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<td>比較QCA方法のための探索 conjunctural causation  - 从 Type I 和 Type II 错误的视角 -</td>
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<tr>
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Comparing QCA Methods for Exploring Conjunctural Causation
- From the Perspective of Type I and Type II Errors -

Taisuke Fujita

Abstract

The existing literature in the field of social sciences does not analyze conjunctural effects adequately because of the limitations in comparative methods. For example, statistical analyses, such as regression analysis, tend to commit type II error in examining conjunctural effects and overlook true conjunctural effects. Qualitative Comparative Analysis QCA has come to be employed in many studies as a method for exploring conjunctural causations, especially against non-large N cases. QCA, especially the classical form crisp-set QCA csQCA, however, has been criticized for reasons such as its inability to include control variables and the dichotomization of variables. In other words, it has been criticized for committing type I error in testing conjunctural effects. In order to overcome this criticism, a developed version of QCA fuzzy-set QCA fsQCA was introduced and has been applied in preceding studies. fsQCA allows us to employ nonbinary variables and is considered to be superior to csQCA. The purpose of this paper is to discuss whether fsQCA is better than csQCA for exploring conjunctural causations. From the perspective of type I and type II errors, the present paper claims that fsQCA is not always preferable to csQCA. As an illustrative analysis, the present paper analyzes an empirical research question concerning countries’ frequencies in filing dispute settlements under GATT. 

General Agreement on Tariffs and Trade
WTO World Trade Organization using the two methods. The results also provide an implication on comparative methods beyond QCAs although comparative methods, especially statistical analyses, emphasize the importance of avoiding type II error and using detailed measurement, this may not always be the case.

**Keywords:** Comparative Method, Conjunctural Causation, Qualitative Comparative Analysis QCA, Type I and Type II Errors, Measurement

1. **Introduction**

Social phenomena are often complex in that they involve multiple conjunctural causations. Conjunctural interaction causation indicates that a combination of causally relevant conditions generates the outcome. Multiple conjunctural causations indicate that several different combinations of conditions may produce the same outcome. Statistical methods, such as regression analysis, are not adequate for examining such complex phenomena because they tend to focus on the independent effect of each single cause. This is why single-case studies with thick descriptions have been employed in many seminal studies. Single or a few case studies, however, do not allow us to perform a systematic comparison and generalization of the findings. Therefore, many previous studies that employed regression analyses and the case study method have not been able to analyze multiple conjunctural causations adequately.

Qualitative comparative analysis QCA is a suitable method for exploring such multiple conjunctural causations, and numerous studies in the social sciences, such as political science and sociology, have employed this
method QCAs allow systematic cross-case comparisons, while at the same time giving justice to within-case complexity, particularly in small- and intermediate-N research designs. Rihoux and Ragin 

QCA, especially classic QCA crisp-set QCA csQCA, however, has been criticized for reasons such as its inability to include control variables and the dichotomization of conditions or variables. In order to overcome the latter criticism, a developed version of QCA fuzzy-set QCA fsQCA was introduced by Ragin and has been applied in many studies fsQCA allows us to employ nonbinary variables and is considered to be superior to csQCA.

The purpose of this paper is to discuss whether fsQCA is better than csQCA for exploring conjunctural causations. And, from the perspective of type I and type II errors employed in statistical inferences, the present paper claims that fsQCA is not always preferable to csQCA, as the former tend to commit type II errors.

In order to illustrate this, the paper uses both methods - csQCA and fsQCA - to analyze an empirical research question in terms of the conjunctural effects of multiple causes what explains the worldwide differences in the frequencies with which developed and democratic countries resort to Dispute Settlement DS under the General Agreement on Tariffs and Trade GATT or the World Trade Organization WTO.

This paper proceeds as follows. The second section briefly explains QCAs csQCA and fsQCA, and the third section discusses their strong and weak points, especially from the perspective of type I and type II errors. In the fourth section, I perform empirical analyses on countries’ GATT WTO

1 See Ishida and Rihoux et al., for instance.
2 Even in literature pertaining to international relations, where fewer studies have used QCAs compared to other fields in political science, studies such as Koenig-Archibugi have used fsQCA.
filings by csQCA and fsQCA, in order to illustrate the points in the previous section. In the fifth section, I discuss the illustrative analysis results by QCAs. In the concluding section, I touch upon this paper’s implications.

2. What is QCA

The most important merit of employing the QCA is its ability to explore conjunctural effects ✑interaction effects ❐. Of course, statistical methods, such as regression analysis with interaction terms, also allow us to test conjunctural causations. Such methods, however, suffer from at least two limitations. First, statistical methods require a large number of samples, which are often not available for social phenomena. Second, interaction terms in regression analyses are often accompanied by the multicollinearity problem ❐Ragin .Foundation.Fujita .Foundation. Thus, statistical methods such as regression analysis pose problems in analyzing conjunctural causation. In other words, regression analysis is likely to commit the type II error in inferring conjunctural effects ✑it is likely to overlook TRUE conjunctural effects ❐

QCAs are comparative methods that provide the benefit of exploring multiple conjunctural causations. In order to perform a systematic comparative analysis of complex cases, cases are transformed into configurations in QCAs. Here, □configuration □indicates a specific combination of causal conditions or variables. If one considers □conditions, there are □□ □□ □□ = □□ configurations. QCAs employing Boolean algebra and set logic examine which configurations lead to a given outcome of interest or which configurations are necessary or sufficient conditions to the outcome □. By using

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3 The central focus of QCAs is not on the variable but on the configuration or the case. In this sense, QCA is a case-oriented method, while statistical analysis ✑such as regression analysis ✑is a variable-oriented one ❐Ragin .Foundation.
Boolean algebra and its minimization, QCAs achieve generalization, par-simonious expression, and replicability.

However, the first generation of QCAs, csQCA, which employs dichoto-mous measurement, has received criticism. First, csQCA demands that analysts dichotomize variables’ values. Converting continuous variables to a binary version is criticized for the ensuing information loss, which leads to easy admittance of conjunctural associations. Second, it is difficult to include many control variables in csQCA. Because csQCA examines the association between all logically possible combinations of causal conditions and outcomes, increasing the number of conditions makes it hard to interpret the analytical results. This leads to the omitted variables problem and, once again, the issue of admitting conjunctural associations too easily. In short, csQCA is criticized for committing type I error in inferring conjunctural effects, that is, catching FALSE conjunctural effects.

fsQCA, developed by Ragin, has been thought to overcome the above problem, especially the dichotomization problem. fsQCA uses the fuzzy-set membership score rather than the binary score. The fuzzy set can take values in the interval between 0 and 1, rather than 0 or 1 as in the crisp set. Measurement called calibration is done by specifying at least qualitative breakpoints for membership, full nonmembership, and the crossover point. Employing fuzzy-set membership nonbina-

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4 For a review of critiques on QCA, see Rihoux and Ragin. In this paper, causal conditions and independent variables are used as interchangeable concepts.

5 The second criticism, however, is not necessarily problematic. As Achen argued, including many variables is not good research design, and we should limit cases so that we do not need many control variables.

6 It follows that csQCA has only one breakpoint, that is, the crossover point, because it dichotomizes conditions.
ry scores enables us to use formal criteria, such as the consistency rate for confirming the validity of analyses. The consistency rate measures the extent to which a certain condition is consistently relevant for the outcome at hand. By employing the nonbinary measurement and formal criteria, fsQCA is thought to overcome the problem of type I error in inferring conjunctural effects. Does calibration by the fuzzy set and formal criteria enable fsQCA to yield more exact and reliable results than csQCA? I consider this point in the next section.

3. Is fsQCA superior to csQCA?

Ragin claimed the superiority of fsQCA over csQCA as follows. Assume that the score on the causal condition is by fuzzy-set membership score. In a crisp-set analysis, both scores would be recoded via dichotomization and thus be considered consistent with a subset relation however, this is not true from a fuzzy-set perspective. Is it problematic to consider the above case as being consistent, as Ragin claims? We can answer in the affirmative only if we calibrate both the conditions and the outcome properly.

Measurement or specifying breakpoints is more important in QCAs than in regression analyses. This is because the measurement in both csQCA and fsQCA involves assumptions about the forms of causal relationships. Since QCAs do not have the ability to estimate or adjust causal function like regression analysis, specifying breakpoints in QCAs directly determines forms of causal relationships. Thus, specifying break-

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7 However, all the blame should not be apportioned to QCA’s inability to estimate or adjust causal function. In quite a few statistical analyses, the ability to estimate or adjust causal function has been used without checking whether the assumption of the statistical model on causal relationship is valid to the phenomena under investigation.
points adequately is extremely important for QCA.

Then, how can we know the location of the proper breakpoints? Many QCA studies emphasize substantive or theoretical knowledge for this purpose. Substantive and theoretical knowledge must be very important and reliable for specifying breakpoints if what we should consider is only the nature of the conditions or the outcomes themselves. Specifying breakpoints is, however, directly linked to assuming the form of causal function in QCAs, as described above. Specifying breakpoints properly requires us to know not only the nature of the conditions or the outcomes themselves, but also the form of the causal relation between the configurations and outcomes. Regarding the forms of the causal relations, substantive or theoretical knowledge does not appear to be so reliable. How can we know the forms of causal relations of so many configurations in QCAs?

Using tight calibration can possibly introduce some risk in this matter. fsQCA requires tighter calibration than csQCA, because the former uses more detailed nonbinary measurement or breakpoints. The crisp-set analysis requires breakpoints for the crossover point only. The fuzzy-set analysis forces us to set breakpoints not only for the crossover point but, at least, also for the full membership and the full nonmembership. Moreover, in fsQCA, assessment of each row configuration uses fuzzy scores for all cases under analysis, not just those cases with greater than membership in that row as in csQCA. The evidentiary bases for consistency assessments are much broader in fuzzy-set analyses than in crisp and multi-value analyses. Thus, tight calibration by fuzzy-set analysis may make the consistency rate lower than that in crisp-set analysis, indicating less likelihood of admitting causal effects. Such tight calibration is beneficial only if

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8 Recall that we have configurations with only causal conditions.
the measurement is reliable. Since measurement in QCA is more difficult than that in regression, due to the abovementioned distinctive feature of QCA, tight calibration required in fsQCA thus possibly leads to type II error. Therefore, using fsQCA may worsen the matter.

QCA is considered to be important for its potential to catch the emergent property of configurations in the first place. This potential results from its ability to avoid type II error. csQCA can be considered to employ loose measurement in order to avoid type II error. If we cannot be certain about the reliability of measurement, it is plausible to choose crisp-set analysis complementarily to avoid type II error.

4. Illustrative Analysis

In order to illustrate the above argument regarding the difference between csQCA and fsQCA, the present paper performs an illustrative analysis on the following question: What explains the difference in the frequency with which developed and democratic countries resort to the DS mechanism in GATT-WTO filing? This research question is optimal for the present purpose, because it has been already analyzed by both csQCA and regression analysis. A comparison of their results in-

9 In the context of GATT-WTO filing, the DS institution is a quasi-judicial institution. A country resorts to DS when it finds a trade counterpart violating the international liberalization agreement of the GATT-WTO in such a way as to harm that country’s trade. A country files a dispute under GATT-WTO in order to demand that its trade counterparts open their domestic markets with regard to a certain industry. Thus, the differences among countries in the frequency of their being a plaintiff lead to the differences in the benefits received by the countries from the institution. Despite the benefits derived from the use of DS, there are considerable differences in the instances and frequency of DS usage among developed and democratic countries.

Therefore, hereafter, the present paper omits the details of the analyses using csQCA.
dicates that the analysis by csQCA does not commit type I error. First, regression analysis cannot analyze conjunctural effects adequately in the research question owing to problems such as multicollinearity and committing type II error. Second, the case study shows that there is conjunctural causation, at least in the case at hand, indicating that the analysis result by csQCA is not due to type I error.

**Hypothoses**

Three causal conditions are considered to influence the frequency of GATT-WTO filing—electoral system, government party system, and competitiveness of the agricultural sector. Let me explain them in order.

The first condition concerns the electoral institution or the electoral district magnitude. Because it decides the area from which Members of Parliament (MPs) gather votes for their re-election, it affects the incentives of MPs who decide the policy on GATT-WTO filing. Since small districts make small constituencies for gathering votes, interest groups supporting the use of DS, such as export industries, have fewer rivals to compete with in influencing the MPs. Thus, small districts tend to empower the groups that support the use of DS. Therefore, countries with small electoral districts can be expected to file DSs under GATT-WTO frequently, while those with large districts do not.


□□ This argument follows the logic adopted by Rogowski in explaining the link between electoral institutions and trade policies. See also Nielson 2004.
Hypothesis Countries with small constituencies frequently file DSs under GATT/WTO, while those with large constituencies do not.

Second, the number of veto players is an important condition. Veto players are entities without whose agreement a policy can neither be adopted nor changed. Hence, policy-making becomes increasingly difficult with an increase in the number of veto players. For instance, O’Reilly showed that the fewer the veto players for a country, the more frequently it is likely to change the liberalness of its trade policy. It follows that a country with many veto players will find it more difficult to file DSs under GATT/WTO.

The present paper counts the number of veto players as the number of government parties. Because trade policies regarding the use of DS do not require making laws, government parties enjoy some amount of autonomy in deciding these policies without negotiating with the opposition parties. Therefore, in the present analysis, I consider the number of government parties in the Lower House as the number of veto players. A small number of government parties indicates few veto players.

Hypothesis Countries with few government parties frequently file DSs under GATT/WTO, while those with many government parties do not.

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Immergut and Tsebelis are regarded as pioneering works on the veto player theory.

The veto player theory explains the cross-country variation in various policies such as trade policy, budget deficit, and law making.

For instance, Minnich also counted veto points based on the number of government parties.
The third condition concerns the international competitiveness of a country’s agricultural sector. Here \( \text{competitiveness} \) indicates a sector’s economic productivity. Countries with strong competitiveness in the agricultural sector tend to be agricultural exporters, and those with weak competitiveness, agricultural importers. Generally speaking, the agricultural sector is politically influential, as the recent negotiation at the WTO and the Trans-Pacific Partnership (TPP) have shown.

Thus, the international competitiveness of a country’s agricultural sector is a key determinant of its frequency of filing DSs. A country with a competitive agricultural sector is more likely to challenge its counterpart’s trade barriers against it, since it will face greater pressure from its domestic sector to file a DS under GATT \( \text{\&} \) WTO against the counterpart. It follows that a country with a highly competitive agricultural sector frequently files DSs under GATT \( \text{\&} \) WTO.

Hypothesis: Countries with a competitive agricultural sector tend to frequently file DSs under GATT \( \text{\&} \) WTO, while those with an uncompetitive agricultural sector do not.

Exploring the abovementioned hypotheses requires us to consider the possibility of conjunctural effects among the conditions. While the institutional conditions, constituency size, and number of government parties can be regarded as supply-side conditions for filing a DS under GATT \( \text{\&} \) WTO, the agricultural condition can be regarded as a demand-side one. The institutional conditions merely affect the range of choices from which the actors can choose but do not determine the actors’ preference. The presence of a small constituency empowers the groups supporting the use of DSs and in-
creases their influence, but it does not determine the existence of these groups. For instance, small constituencies may, in fact, favor groups opposing but not supporting the use of DSs in countries where a politically powerful agricultural sector is economically uncompetitive in the international market.

*Analyses by QCAs*

I analyze data of countries and time periods. The unit of analysis, then, is country-period of time. The criteria for selecting countries are that they are democracies and developed economies. A country is coded as a democracy if it is rated or more in POLITY IV while a country is considered a developed country if it is a member of the Organization for Economic Co-operation and Development (OECD).

*Operationalization and Measurement: Outcome*

First, outcome Filing frequency is measured as follows.

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*See Marshall and Jaggers*  
Note that all of the countries have not been analyzed for both time periods. For instance, countries that became democracies or OECD members between were analyzed only for the period after the event. Countries and period of time analyzed include Australia, Austria, Canada, Czech Republic, Finland, Hungary, Japan, Korea, Mexico, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, and the US. In all, cases were analyzed.
Number of complaints filed by a country Number of complaints worldwide
Export volume of the country Total export volume worldwide

In crisp-set analysis, if the value is greater than the median of all the cases, then that country is considered a frequent user of the DS mechanism $C = \text{median}$. 

Crisp-set Measurement for Outcome
If outcome $> \text{median}$, then $C = \text{Many complaints}$
If outcome $\leq \text{median}$, then $C = \text{Few complaints}$

Figure 1 Frequency of DS Use (1980-1994)

Figure 1 illustrates countries’ frequencies of filing DSs under GATT WTO from 1980-1994. By dividing this time period into periods, we can see that the pattern of frequency is stable over time. Moreover, since no

The data were sourced from Reinhardt and the WTO webpage http://www.wto.org/english/tratop/dispu/dispu.htm
The data regarding export volumes were sourced from the WTO webpage http://www.wto.org/english/res/stats/htm
country transcends the median line over time and there is a clear differentiation between frequent and infrequent users of the DS mechanism, the phenomenon can be measured appropriately using binary measurements.

As Figure shows, while almost all the frequent users of the DS mechanism have filed a DS thrice at most, many of the infrequent users have actually never filed a DS. Therefore, the measurement for frequent filing in the fuzzy set is as follows:

**Fuzzy-set Measurement for Outcome**

- Threshold for full membership =  Many filings
- Crossover point =
- Threshold for full nonmembership =  Few filings

**Operationalization and Measurement: Electoral District Magnitude**

The size of the electoral district $D$ is measured based on the mean constituency size of the Lower House.

Hence, in the crisp set, $D = $ if the value is less than 1, indicating that the electoral districts of the country are small, and $D = $ if the value is 1 or more. The value 1 has been adopted as a cut-off point for dichotomizing the causal condition, since the size of the constituency is theoretically important for classifying electoral systems into the two major types—the single-member district system (SMD) or the proportional representative system (PR).

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*The data were sourced from Beck et al.*

*The causal condition pertaining to the Japanese and Korean cases, however, is not coded using the above rule. The mean district size of Korea is much higher than 1. However, the Korean electoral system is a mixture of SMD and PR, and most of the MPs are elected through SMD rather than PR. A similar pattern exists in Japan. Hence, both Japan and Korea have been classified as small-constituency countries.*
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Crisp-set Measurement for Electoral Districts

If average magnitude < ø, then D = ø Small district
If average magnitude ≥ ø, then D = ø Large district

While district magnitude cannot be smaller than ø, the district size of many large districts in countries is around ø. Further, whether district size is larger than ø is theoretically important. Therefore, in the fuzzy set, the measurement for district size is as follows:

Fuzzy-set Measurement for Electoral District

Threshold for full membership = ø Small district
Crossover point = ø
Threshold for full nonmembership = ø Large district

Operationalization and Measurement: Number of Government Parties

The number of government parties P in the Lower House has been counted in the present analysis as the number of veto players. A small number of government parties indicates few veto players.

In crisp-set analysis, the causal condition P is dichotomized on the basis of whether the government is a coalition:

Crisp-set Measurement for Government Parties

If the number of government parties < ø, then P = ø Few
If the number of government parties ≥ ø, then P = ø Many

While the number of government parties cannot be smaller than ø, the number of countries with many government parties is around ø. Moreover,
whether the number is larger than \( \bar{3} \) is theoretically important. Therefore, in the fuzzy-set analysis, the number of government parties is measured as follows:

**Fuzzy-set Measurement for Government Parties**

- Threshold for full membership: \( \bar{3} \text{ Few} \)
- Crossover point: \( \bar{3} \text{ Many} \)
- Threshold for full nonmembership: \( \bar{3} \text{ Many} \)

**Operationalization and Measurement: Agricultural Competitiveness**

The last causal condition is the competitiveness of the agricultural sector \( \bar{3} \text{ A} \), which is measured using the value of \( \bar{3} \% \text{PSE} \). The term \( \bar{3} \% \text{ PSE} \) calculates what proportion of the gross revenue of the agricultural sector is accrued due to governmental policies such as subsidies and tariffs. If a country has a high \( \% \text{PSE} \) value, it means that the agricultural sector of the country is largely dependent on the protective policies implemented by its government. It follows that the lower this value for a country, the more competitive its agricultural sector.

In crisp-set analysis, the causal condition \( \bar{3} \text{ A} \) is dichotomized based on whether the value exceeds the median value of the OECD for the same period of time. The value of \( \bar{3} \text{ A} \) assigned to each unit \( \bar{3} \text{ E} \) is based on the mean value of that country \( \bar{3} \text{ E} \) during that period of time \( \bar{3} \text{ E} \).

**Crisp-set Measurement for Agricultural Competitiveness**

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*The data regarding \( \% \text{PSE} \) were obtained from OECD.*
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   – From the Perspective of Type I and Type II Errors –

If \( \%PSE < \text{OECD average} \), then \( A = \text{Competitive} \)

If \( \%PSE \geq \text{OECD average} \), then \( A = \text{Uncompetitive} \)

For the fuzzy-set measurement of agricultural competitiveness, the \( \%PSE \) values of the countries are calibrated across four levels: the most competitive, competitive, uncompetitive, and the least competitive. Following Ragin, I employ the measurement for each level as follows:

Fuzzy-set Measurement for Agricultural Competitiveness

- Full membership = Competitive agriculture
- More in than out
- More out than in
- Full nonmembership = Uncompetitive

Results

Because the purpose of the analysis is to illustrate the abovementioned discussion on csQCA and fsQCA, I present the result of the analyses only on the outcome of MANY filings and not on that of FEW filings.

Table: Truth table by csQCA

<table>
<thead>
<tr>
<th>District Magnitude</th>
<th>Number of Parties</th>
<th>Agricultural Competitiveness</th>
<th>Number of Cases</th>
<th>Many Filings</th>
<th>Few Filings</th>
<th>Frequent Complaints</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{Small} )</td>
<td>( \text{Few} )</td>
<td>( \text{Competitive} )</td>
<td>( \geq )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \text{Small} )</td>
<td>( \text{Few} )</td>
<td>( \text{Uncompetitive} )</td>
<td>( \geq )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \text{Small} )</td>
<td>( \text{Many} )</td>
<td>( \text{Competitive} )</td>
<td>( \geq )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \text{Small} )</td>
<td>( \text{Many} )</td>
<td>( \text{Uncompetitive} )</td>
<td>( \geq )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \text{Large} )</td>
<td>( \text{Few} )</td>
<td>( \text{Competitive} )</td>
<td>( \geq )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \text{Large} )</td>
<td>( \text{Few} )</td>
<td>( \text{Uncompetitive} )</td>
<td>( \geq )</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>( \text{Large} )</td>
<td>( \text{Many} )</td>
<td>( \text{Competitive} )</td>
<td>( \geq )</td>
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<td></td>
</tr>
<tr>
<td>( \text{Large} )</td>
<td>( \text{Many} )</td>
<td>( \text{Uncompetitive} )</td>
<td>( \geq )</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
Table Ⅲ is the truth table by csQCA analysis. It shows the value of each configuration for every causal condition and outcome. The truth table, thus, enables us to identify the configurations causing the outcome of interest.

According to table Ⅲ, the following configurations tend to make countries frequent users of the DS mechanism.

$$\text{DPA} + \text{DPa} + \text{DpA} + \text{dPA} \text{ } \square \text{C}$$

The above formula shows that any of the conditions - DPA, DPa, DpA, or dPA - is required for a country to be a frequent complainant in DS. When all hypotheses of this paper are met by the country in question, that country is a frequent user of the DS mechanism. These results can be interpreted as follows: the outcome whether a country is a frequent user of the DS mechanism cannot be determined based on a single condition; there exist multiple conjunctural causations.

Table Ⅲ Truth table by fsQCA

<table>
<thead>
<tr>
<th>fsdistrict</th>
<th>fsparty</th>
<th>fsagriculture</th>
<th>Number</th>
<th>Consistency</th>
<th>Outcome</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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</tr>
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<td>1</td>
</tr>
</tbody>
</table>

In this formula expressed by Boolean algebra, $\square D \square$ indicates $D = \square$ small district, and $\square d \square D = \square$ large district. Similarly $\square P \square$ indicates $P = \square$ few parties, $\square p \square$ indicates $P = \square$ many parties, $\square A \square$ indicates $A = \square$ competitive, and $\square a \square$ indicates $A = \square$ uncompetitive. Logically, $\square \text{DPA} \square$ indicates $D$ and $P$ and $A$, $\square \text{DPA} + \text{DPa} \square$ indicates DPA or DPa.
As table shows, the following configurations by fsQCA tend to make countries frequent users of the DS mechanism. The results by fsQCA vary considerably, depending on consistency rate cutoff point. As described above, consistency measures the extent to which a certain condition is a consistently relevant condition for the outcome at hand.

<table>
<thead>
<tr>
<th>Consistency cutoff</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.65</td>
<td>D  C</td>
</tr>
<tr>
<td>0.70</td>
<td>DP + DA  C</td>
</tr>
<tr>
<td>0.75</td>
<td>DA  C</td>
</tr>
</tbody>
</table>

If we adopt the most severe consistency cutoff point, 0.75, the configuration causing frequent filing under GATT/WTO is only DA countries with small electoral districts and competitive agricultural sectors. If we adopt a consistency cutoff point of 0.70, the configurations causing frequent filing under GATT/WTO are DA or DP countries with small electoral districts and few government parties. Because configuration with a consistency below 0.65 should not be considered valid, we should interpret that configurations DA + DP causes frequent filing.

It follows that PA small number of government parties and competitive agricultural sector can be considered as the configuration causing frequent filing only for the result by csQCA and not for that by fsQCA consistency rate = 0.75. This is because some cases of dPA in fsQCA fall under the diagonal line, possibly due to the high scores for Party and Agriculture, as table and figure shows. Figure also shows the relationship between the fuzzy-set score of outcome and that of the configuration fsdPA, whose data

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Rihoux and Ragin claimed that one should avoid using a consistency threshold below.
are sourced from table 6. This is understandable because consistency is more sensitive to cases under the diagonal, as they are located in the lower area $\text{Xi} < \text{Yi}$, they have a smaller denominator $\text{Xi}$.

Table 7. Fuzzy-set scores of all the cases for all the conditions, outcomes, and configurations

<table>
<thead>
<tr>
<th>Case id</th>
<th>fsdistrict</th>
<th>fsparty</th>
<th>fsagriculture</th>
<th>fscomplaint</th>
<th>fsdPA</th>
</tr>
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<tbody>
<tr>
<td>Australia</td>
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<td>Australia</td>
<td>Ÿ÷÷õĀý÷õĀø ø÷õĀë÷õ÷û</td>
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<tr>
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<tr>
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</tr>
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</tr>
</tbody>
</table>

Consistency $\text{Xi} < \text{Yi}$
As noted previously, measurement, especially in fsQCA, is very difficult, and the calibration of those conditions may not be adequate. Therefore, I illustratively recalibrate agricultural competitiveness using fuzzy-set analysis.

Fuzzy-set Measurement for Agricultural Competitiveness

- Recalibration
  - Full membership = Ⅰ
  - More in than out = ⅠⅠ
  - More out than in = ⅠⅠ
  - Full nonmembership = Ⅰ

This recalibration causes the consistency rate to rise from ⅠⅠⅠⅠⅠ to ⅠⅠⅠⅠⅠ. The value ⅠⅠⅠⅠⅠ is too low to claim that PA joins the causal configurations for frequent users of the DS mechanism. Still, it is notable that a tentative change in fuzzy-set membership measurement has a large impact on the fsQCA result.
5. Discussion

The analyses results for csQCA and fsQCA differ. While the analysis by csQCA indicates that PA causes frequent filing, that by fsQCA does not. This difference seems to follow the argument made in section ושא, that csQCA tends to commit type I error of catching FALSE conjunctural effects, while fsQCA is apt to commit type II error of overlooking TRUE conjunctural effects ו.

Which QCA commits the error in the empirical research question at hand ו. Is the criticism against csQCA correct, and is fsQCA preferable to csQCA ו. It is probable that fsQCA commits type II error in the present analysis. First, according to previous studies that analyzed the question using csQCA, regression, and case study method ו. Fujita ו. Fujita ו. PA also causes frequent filing under GATT ו. WTO, thus confirming the validity of the csQCA result. Second, the present analysis shows that the results by fsQCA vary depending on the fuzzy-set membership measurement to a large extent. Considering the difficulty of measurement in fsQCA, this second point cannot be overlooked easily ו.

In sum, at least for the empirical question at hand, it seems fsQCA, and not csQCA, commits the error. Thus, we cannot be too careful in using fsQCA, as it may commit type II error of overlooking TRUE conjunctural effects, especially when the phenomenon to be analyzed has little difficulty in dichotomous measurement, like filing DSs under GATT ו. WTO ו.

6. Conclusion

Social phenomena are often complex in that they involve multiple con-
Comparing QCA Methods for Exploring Conjunctural Causation
- From the Perspective of Type I and Type II Errors -

Conjunctural causations. In order to analyze such complex phenomena systematically, QCA was developed and has been employed by many studies. csQCA, however, has been criticized for reasons, such as its dichotomization of conditions. As the developed version of csQCA, fsQCA allows us to employ non-binary variables and thus is considered to be superior to csQCA.

The present paper claimed that fsQCA is not necessarily preferable to csQCA. In order to illustrate this contention, the paper used both csQCA and fsQCA to analyze an empirical research question: What explains the worldwide differences in the frequencies with which developed and democratic countries file DSs under GATT/WTO?

My argument was NOT that crisp-set analysis is superior to fuzzy-set analysis. In principle, csQCA is a subset of fsQCA. However, using fsQCA with only formal criteria in mind leads to unreliable analysis, as the illustrative analysis of this paper showed. We should remember that a strong point of QCA, compared to statistical methods such as regression analysis, is its ability to catch conjunctural effects. The ability to avoid type II error. fsQCA tends to commit type II error, the same error committed by regression analysis, the very reason for which QCAs were developed and employed in the first place. It seems plausible to use the result by csQCA as a reference point when using fsQCA.

This research provides an implication on comparative methods beyond QCAs. Comparative methods, especially statistical ones, have emphasized the following two principles. First, avoiding type II error is crucial. Using the significance level in statistical inference is such an example. Second, the more detailed the measurement, the better. The present paper’s argument, that fsQCA is not always preferable to csQCA, implies that these two principles do not always hold.
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