as big data and cloud computing to incorporate individual behavior into the personal credit system and form a new constraint mechanism.

7. Conclusion

The rapid development of the sharing economy has improved the efficiency of resource utilization, contributing to the quality of economic development. However, various undeniable problems have arisen in the operation and development of the sharing economy at home and abroad, with very prominent negative externalities brought by its disorderly development.

Therefore, this article analyzed the source of negative externalities in the sharing economy. Through the QCA method, three sources of negative externalities were obtained. We believe that sharing of products or services and restraint mechanisms work together to create conditions for negative externalities in the sharing economy. Results found that sharing economy modes with less sharing and more relaxed constraint mechanisms, such as online vehicles and network short-term rentals or modes with higher sharing nature and

stricter restraint mechanisms, such as shared bikes, both promoted negative externality. Finally, corresponding policy recommendations are proposed for this issue. This paper started with practical problems and proposed how various factors interact and ultimately contribute to the formation of negative externalities in the sharing economy. The conclusion of this paper provides a new path for the healthy development of the sharing economy and avoids its adverse effects. It also provides a theoretical basis for the government governance of the sharing economy.

Note

1. [Figure 2](#) only shows the result form of the QCA method and does not represent the final results of this study.

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Further reading

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