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Contextual analyses with QCA-methods

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Abstract Contextual analyses are essential in comparative research, as they investigate the importance of contextual conditions for causal relationships. During the last decades, an increasing number of comparative studies have also focused on how contextual conditions affect causal relationships. At the same time, new comparative methods have been developed based on set-theoretical logics. Two of the most prominent methods are csQCA and fsQCA, which are used in comparative studies with increasing frequency. However, the conventional design for contextual analysis is still based on quantitative methods and the use of interaction-factors. This article discusses why the use of interaction-factors is not suitable together with QCA-methods. Instead of the conventional design, the article presents an alternative design for contextual analyses with QCA-methods grounded on subgroup-design. Based on one recently-developed methodology comparative multilevel analysis (CMA), some guidelines for performing contextual analyses with two set-theoretical methods (csQCA and fsQCA) are presented. As illustrated with examples, the combination of CMA and QCA provides opportunities to use QCA for contextual analysis.

Keywords Contextual analysis · QCA · Comparative multilevel analysis · Fuzzy-set · Interaction

1 Introduction

One prominent trend in comparative research during the last decades has been the increasing number of contextual studies. These studies are unified by their ambition to investigate whatever causal relationships are dependent on contextual conditions, which is related to a central theme in comparative politics: that context matters (Franzese 2007; Kam and Franzese 2007). That the importance of economic development for democratization is affected by conditions in the international context is an example of this principle (Boix 2011). Another

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major trend in comparative research is the development of new methods for comparative analyses. One of the most important developments is done within the field of qualitative comparative analysis (QCA) (Ragin 1987, 2000; Rihoux and Ragin 2008; Schneider and Wagemann 2012). A set of new methods has been developed which allows researchers to analyse set-theoretical relationships between conditions in settings that previously either precluded or complicated analyses.

However, what is striking is that set-theoretical methods as QCA are not used to perform contextual analyses. On one hand, contextual researchers do not use QCA. Instead, quantitative methods are primarily used to analyze contextual conditions (Franzese 2007; Kam and Franzese 2007). On the other hand, work based on QCA does not focus on contextual conditions for causal relationships, but on the importance of necessary and sufficient conditions for outcomes (e.g., Rihoux and Ragin 2008; Schneider and Wagemann 2012). As a consequence, there are few guidelines on how to perform contextual analyses with QCA-methods. The aim of this article is therefore to present guidelines for how two QCA-methods—crip-set QCA (csQCA) and fuzzy-set QCA (fsQCA)—may be used for contextual analysis, which investigate how causal relationships are dependent on contextual conditions.

The article is organized in ten sections. After this introduction, the next section discusses what contextual theories claim. How contextual theories are conventionally tested in comparative studies with statistic design is presented in the third section. Why the use of interaction-design is not useful together with configurative methods as QCA is explained in the fourth section, while the fifth section presents an alternative design (subgroup-design) for contextual analyses which is useful together with QCA-methods. A general methodology for contextual analyses with few cases—Comparative multilevel analysis (CMA)—is than presented in the sixth section. The following two sections provide illustrations about how CMA may be used together with QCA to analyse contextual effects. In the last section, some critical questions are raised together with some questions for future development of the usage of QCA to analyse contextual effects.

2 Contextual theories

In contextual theories, the concept of context refers to conditions surrounding causal relationships. The basic idea in contextual theories is that causal relationships work differently in different contextual settings. The setting that is in focus varies between different theories. Examples of settings that have been in focus include demographic, cultural, historical, institutional, psychological, and technological conditions (Tilly and Goodin 2006). These contextual conditions are assumed to surround the causal relationships, which means that the contextual factors are not included in the causal relationship as direct or indirect cause to the outcome. Therefore, in analyzing the importance of context, it is crucial to place the context outside the causal relationship and recognize that context is not a part of the causal relationship. Instead, context is a part of the environment which may affect the causal relationships (Falleti and Lynch 2009; Franzese 2007).

Contextual theories partly challenge the traditional view in social science, that cause through mechanisms leads to deterministic outcomes (Bunge 1996) by claiming that the causal relationship is dependent on contextual conditions, which is illustrated in Figure 1. Depending on contextual conditions, the same cause(s) may lead to different outcomes, or different causes may result in the same outcome. This implies that the indeterminacy of the outcome is not solely based on the mechanism between cause(s) and outcome but also on the context (Falleti and Lynch 2009). Expressed in a different way, the traditional view on

	Context (C)		*Context level*
	↓		
Cause/Condition (X)	→	Effect/Outcome (Y)	*Case level*

Fig. 1 Context as condition for causal relationship

causal relationships is that "If X, then Y", while contextual theories claim "If C, then X gives Y", where C represents contextual condition, X is cause (condition) and Y refers to effect (outcome). An alternative formulation with the same content is that the effect of X on Y depends on C (Franzese 2007), which also illustrates that context (C) as condition may reinforce or weaken the strength between the cause (X) and the outcome (Y). According to contextual theories, the context does not directly affect the condition or the outcome, which is a realistic alternative, claimed by theories that link macro- and micro-phenomena together (e.g., Coleman 1990). Instead, the context is expected to affect the relationship between the cause and the outcome (Goertz 1994; Mackie 1965).

As is also illustrated in Figure 1, contextual theories claim that conditions on one level affect causal relationships on another (lower) level, which creates a multilevel structure of factors. A multilevel structure divides factors according to the analytical level to which they refer (Goldstein 2003; Iversen 1991). One classic example of multilevel structure is the division of factors in research about students' achievements. In analyses like that, factors are divided into the school, classroom, and student level (Snijers and Bosker 1999). Without a multilevel structure, the analysis has no opportunity to assert or distinguish effects between contexts from effects within contexts. This is fundamental for estimating whether the context has effects on causal relationships, which are the main idea of contextual theories.

3 Conventional design for contextual analyses

The challenge for contextual studies is to identify contextual effects, which are the effects of contextual conditions on the relationship between cause(s) and outcome. To empirically investigate whether contextual effects occur, a first step is to specify the casual relationship or set of causal relationships that are expected to be affected by the context. A second step is to identify the context that is expected to be condition for the causal relationships. This is, of course, a challenge, but the selection of both contextual conditions and causal relationships is normally guided by theoretical considerations. After the specification of the causal relationship and identification of relevant contexts, the next step is to analyze whenever the causal relationship is diverse in different contexts. A difference in the causal relationships indicates contextual effects (Falleti and Lynch 2009; Franzese 2007; Iversen 1991).

Most contextual studies use statistical design to investigate contextual effects. The conventional design for statistical studies on contextual effects is based on multiplicative interaction models that include at least one interaction factor, which is constructed by multiplication of the independent factor and the contextual factor (Aneshensel 2013; Brambor et al. 2006; Franzese 2007; Kam and Franzese 2007). In the simplest form, a multiplicative interaction model consists of five components: constant (β_0); factor for condition ($\beta_1 X_i$); factor for contextual condition ($\beta_2 C_i$); interaction factor ($\beta_3 X_i C_i$); and residual (ε):

$$Y_i = \beta_0 + \beta_1 X_i + \beta_2 C_i + \beta_3 X_i C_i + \varepsilon$$

According to this equation, the effect of independent factor X on the dependent factor Y depends on or is moderated by the contextual factor C. This means that the effect of X is not solely dependent on the coefficient β_1 and the values on factor X, but also on the values related to the interaction factor (X_iC_i). The effect from the contextual condition (C) is indicated with the regression coefficient (β_3) of the interaction factor (X_iC_i). If the coefficient is significant it indicates contextual effect. When the contextual condition is positive conditionally (dummy variable) for the effect or increases the effect (continuous variable), the coefficient is positive, while a negative coefficient indicates that the contextual condition is negative conditionally or decreases the effect.[1]

In both contextual theories and contextual analysis, contextual effects refer to when aspects of a setting (context) as conditions affect the relationships between factors. Contextual conditions may influence causal relationships in three major ways (Aneshensel 2013; Brambor et al. 2006; Franzese 2007). Firstly, the contextual conditions may affect the existence of causal relationships, which means that the independent factor affects the dependent factor provided that certain conditions in the context occur. Secondly, contextual conditions may also affect the strength of the causal relationship. Although the same kind of causal relationship exists in various contexts, the strength between the independent and dependent factors may vary between contexts. Thirdly, the contextual conditions may affect how the independent factor affects the dependent factor. The same independent factor can influence the dependent factor positively or negatively, depending on the context in which the factors occur. All three forms of contextual effects can be analyzed by multiplicative interaction models.

4 Interaction-design and QCA-methodology

However, the strategy to use interaction factors to investigate contextual effect is not functional within QCA-methodology. The creation of interaction factors is—as most statistical methods—based on linear algebra, while QCA-methodology is based on set-theoretic assumptions (e.g., Boolean algebra). According to set-theoretic logics, multiplication expresses intersection between at least two sets. The value of intersection is not the product of the values as in linear algebra; instead, the value of intersection corresponds to the lowest of the combined values (Goertz and Mahoney 2012; Schneider and Wagemann 2012). For example, if one case has the values 0.3 and 0.7 on two variables, the value of intersection is 0.3, while the value of interaction is 0.21.

As a consequence, intersection cannot be used to indicate contextual interaction. One central principle behind the use of interaction factor is that the contextual factor through multiplication influences the value of the independent factor, and thereby the effect of the independent factor on the dependent factor. For example, if two cases have the same value on the independent factor (e.g., 0.3), the value of interaction is different if one case has low value on the contextual factor (e.g., 0.4) and the other case has high value (e.g., 0.9). However, when set-theoretical multiplication is used to measure the intersection, the value of intersection is not affected by the values on the contextual factor as the value of the independent factor is lowest (Goertz and Mahoney 2012; Grofman and Schneider 2009; Schneider and Wagemann 2012). This means that the value of the contextual factor affects the intersection when the value

[1] Positive conditionally means that the presence of contextual condition is necessary for the existence of causal relationship, while negative conditionally refers to when the presence of contextual condition dissolves the causal relationship.

of the contextual factor is lower than the independent factor, which means that intersection only can indicate decreasing interaction with the context, which is not sufficient for analysing contextual effects.

There is one exception from the differences between interaction and intersection. When variables with only two values or categories are combined as one or zero, the value of interaction and the value of intersection equal each other. The value of one indicates that both phenomena are present, while zero expresses that both or one of the phenomena is absent (Goertz and Mahoney 2012; Ragin 1987, 2008). This is the case when csQCA is used, which is based solely on binary factors (conditions). However, csQCA assumes that the dependent factor (outcome) is constant, which makes csQCA unsuitable for contextual analyses as the main hypotheses in contextual theories is that the same condition gives different outcomes in different contexts. To test this kind of contextual hypotheses requires methods that allow the dependent factor to vary between different values or categories.

Additionally, there are also problem to interpret the outcome of csQCA when contextual factors are included in the analyses. One simple example may illustrate this. Assume that one contextual factor (C) is analyzed with csQCA together with one independent factor (X) to explain the outcome on the dependent factor (Y). Further, assume that the outcome of the analysis is CX = Y. According to the principles of QCA, this combination is interpreted as if the contextual factor C together with the independent factor X is necessary for the outcome X (Ragin 1987, 2008). However, this is not what hypotheses about contexts as conditional conditions claim. Instead, they claim that the independent factor X gives the outcome Y under the condition of C (Aneshensel 2013; Brambor et al. 2006; Franzese 2007).

There are two major differences between the outcome from csQCA-analyses and what contextual hypotheses claim. First, according to contextual hypotheses, the contextual factor is necessary for the causal relationship between the independent factor (condition) and the dependent factor (outcome). The independent factor is not expected to be necessary for the contextual factor as in the outcome (CX = Y) from the csQCA-analysis. Second, hypotheses about context as conditional conditions do not concern the direct relationship between the contextual factor and the dependent factor, which is expressed with the outcome from the csQCA-analyses. Additionally, some contextual factors are not realistically regarded as direct effects on the dependent factor. For example, contextual theories may claim that causal relationships are different between historical periods. In sum, these differences also illustrate that the use of interaction-design together with QCA-methodology is not a functional way to analyze contextual effects.

5 Alternative design: subgroup-design

An alternative design to the use of interaction factors is offered by subgroup-analyses. Instead of analysing contextual effects by including the interaction factor, the subgroup-design investigates if there are differences or similarities between subgroups. Causal relationships are investigated within each subgroup with statistical methods and then compared to each other. Where there are contextual effects, the outcome from the statistical analyses is expected to be different between the subgroups (Aneshensel 2013; Iversen 1991).

The subgroup-design is preferable to interaction-design when the entire or substantial parts of the model are expected to differ across groups or contexts. Contextual effects on entire models are certainly possible to analyze with interaction-design, but it requires that a large number of interaction factors is included, which significantly complicates the interpretation of the statistical outcome and creates highly complex models. However, interaction-design is more often used than subgroup-design in comparative studies because interaction-design is regarded to have three major advantages before subgroup-design (Aneshensel 2013; Brambor et al. 2006; Franzese 2007). The first advantage is that interaction-design provides stronger statistical power than subgroup-design since the sample is not divided into subgroups. All other aspects (e.g., principle of significance and magnitude of effects) being equal, significant effects are harder to identify in smaller samples and the probability to correctly reject a false hypotheses is lower. The second advantage is that interaction-design provides a specific coefficient that indicates the contextual effect, while the contextual effect needs to be calculated by comparing coefficients from different subgroup-analyses when the subgroup-design is used. Third, as other independent factors are held constant across the contextual factor, the only factors that are affected by the contextual factor are those which are included in the interaction-factors. This provides opportunities to investigate contextual effects on selected or specific aspects according to the contextual hypotheses. However, all these advantages require that the number of cases is enough to perform statistical analyses with models including considerable number of factors, which are not always the cases for comparative studies.

Nevertheless, when subgroup-design is used in comparative studies for contextual analyses, it is mostly performed with statistical analyses. There are few methodological procedures in comparative analyses which use the opportunities with subgroup-design. One exception to this is CMA, which is an attempt based on comparative logic to develop a methodology for analyzing contextual effects in multilevel structures with comparative methods (Denk 2010). This methodology is developed with inspiration from both traditional logics for comparison (e.g., Przeworski and Teune 1970), and subgroup-analysis with statistical methods (e.g., Aneshensel 2013; Iversen 1991).

6 Comparative multilevel analysis

CMA is performed in four steps. In the first step, the cases are *grouped in relation to their similarities on the context level*. The grouping of cases takes place according to their relationship with properties on a higher analytical level than the cases themselves, which creates a multilevel structure. As a consequence, cases from different systems that have contexts with the same properties constitute one group of cases. This step is essential as it structures the analysis in a way that provides possibilities to combine comparisons within contexts with comparison between contexts.

In the second step, *cases within each group are compared*, with the aim of investigating causal relationships between independent and dependent factors within the groups. The comparison is based on established methods used for comparative analyses. For example, most similar systems design (MSSD), csQCA and fuzzy-set QCA (fsQCA) can be used for these analyses. Whatever method is used, the outcome is a number of comparative expressions that represent the causal relationships within the groups. For each group, one comparative expression is developed based on comparative analyses, which results in as many comparative expressions as there are groups. Together, these comparative expressions, which identify causal relationships within contexts, are necessary but not sufficient for analysis of contexts as conditional factors for causal relationships.

The third step consists of a comparison between contexts based on the comparative expressions that are formulated in the previous stage. The step identifies differences and similarities in causal relationships between contexts. Under conditions that there is a multilevel structure, this step provides opportunities to analyse effects of contexts on causal relationships within the contexts. The principle for establishing contextual effects is similar to the traditional logic used in comparative analyses. If there are differences in causal relationships between contexts, it indicates the effect of contexts, while similarities between contexts indicate that context has no effects on the relationships between factors. As mentioned before, there are two kinds of effects when context is regarded as a conditional factor for causal relationships: (a) the same conditions (causes) provide different outcomes (effects) in different contexts; and (b) different conditions (causes) provide the same outcome (effect) in different contexts. These two effects may also be mixed in the way that they occur in the same set of cases or contexts.

Based on the previous step, conclusions about contexts as conditional conditions for causal relationships are formulated in the fourth step. The conclusion establishes whenever there are contextual effects by analyzing the way that contexts affect causal relationships between factors within contexts. However, if there are contextual effects, the conclusions may also identify which aspects of the causal relationships are affected by the contexts. The context may be a conditional condition for relationships between some conditions and the outcome, while other conditions have relationships with the same outcome independent of the context. As Rohlfing (2012) points out, if CMA is used only to identify contextual effects without interpretation, it may oversimplify the complexity and diversity of solutions. It is therefore significant that the pattern of contextual effects is interpreted after identification.

The four steps create a stepwise grouped comparison with a multilevel structure, which provides opportunities to (a) include factors on different levels, (b) examine relationships between factors on different levels, and (c) investigate contextual effects on relationships between factors based on comparative analysis (few-cases-methods). As mentioned above, when CMA is applied, it requires that the methodology is combined with a method to analyze the relationships between factors inside contexts. An advantage with CMA is that it can be combined with different methods.

7 CMA and csQCA: an example

One of the methods with which CMA can be combined is csQCA (Ragin 1987, 2000; Schneider and Wagemann 2012). The foundation of csQCA is the use of Boolean algebra, which is based on a binary language that expresses presence or absence of conditions. Additionally, Boolean algebra uses multiplication to express conjunction ("and"; e.g., AB) and addition to indicate disjunction ('or'; e.g., A+B), which combines conditions in different ways into configurations. To explain one outcome, csQCA applies Boolean minimization to identify under which configurations the outcome occurs. The core principle of Boolean minimization is if two expressions differ in only one condition but produce the same outcome, then the condition that differentiates the two expressions may be regarded as irrelevant and to be excluded, which provides a combined expression that is less complex (Ragin 1987:93).

How contextual effects can be analyzed by combining CMA with csQCA can be illustrated by a simple example. Assume that we use csQCA to investigate whether religious contexts influence how mobilization of a minority (M) is affected by the size of the minority (S) and the wealth of the minority (W). Further, assume that we select 12 minority groups in three contexts which have different religious majorities (Buddhist, Hindu, and Christian). In Table 1, the information about the different minority groups in the example is summarized.

Table 1 Illustration of CMA with csQCA

Case	Context	Size of minority	Wealth of minority	Mobilization of minority
1	B	S	w	M
2	B	S	w	M
3	B	s	w	m
4	B	s	w	m
5	H	s	W	M
6	H	s	W	M
7	H	s	w	m
8	H	s	w	m
9	C	S	W	M
10	C	S	W	M
11	C	s	W	m
12	C	s	W	m

Table 2 Outcome of comparison within contexts

Context	Mobilization (M)	Non-mobilization (m)
B	Sw = M	sw = m
H	sW = M	sw = m
C	SW = M	sW = m

According to the logic of CMA, the cases are first divided into groups based on their context. In the example, this step creates three groups which represent different religious contexts. This division provides another structure of the analysis than when csQCA is applied without CMA, as the csQCA divides the cases based on their outcome (dependent factor). However, in the next step, csQCA is used to analyse the cases within the contexts, which means that the cases are divided a second time based on their outcome within the contexts. The results from these analyses are presented in Table 2. In the third step, the comparative expression presented in Table 2 is compared to investigate the differences and similarities between contexts. When using csQCA, there are three sets of comparison between contexts. The first set of comparative expressions refers to cases with positive outcome in different contexts, which establish whether a different condition provides the same outcome in different contexts. In the example, we can conclude that the conditions for mobilization (M) are different between the three contexts. This can be expressed, if we use a system with brackets to specify conditions within the context, in the following way: B[Sw = M]+ H[sW = M] + C[SW = M]. The second set consists of comparative expressions that represent cases with a negative outcome (no-mobilization) in different contexts. When comparing these comparative expressions, we also investigate whether different conditions provide the same outcome in different contexts. In the example, there are similarities between the Buddhist and Hindu contexts, as the combination [sw = m] gives the same outcome (no-mobilization) in both contexts. However, in the Christian context, the same outcome is provided by the combination [sW = m]. This indicates that there are contextual effects between the Christian context and the other two contexts, which can be summarized as B+H[sw = m] + C[sW = m]. The third set of comparisons is diagonal, with the aim of identifying whether the same conditions provide different outcomes in different contexts. This is another form of contextual effects than is investigated by the previous sets of comparative expression. In the example, this form of contextual effect appears when a positive outcome in the Hindu context is compared with the negative outcome in the Christian context. The same combination of conditions (sW) results in different outcomes. In the Hindu context, the outcome is positive [sW = M], while the outcome in the Christian context is negative [sW = m]. The conclusion from these comparisons is that there are contextual effects. Depending on contextual condition, different conditions give the same outcome and the same conditions give different outcomes.

8 CMA and fsQCA

Another method that can be combined with CMA is fsQCA (Ragin 2000, 2008, 2009; Schneider and Wagemann 2012). Even if there are similarities with csQCA, there are three differences that have an impact on how fsQCA is used to conduct analyses of contextual effects. First, analyses with fsQCA are based on fuzzy-set membership scores that express the degree to which cases belong to a set, which is any collective of distinct objects that can be described by certain properties or characteristics. The membership in a set can be expressed by values between full membership (1) and full non-membership (0) in the set. Based on the membership scores, fsQCA analyzes sub-set relations, which refer to the degree to which membership scores in one set are consistently less than or equal to membership scores in another set. Two aspects of sub-set relation are mainly analyzed with fsQCA: consistency and coverage. *Set-theoretic consistency* refers to the degree to which cases share conditions or combinations of conditions, which indicates how closely the sub-sets of conditions and outcome are related to each other. *Set-theoretical coverage* refers to an indication of the degree to which the minimal formula is an outcome of the analysis covering observed cases, which provides information on the relevance of conditions for the outcome. If there are several paths (combinations of conditions) to the same outcome, this is indicated by a low degree of coverage (Ragin 2006, 2008, 2009; Schneider and Wagemann 2012). These two set-theoretical relations measured with fuzzy-set membership scores are in focus when CMA is used together with fsQCA.[2]

Second, coefficients are calculated to provide an indication of consistency and coverage. To calculate the degree of consistency for the necessary condition, fsQCA uses the following formula: $(Y_i \leq X_i) = \sum[\min(X_i, Y_i)]/\sum(Y_i)$, where Y_i indicates the membership score in outcome (Y) for case i and X_i is the membership score in condition (X) for case i. If the cases have lower or equal membership scores on the outcome than the condition, then the value of consistency will be high, which indicates that the condition is a necessary condition for the outcome. In a similar way, another formula—$(X_i \leq Y_i) = \sum[\min(X_i, Y_i)]/\sum(X_i)$—is used to indicate the degree to which a condition is sufficient for the outcome. This formula measures the degree to which cases have lower membership scores on the condition than the outcome. If the cases have lower membership scores on the condition than the outcome, it indicates that the condition is sufficient for the outcome, and the value of consistency for the sufficient condition will be high.

To measure coverage, fsQCA calculates the degree to which cases of different solutions cover the investigated cases. Coverage is regarded as the size of the overlap of the two sets

[2] In the following examples (Tables 3, 4), coefficients for consistency and coverage are used. However, fsQCA offers additional coefficients that indicate theoretical set-relationships and can be used in contextual analyses with CMA. For example, when combinations of conditions are analyzed, different aspects of theoretical set-relationships are indicated by solution consistency, solution coverage, raw coverage, and unique coverage (Ragin 2008; Schneider and Wagemann 2012). These coefficients, in combination with CMA, provide opportunities to analyze how context affects different aspects of causal relationships.

(condition and outcome) relative to the size of the larger set. When measuring the coverage for the necessary condition (X), the larger set is the condition, which provides the following formula: $(Y_i \leq X_i) = \sum[\min(X_i, Y_i)]/\sum(X_i)$. The large set when the coverage for sufficient condition is measured consists of the outcome (Y). The formula for calculating the coverage for the sufficient condition is therefore $(X_i \leq Y_i) = \sum[\min(X_i, Y_i)]/\sum(Y_i)$. The calculation of coverage indicates whether the solution is relevant for the outcome, which is the first step in investigating the outcome's importance. For both coefficients of consistency and coverage, the critical value for strength and relevance is stipulated to be 0.75 (Ragin 2006, 2008, 2009). Values below this critical value indicate weak strength (consistency) or low relevance (coverage). When combining fsQCA with CMA, it is the coefficients of consistency and coverage that are used to indicate causal relationships within contexts and indicate contextual effects on causal relationships between contexts.

Third, when csQCA is used, the outcome is constant. However, with fsQCA, the outcome varies between cases. The cases have different degrees of membership in the outcome. This means that when fsQCA is used with CMA, contextual effects on outcome are not analyzed in a special part of the analysis, as when csQCA is used. Instead, contextual effects on the causal relationship between conditions and outcome are analyzed in total.

9 Illustration of CMA with fsQCA

To illustrate how fsQCA can be combined with CMA, we use a fictive example with mobilization of minority (M) as the outcome and relative size of a minority as the condition (S). To keep the example simple, we assume that there are 12 cases of minorities in two context settings which have different religious majorities. In one context, the majority is Buddhist, while the other context is dominated by a Hindu majority. The aim is to investigate if these contextual conditions influence how mobilization of a minority is affected by the size of the minority. The information about the cases is presented in Table 3.

When all cases are analyzed with fsQCA, the outcome indicates that the size of a minority is a sufficient and necessary condition for mobilization of the minority. As the coefficients in Table 4 indicate, the condition has relevance (coverage) and impact (consistency) for the

Table 3 Illustration of CMA with fsQCA

Case	Context	Size of minority	Mobilization of minority
1	B	0.3	0.1
2	B	0.4	0.2
3	B	0.5	0.3
4	B	0.6	0.4
5	B	0.7	0.5
6	B	0.8	0.6
7	H	0.1	0.2
8	H	0.2	0.3
9	H	0.3	0.4
10	H	0.4	0.5
11	H	0.5	0.6
12	H	0.6	0.7

Table 4 Outcome of CMA with fsQCA: fictive example

	All cases		Buddhist context		Hindu context	
	Consistency	Coverage	Consistency	Coverage	Consistency	Coverage
Sufficient condition	0.778	0.875	1.000	0.778	0.636	1.000
Necessary condition	0.875	0.778	0.778	1.000	1.000	0.636

outcome. However, if QCA is applied together with CMA the results are changed. In the first step, the cases are divided according to their contexts. It creates two groups which represent different religious contexts with six cases in each group. Then, as a second step, fsQCA is used to analyze the relationship between the condition and outcome within each contextual group. This step produces a set of coefficients about fuzzy-set relationships within the groups. These coefficients are also presented in Table 4. In the third step, the coefficients from the different contexts are compared. Differences between the coefficients are regarded as an indication of contextual effects. When compared, we notice that the size of the minority is a sufficient and necessary condition for minority mobilization in the Buddhist context, but in the Hindu context the size of the minority is neither a sufficient nor a necessary condition, as the coefficients for sufficient consistency and for necessary coverage are lower than the critical value of 0.75 (Ragin 2006, 2008, 2009). These differences indicate that there are contextual effects on the causal relationship between the size of a minority and mobilization of the minority, which is the conclusion that is formulated in the fourth step.

10 Conclusion

This article presents some basic guidelines for contextual analyses with QCA-methods combined with the CMA-methodology. With relative few complements, QCA-methods provide opportunities to analyze whatever contextual conditions affect the relationships between conditions and outcome. With this approach, there is a new methodology to use for contextual analyses, as well as a new research area for the use of QCA-methods. For research on contextual effects, this provides opportunities to investigate contextual effects under circumstances that exclude the use of statistical methods. For example, when the number of cases is not enough for statistical methods, the use of QCA-methods can be a more realistic alternative.

As discussed more elaborated by others (e.g., Goertz and Mahoney 2012; Schneider and Wagemann 2012), the use of QCA-methods instead of statistical methods is not only selection of method based on the number of cases. The formulation of hypotheses is also different when QCA-methods are used. Statistical methods test hypotheses about how the probability for different values on the dependent factor is affected by other (independent) factors. As a set-theoretical method, QCA is used to analyze how membership in one set is related to membership in another set. For contextual analyses, this means that questions about how the importance of membership in one set (condition) for memberships in another set (outcome) is affected by the membership in one contextual set. This way of formulating and testing hypotheses is different than when statistical methods are used. The use of QCA-methods provides opportunities to formulate contextual hypotheses in alternative ways, but also to empirically test hypotheses which are developed by set-theoretical logic.

The use of QCA together with CMA for analyzing contextual effects also raises questions that have not been on the agenda for QCA-methods before. For example, questions about interdependence are central when cases within the same context are analyzed (Franzese and Hays 2008; Jahn 2006). The classic problem of interdependence, as it was formulated by Francis Galton (1889), is that cases are not independent from each other as assumed by the methods (Naroll 1961, 1965). Instead, through different processes or structures, cases may be dependent to other cases. In comparative methodology, strategies to control for independence between cases have been developed (Franzese and Hays 2008; Wellhofer 1989). The next step in developing the use of QCA for contextual analyses may therefore be to further introduce the problem of interdependence and develop guidelines based on QCA-methods to address these problems.

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