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Introduction: SMMR in a Nutshell

This book is written for researchers who are interested in strengthening their descriptive or causal inference by combining two methods in a meaningful manner. More specifically, this book is for researchers who want to go beyond their findings generated by qualitative comparative analysis (QCA) by performing follow-up within-case analyses. Likewise, this book is also for case study researchers who usually perform within-case analyses and now seek to ascertain the empirical scope of their findings by inserting their case studies into a QCA design. This book is, thus, written for social researchers who feel that the use of just one method is not enough. Beyond that, the book is also for those who hold that the focus on only one level of analysis – either the cross-case or the within-case level – is inferior to the integrated analysis of both levels with the goal to enhance descriptive and causal inference.

1.1 Multi-Method Research

Multi-method research has become an almost universally accepted approach to enhancing social science research. As its name suggests, more than one method is applied for drawing either descriptive or causal inference on the conditions that drive a phenomenon of interest. As there are many methods, there are also plenty of shapes and flavors of multi-method designs. Of particular interest in the context of this book are those that combine methods for drawing inferences on the cross-case level, on the one hand, and the within-case level, on the other – probably the most common form of combining methods. What this book proposes is to adopt a set-theoretic perspective at both levels of analysis and to combine QCA with the within-case analyses of purposefully selected cases. For this, I use the label set-theoretic multi-method research (SMMR).

SMMR's stance that causal analysis requires both a cross-case effect and a within-case mechanism is fully in line with the writings of many methodologists and philosophers. Under the label of evidential pluralism, Russo and Williamson (2007) (see also Shan and Williamson, 2023) postulate that causal analysis requires evidence on difference making and on a mechanism. While initially designed for medical research, this position has been widely embraced by social science researchers, in particular those working on proper designs for multi-method research involving qualitative methods, such as Crasnow et al. (in press), Goertz and Haggard (in press), Mahoney (2021), or Rohlfing (2012). Runhardt (2022) outlines some challenges to implementing evidential pluralism via multi-method research designs. As this book will show, SMMR, with its "unifying framework" (Rohlfing and Schneider, 2018) of set theory both at the cross-case and the within-case levels, is able to master many of these challenges better than other multi-method approaches, in particular those that combine quantitative methods with qualitative case study approaches.

So far, the main multi-method focus in most of the social sciences has been on combining quantitative techniques at the cross-case level with qualitative techniques at the within-case level. Emblematic for this literature is Lieberman's nested analysis approach (Lieberman, 2005). The basic idea is to use a regression analysis to identify patterns at the cross-case level as a guide for selecting cases for process tracing at the within-case level, with the goal to either improve or test the cross-case regression model. Lieberman's proposal has been both criticized (e.g. Rohlfing, 2008) and refined (e.g. Weller and Barnes, 2016). Both Seawright (2016) and Goertz (2017) present a more comprehensive discussion on "combining qualitative and quantitative" tools. They lay out the role of qualitative case studies when combined not only with regression analysis, but also with (natural) experiments, matching techniques, or game theory.

One of the Achilles heels of multi-method approaches is that, more often than not, the assumptions that go into different methods are irreconcilable (Beach and Kaas, 2020; Bennett and Elman, 2006; Chatterjee, 2013). For instance, when combining regression analysis with case studies à la Lieberman's nested analysis, the ontological assumption at the cross-case analysis is that of average net effects and at the within-case analysis that of causally complex configurations or processes. In addition, more sophisticated quantitative case selection strategies, such as the pathway case by Gerring (2017) or the list of techniques outlined by Seawright and Gerring (2008), do not overcome this vexing problem. In Seawright (2016), the proposal for solving this Gordian knot of incongruity is to subordinate the qualitative part to the quantitative part. The latter does the heavy lifting of causal inference, whereas the former takes on the role of probing those assumptions that need to hold so

that the plausibility of the causal inferences drawn with quantitative methods is increased. Humphreys and Jacobs (2015), in turn, propose a Bayesian approach as the framework in which qualitative and quantitative techniques can be integrated into one multi-method approach without contradicting one another.

In this book, I argue that SMMR overcomes the incompatibility problem of many multi-method approaches. SMMR achieves this by applying set-theoretic tools and notions at both the cross-case and the within-case levels of analysis and by guiding the analyses at both levels based on a series of case selection principles.

1.2 Set-Theoretic Multi-Method Research

In this book, I propose SMMR for combining cross-case and within-case analyses in an integrative framework. At both levels of analysis (cross-case and within-case), approaches are rooted in set theory and the analysis of set relations. This provides a unifying framework for descriptive and causal analysis in SMMR without ontological clashes (Rohlfing and Schneider, 2018). Integrated theories are defined as theories that cover both the cross-case level and the within-case level (Dessler, 1991; Goertz, 2017; Mahoney, 2021; Rohlfing, 2012). SMMR is geared toward developing or testing such theories. More specifically, at the cross-case level, the set-theoretic method of QCA is used to discern necessary and sufficient conditions for the outcome of interest. These findings are then used for identifying the appropriate cases for the within-case level analysis with the goal of analyzing the mechanism(s) that connect the necessary or sufficient conditions to the outcome at the cross-case level. SMMR with its combination of QCA and follow-up case studies gives empirical researchers exciting opportunities to build, test, and refine descriptive and causal explanations rooted in a set-relational framework.

Set-theoretic multi-method research (SMMR) is defined as the purposeful combination of QCA results obtained at the cross-case level for the study of mechanisms at the within-case level to formulate integrated, set-relational descriptive or causal inferences about a phenomenon of interest.

Qualitative comparative analysis can be combined with many different methods, including statistical methods (see e.g. Meuer and Rupiotta, 2017a,b). At the core of this book and of SMMR is the combination of QCA and within-case analysis. This combination can occur in two possible sequences: we can run the truth table analysis first (“cross-case analysis first design”) or start with

the within-case part (“within-case analysis first”; Beach and Rohlfing, 2018). In a design performing the within-case analysis first, the within-case analysis either tests a hypothesis on a mechanism, or develops or modifies such a hypothesis in an exploratory fashion. The truth table analysis then builds on the within-case insights and probes set-relational patterns at the cross-case level. Within-case analysis first designs are valuable. They do not raise any particular research design issues, though. It even seems fair to say that any applied QCA that follows standards of good practice (Koivu et al., 2019; Schneider and Wagemann, 2010; Wagemann and Schneider, 2015) contains elements of within-case analysis first designs, simply because of the case-oriented nature of QCA as an approach (Berg-Schlusser et al., 2009).

Cross-case first designs raise methodological challenges.¹ This is why this book focuses on this type of SMMR. A cross-case analysis identifies patterns, based on which different types of cases are established. This information is then used for selecting cases for within-case analysis. In SMMR, it begins with the truth table analysis. The result of this cross-case analysis – the QCA solution formula – is then used for systematic case selection for within-case analysis with the goal to improve the QCA model or to probe the causal status of that model. In a sense, the cross-case part of SMMR can be perceived of as a procedure to sort cases into boxes. Cases from each box are adequate choices for different analytic goals during the second part of SMMR, the within-case analyses.

At the cross-case level, SMMR rests on the use of QCA. Over the past few decades, this technique has made inroads into various disciplines. Originally invented and developed in the fields of Political Science and Sociology (Ragin, 1987, 2000, 2008; Schneider and Wagemann, 2012), it is now also increasingly used in many other fields, such as business and management, environmental science, or public administration (Oana et al., 2021, chap. 1.3). This fact makes this book relevant for readers from all these and many other disciplines. The use of QCA – and its combination with within-case analysis – is not restricted to any field or discipline.

During the within-case analysis, many different, or in fact any, data analysis techniques can be applied – from quantitative analyses to archival research, interviews, participant observations, and so on. Whichever data and data analysis technique are most appropriate for uncovering information on the mechanism(s) can and should be chosen. This means that the within-case

¹ Among cross-case first SMMR designs, one could further distinguish between those that are more condition-centered and those that are more mechanism-centered (Beach and Rohlfing, 2018). This distinction rests on which of the two levels of analysis takes more room and attention. Any SMMR design must include both levels and cannot neglect any of the two.

analytic part of SMMR is not confined to process tracing, the method perhaps most associated with within-case analysis. The only thing that matters for SMMR is that, ultimately, the within-case evidence is translated into set membership scores and the logic of the within-case analysis is that of discerning set relations.

Also important to note is that the within-case analysis is useful for more than improving the cross-case model and probing its causal status. For instance, within-case evidence can contribute to probing the validity of data, reshaping the scope conditions, or reformulating the concepts under investigation (Rohlfing and Schneider, 2018). All of these are important benefits of within-case analysis and all of them are fostered by the SMMR designs introduced in this book. Yet the core focus of SMMR is model-related, that is, investigating the causal status of a QCA solution and enhancing, if needed, its descriptive accuracy by detecting conditions that are missing from the model.

1.3 Empirical Example

Throughout the book, I rely on examples of published research to explain and illustrate the principles and practices of SMMR. Often I will alter the original data or analytic setup to better focus on the methodological points I intend to make.

For illustrative purposes, take the study by Schneider and Makszin (2014). Their goal is to explain why in some countries social inequality does not lead to participatory inequality, defined as unequal turnout in elections across different social groups. At the cross-case level, they use QCA to analyze attributes of the welfare regime. They find several combinations of welfare state attributes that are sufficient for, or lead to, low levels of participatory inequality. Schneider and Makszin (2014) subsume these combinations under the concept of supportive welfare regime. At the within-case level, they find individual-level survey data evidence that cognitive and material resources and social engagement operate as the causal mechanisms linking the supportive welfare regime types to low participatory inequality.²

The argument by Schneider and Makszin (2014) can be graphically represented as shown in Figure 1.1. At the cross-case level – the QCA solution formula – we see that in countries with supportive welfare regimes, participatory inequality across different social groups is low. The hypothesized mechanism through which welfare regimes exert their effect on participatory equality

² In Chapter 5, I discuss the study of Schneider and Makszin (2014) in more detail.

Figure 1.1 Causal mechanism linking supportive welfare regimes and low participatory inequality

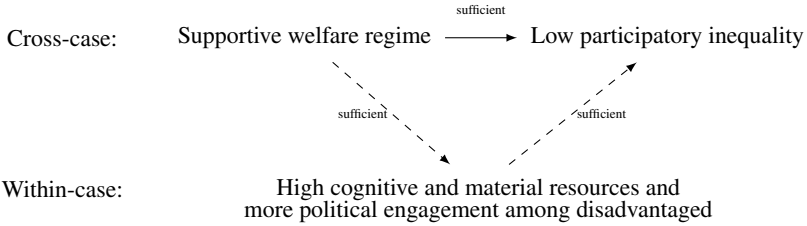
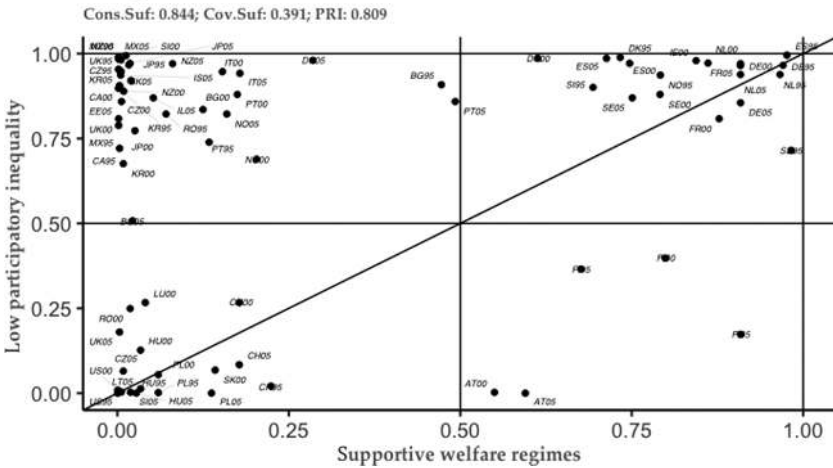


Figure 1.2 XY plot: supportive welfare regime and low participatory inequality



is that such regimes provide citizens from challenging social backgrounds with higher cognitive and material resources and social engagement than comparable citizens not living in such welfare regimes. Endowed with such resources and engagement, those citizens are more likely to participate in politics, which, in turn, produces low participatory inequality.

Figure 1.2 provides a graphical representation of each case’s fuzzy set membership score in the supportive welfare regime plotted against their membership in the outcome low participatory inequality. This is an enhanced XY plot (Schneider and Rohlfing, 2013). It is very useful for understanding SMMR and I explain its features in detail below. For now, it suffices to understand that cases in the upper-right triangle, such as France in 1995 (FR95)

or Spain in 2005 (ES05), are typical cases for the statement that having a supportive welfare regime is sufficient for low participatory inequality. In those cases, we expect to find the within-case causal mechanism “resources and engagement” to operate. In contrast, in cases in the lower-left quadrant, such as Czechia in 2005 or Hungary in 2000, neither of which are members of the set of countries with a supportive welfare regime nor of the set of cases with low participatory inequality, we expect to find that they are not members of any of the mechanisms. If both expectations are confirmed by empirical evidence, we have support for the causal mechanism claim depicted in Figure 1.1. Furthermore, cases in the lower-right quadrant, such as France in 1995, 2000, and 2005, are puzzling because they contradict the statement of sufficiency: they do have a supportive welfare regime but nevertheless do not show low participatory inequality. In contrast, cases in the upper-left quadrant, such as Portugal in 2005, do not contradict the sufficiency claim but are nevertheless puzzling, too. They do show the outcome low participatory inequality but do not have a supportive welfare regime.

Which cases should be selected for within-case analysis to achieve which analytic goal? The purpose of SMMR – and of this book – is to answer this question. In a nutshell, deviant cases (upper-left and lower-right quadrants in Figure 1.2) are needed for enhancing the descriptive inference. Typical cases and individually irrelevant (iir) cases (lower-left quadrant), in turn, are needed for causal inference.

1.4 The Elements of SMMR

This book takes as its basis previous work on SMMR, jointly authored with Ingo Rohlfing (Schneider and Rohlfing, 2013, 2016, 2019; Rohlfing and Schneider, 2013, 2018). It refines and, where necessary, rectifies the framework laid out in previous work: it formulates additional principles that guide case selection for within-case analysis, introduces more sub-types of cases, and spells out the principles and practices of SMMR on the analysis of necessity claims. In Section 1.6 and throughout the book, I also situate SMMR in relation to similar approaches to combining QCA with other, case-based methods.

One consequence of SMMR being a comprehensive answer to the typical challenges in applied social science research is that it requires the use of a dedicated software package. Only with the help of the `smmr()` function from the R (R Core Team, 2018) package `SetMethods` (Oana and Schneider, 2018) is it possible to properly implement SMMR. This is why in this book I not only

explain in detail the logic of SMMR, but also the use of the `smmr()` function based on plenty of examples of applied SMMR, a glossary of key terms, and an index for better navigation.

In this section, I introduce the key elements of SMMR. These are the distinction between the cross-case and the within-case levels; descriptive and causal inferential goals; types of cases; single-case and comparative SMMR designs; and crisp and fuzzy set approaches. I also briefly address the topic of QCA solution types and causal inference, an issue I return to in greater detail in Section 5.4.

1.4.1 Cross-Case and Within-Case Levels

The distinction between the *cross-case* and the *within-case levels* is key to SMMR. It shares this feature with many well-known designs in the qualitative literature, such as the most different system design and the most similar system design (Mahoney, 2000; Przeworski and Teune, 1970). It is also in line with how many other (qualitative) multi-method researchers and methodologists approach the topic of causal analysis (e.g. Goertz and Haggard, in press; Mahoney, 2021; Rohlfing, 2012; Runhardt, 2022; Russo and Williamson, 2007). Figure 1.3 shows a graphical representation of the basic notion of different levels. At the cross-case level, we see the QCA solution S connected to outcome Y . This expression can be a statement of necessity or of sufficiency, or both. In this book, I mostly focus on studies whose goal is the detection of sufficient conditions. Compared to the others, this is by far the most dominant approach within applied QCA.³

At the cross-case level, the *solution formula* S can stand for a single set ($A \Rightarrow Y$), a disjunction ($A + B \Rightarrow Y$), a conjunction ($A * B \Rightarrow Y$), or a disjunction of conjunctions ($A * B + C * D \Rightarrow Y$), the highest form of complexity, and the one routinely encountered in applied QCA. The implications for SMMR are manifold. The more complex the QCA solution formula, the more sub-types of cases exist, and the more SMMR principles need to be taken into account when choosing cases for within-case analysis. This is why this book is structured along these elements of causal complexity. I begin with the simplest (and also least frequently encountered) scenario of a single sufficient condition and end with the most complex (and also most commonly encountered) form of a causally complex QCA solution formula, consisting of INUS conditions.⁴ In QCA, three solution types are distinguished: conservative, intermediate,

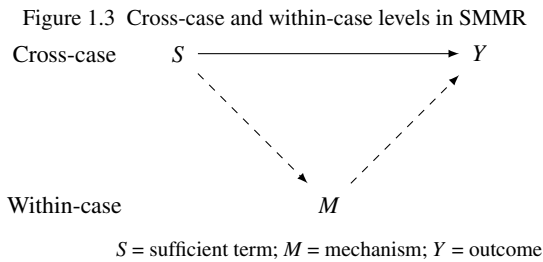
³ I discuss the implications for SMMR when encountering necessary conditions in Section 4.4 and in Chapter 6.

⁴ INUS stands for an insufficient but necessary conjunct of unnecessary but sufficient conjunction (Mackie, 1965).

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and most parsimonious (Ragin, 2008). All three solution types can be used in SMMR, a point I return to at the end of this chapter and in Section 5.4.



Mechanism M is located at the within-case level. Within the SMMR framework, this comprises any form of mechanism that can be subjected to empirical scrutiny. The SMMR framework does not take any position on whether the cross-case expression causes, or triggers, the mechanism *M* or whether it simply provides the context within which *M* operates and unfolds its effect on the outcome.⁵

The empirical evidence for studying mechanisms in SMMR can vary, as long as the evidence is located at the within-case level. This means that *M* is not another condition to be added to the QCA model at the cross-case level. Although process tracing (Beach and Pedersen, 2019; Blatter and Haverland, 2012; George and Bennett, 2005) and qualitative evidence, in general, are the most likely candidates for framing the within-case empirical evidence, SMMR does not restrict the within-case phase to process tracing or qualitative data. Schneider and Makszin (2014; see also below), for instance, use aggregate numbers from large-*N* individual-level survey data to check if their postulated mechanisms are in place. Just like in QCA, also in SMMR any form of empirical evidence can be used for calibrating sets at the within-case level.⁶

What is required in SMMR is that mechanisms are perceived as sets in which cases hold membership (Mahoney, 2021; Mikkelsen, 2017). This is what makes SMMR a set-theoretic method: it is based on set membership scores and set relations not only at the cross-case (QCA) level, but also at

⁵ For discussions on the various meanings of “mechanisms” in the social sciences, see, for instance, Beach and Rohlfing (2018, pp. 6ff.), Falleti and Lynch (2009), or Rutten (2022, pp. 6ff.).

⁶ Pagliarin et al. (2023) spell out in useful detail how nonnumeric, qualitative information is gathered and then transformed into set membership scores (see in particular their figure 1). This applies not only to QCA, but also to SMMR and its within-case component. For further useful guidance on how to calibrate sets based on qualitative evidence, such as interviews or archival material, see de Block and Vis (2019) or Tóth et al. (2017).

the within-case (mechanism) level. This unifying framework (Rohlfing and Schneider, 2018) means that SMMR avoids many of the pitfalls that bedevil most other forms of multi-method research, such as the combination between regression and case studies (Chatterjee, 2013) or combining methods in general (Ahmed and Sil, 2012; Beach and Kaas, 2020).

There is nothing unusual about perceiving not only cross-case conditions, but also within-case mechanisms and its elements in terms of (fuzzy) sets. In fact, the in-depth focus on a case in SMMR should make the calibration of the mechanism M easier than it often is for conditions at the cross-case level (Schneider and Rohlfing, 2019, p. 268). The works of Ragin (2008), Goertz and Mahoney (2012), and in particular Mahoney (2021) rest on the position that concepts in social science research – including concepts that constitute mechanisms – are best captured via sets. Furthermore, it is important to reiterate that in SMMR any form of within-case evidence can be used for analyzing mechanisms, not just process tracing.

Even if in Figure 1.3 the mechanism is denoted as just M , it can be a placeholder for various different scenarios. All of them are compatible with the SMMR principles and practices explained in this book. For instance, M can be a chain of steps, as in $S \rightarrow M_1 \rightarrow M_2 \rightarrow M_x \rightarrow Y$. M can also be a conjunction, as in $S \rightarrow M_1 * M_2 \rightarrow Y$, or a disjunction, as in $S \rightarrow M_1 + M_2 \rightarrow Y$.⁷ The SMMR framework remains agnostic as to whether there is such mechanistic complexity and/or heterogeneity across cases of the same kind (Beach, 2018; Beach and Siewert, 2019). This means SMMR can accommodate situations in which more than one mechanism M is linking the sufficient term S to outcome Y or when M consists of a sequence of steps. As we learn throughout the book, SMMR renders plausible the *assumption* of mechanistic homogeneity by restricting inference to cases of the same type (Schneider and Rohlfing, 2016). Pending evidence to the contrary, within-case findings from one case are assumed to hold for all cases of the same type (e.g. all typical cases). As with any assumption, this one can be wrong. It is precisely the set of SMMR principles, though, that increases the plausibility of the homogeneity assumption *and* enables researchers to detect mechanistic heterogeneity and complexity when it is there. But until empirically shown otherwise, mechanistic homogeneity across analytically similar cases is a plausible assumption on which SMMR-based inferences rest.

⁷ See Goertz (2017, chap. 2) for equifinality and causal mechanisms and Beach and Rohlfing (2018, pp. 17ff.) for further forms of mechanistic heterogeneity.