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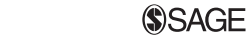

Combining QCA and Process Tracing in Set-Theoretic Multi-Method Research

Carsten Q. Schneider[1] and Ingo Rohlfing[2]

Abstract

Set-theoretic methods and Qualitative Comparative Analysis (QCA) in particular are case-based methods. There are, however, only few guidelines on how to combine them with qualitative case studies. Contributing to the literature on multi-method research (MMR), we offer the first comprehensive elaboration of principles for the integration of QCA and case studies with a special focus on case selection. We show that QCA's reliance on set-relational causation in terms of necessity and sufficiency has important consequences for the choice of cases. Using real world data for both crisp-set and fuzzy-set QCA, we show what typical and deviant cases are in QCA-based MMR. In addition, we demonstrate how to select cases for comparative case studies aiming to discern causal mechanisms and address the puzzles behind deviant cases. Finally, we detail the implications of modifying the set-theoretic cross-case model in the light of case-study evidence. Following the principles developed in this article should increase the inferential leverage of set-theoretic MMR.

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Crisp-set QCA, fuzzy-set QCA, necessity, sufficiency, nested analysis, process tracing, case selection

Introduction

Combining regression analysis with process tracing has received increasing attention in the methodological and empirical literature in recent years.[1] While valuable, this multi-method research (MMR) literature provides little guidance, if not wrong advice, for MMR involving set-theoretic methods and their focus on necessary and sufficient conditions because of the fundamental differences between correlational and set-relational methods (Ragin 2008:chaps. 10-11; Grofman and Schneider 2009).[2] There is, thus, a gap in the methodological literature on how to link the analysis of set relations with inquiries into the underlying causal mechanisms and to resolve puzzles in the form of deviant cases. In this article, we spell out principles for the combination of qualitative case studies with *Qualitative Comparative Analysis* (QCA), as arguably the most formalized technique among all set-theoretic methods (Schneider and Wagemann 2012).[3]

Although it is becoming more common in empirical research,[4] there are only very limited guidelines on how to systematically integrate QCA and process tracing in a single analysis. Ragin (e.g. 2000:90; 2006b:309) emphasizes the general importance of case studies—mainly because QCA, much as regression analysis, infers causation from a cross-case association (Seawright 2005). There is, however, no elaboration of how exactly process tracing and QCA should be linked. The lack of debate is striking because QCA is strongly connected with a thorough knowledge of cases (Ragin 1981, 1987, 2000; Rihoux and Lobe 2009). Similarly, there is broad consensus that process tracing serves to acquire in depth knowledge about the cases under study (George and Bennett 2005: chap. 10; Mahoney 2000; Mahoney and Goertz 2006), but it has not so far been systematically discussed in the context of QCA. Goertz (2008:11-14) offers a short discussion of what he calls qualitative case selection. While insightful, the discussion does not systematically touch on many integral concepts of QCA that, as we show, are paramount for meaningful case selection, such as conjunctural causation, equifinality, and the consistency and coverage of set relations (Ragin 2006b).

In the following, we distinguish between *pre-QCA* and *post-QCA* case studies as a means of clarifying the focus of our article and to relate it to work connected to QCA and process tracing. Figure 1 offers a stylized presentation

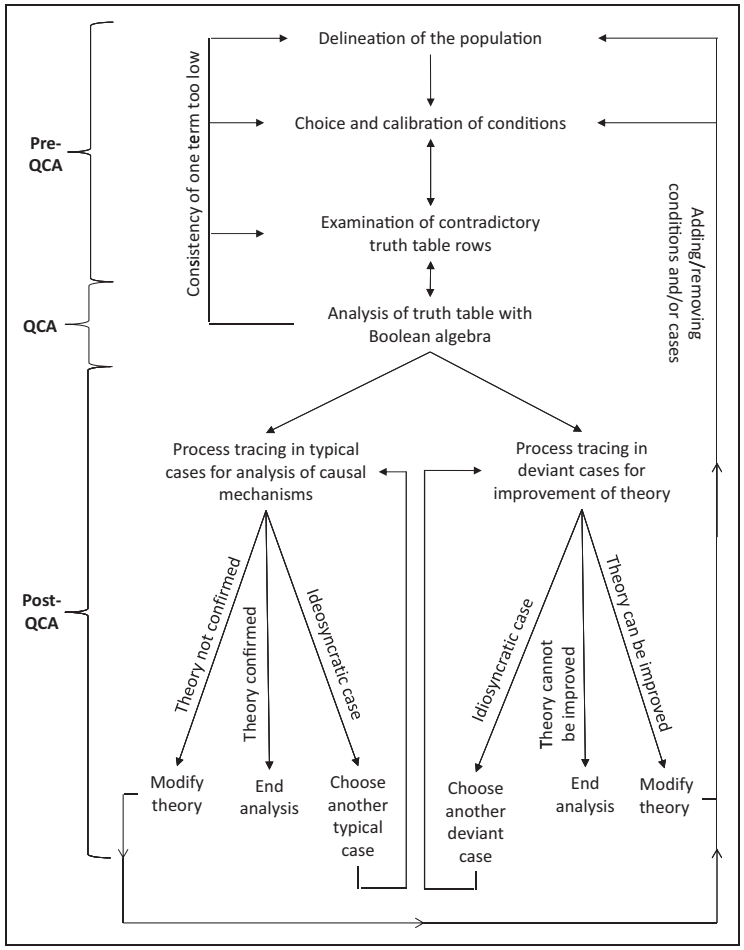

Figure 1. Pre-QCA and post-QCA case studies in QCA.

of the distinction between a pre-QCA part, the QCA as the actual cross-case analysis, and the post-QCA part.[5] "QCA" here refers to QCA as a technique (Berg-Schlosser et al. 2009; Schneider and Wagemann 2010), that is, the analytic moment of analyzing a truth table with Boolean algebra.

Since pre-QCA research has received considerable attention in the past, we leave it with a short discussion here. The main purposes of pre-QCA case studies (see Rihoux and Lobe 2009) are to define the universe of cases (Ragin

2000:chaps. 2, 7), to discern and calibrate conditions to be included in the analysis (Berg-Schlosser and De Meur 2009), and to address contradictory truth table rows (Ragin 1987:113). When one or more rounds of dialogue between ideas, truth tables, and pre-QCA case studies lead to a sufficiently well specified truth table, it can be analyzed in a QCA relying on Boolean algebra. In light of the numerous and excellent treatments of Boolean algebra and its application on empirical data,[6] we again refrain from delving deeper into the specificities of this topic.

In this article, we focus on post-QCA process tracing[7] and its potential implications for the pre-QCA part and the analytic moment of a QCA as depicted in Figure 1.[8] Leaving a detailed discussion of post-QCA case studies for the following sections, we start by highlighting the core characteristics of post-QCA process tracing upfront.[9] First, we transfer the notion of *typical cases* and *deviant cases* (sometimes called anomalous cases) to the realm of set-theoretic MMR and explain how to identify and choose them based on QCA results. Second, we demonstrate that the asymmetric nature of set relations (Ragin 2008:138) has manifest ramifications for case selection. The choice of cases follows different rationales depending on whether one is choosing cases after a QCA that aimed at detecting *necessary* or *sufficient* conditions. Third and related, the case selection procedure hinges on whether one is interested in the *consistency* or *coverage* of a set relation (Goertz 2006; Ragin 2006b). One important consequence of the opportunity to focus on different set relations and corresponding descriptive measures is that there is only *one type of typical case*, but *different types of deviant cases*, all serving different analytic purposes. Fourth, we show that the basic principles of post-QCA case selection are the same for crisp-set QCA (csQCA) and fuzzy-set QCA (fsQCA). However, the more fine-grained information contained in fuzzy-set membership scores provides additional leverage for the selection of the *most* typical and *most* deviant cases.

Fifth, we use formal logic to delimit the reasons for the deviance of anomalous cases. Depending on the type of deviant case, these reasons differ and trigger different analytic angles for process tracing. Sixth, we reverse our perspective and explicate the repercussions of process tracing insights for theory and the QCA model. As Figure 1 shows, we thereby relate post-QCA case studies to the pre-QCA stage and demonstrate how one can go full circle in set-theoretic MMR. Seventh and finally, we broaden the perspective to case selection for *comparative* process tracing by proposing multiple comparative designs that are viable in set-theoretic MMR.

We proceed as follows. In the first section, we set the stage by a discussion of the key principles of set-theoretic MMR upfront and the introduction of

Table 1. Summary of Principles for Set-Theoretic MMR.

	Crisp-Set and Fuzzy-Set QCA	Fuzzy-Set QCA
Single-case and comparative process tracing	*Principle of diverse case selection:* Choose at least one case for each term of the solution. *Principle of unique membership:* Choose cases that are members of just one term. *Truth table principle for sufficiency:* For the choice of a deviant case for coverage, determine the truth table row to which the case belongs.	*Principle of maximum set membership:* The most typical case displays maximum set membership scores in the subset and the superset. *Principle of maximum set membership difference:* The most deviant case displays maximum difference in its set membership in the subset and the superset. *Principle of differences in kind and degree:* Differences in degree should only be established among cases that are similar in kind and located on the same side of the secondary diagonal
Comparative process tracing	*Positive outcome principle:* At least one case must be a member of the outcome in comparative process tracing. *Truth table principle for necessity:* When comparing a typical case and an individually irrelevant case, choose two cases that differ in their membership in the necessary condition and the outcome, but share the qualitative membership in all other conditions that constitute the truth table.	*Principle of deviance in kind:* Choose deviant cases for consistency that are qualitatively different from typical cases in their membership in the superset. *Principle of max-max difference:* When comparing two typical cases, or a typical case with an individually irrelevant case, maximize the difference of the cases' set membership in the superset and the subset. *Principle of maxi-min difference:* When comparing a typical case with a deviant case, maximize the difference of the cases' set membership in the superset and minimize the difference in the subset.

Note. All principles refer to set-theoretic MMR as a method, not to its practice. In principle, it is required, for example, to select at least one case for each sufficient term. In practice, this might not be feasible due to resource constraints, though.

our leading empirical example that we use throughout the article. In the second section, we discuss the logic of the selection principles in csQCA, first focusing on statements of necessity and then sufficiency. For each type of set relations, we also discuss the implications of causal heterogeneity and develop criteria for comparative process tracing. In the third section, we address the very same issues in the context of fsQCA.

Setting the Stage

The following discussion of post-QCA process tracing leads us to the formulation of clear-cut principles that govern set-theoretic MMR (Table 1). Some principles are general because they apply to csQCA and fsQCA, to necessary and sufficient set relations, and to single-case and comparative process tracing. Other principles are specific to comparative case studies, which, in addition, hold regardless of the type of QCA and, with the exception of the truth table principle, pertain to sufficiency and necessity. Finally, five principles are unique to fsQCA as they take advantage of the fine-grained information contained in fuzzy sets. The pursuit of these principles greatly enhances the quality of set-theoretic MMR and fosters the generation of causal inferences.

In the following, we elaborate on these principles step by step. We rely on an empirical study on incremental trade policy change (Samford 2010a) in order to demonstrate the practical implications of the principles and their applicability to real-world data.[10] Since this study is presented in detail by Samford, we limit ourselves to the key issues here.[11] The units of analysis are administrations in 11 Central and Latin American countries between 1970 and the early 2000s. Altogether, 61 cases of trade policy making are investigated. The outcome set is incremental trade policy change (name of set: *inc*). We use five conditions for discerning what the necessary conditions and sufficient conditions for this outcome are: positive economic growth (*posgr*), normal inflation (*norminf*), stable exchange rate (*stabrate*), weak manufacturing sector (*weakman*), and negative economic growth (*neggr*).[12]

We do not aim to make a substantive contribution to the literature because we are exclusively concerned with the methodological elaboration of set theoretic MMR. For this reason, we also do not give a detailed process tracing account of one or more of the cases under analysis. Within-case analyses play an indispensable part in set theoretic MMR, but the exposition of our key arguments does not require the presentation of process tracing results. Methodological arguments should not be judged by the empirical results they produce in a selected example. Instead, they must be evaluated on methodological grounds only. For example, whether a typical case delivers evidence

Table 2. Types of Cases in csQCA for Necessity.

Crisp-Set Membership in Outcome *inc*	1	(4) Deviant Cases Consistency ($n = 3$)	(1) Typical Cases ($n = 34$)
	0	(3) Individually irrelevant cases ($n = 6$)	(2) Irrelevant cases ($n = 18$)
		0	1
		Crisp-set membership in necessary term *posgr+norminf*	

in line with the theoretical expectations is an *empirical* question. As Figure 1 highlights, it might be that one or all typical cases do not offer confirming within-case insights. This would undermine the theoretical arguments that underlie the given empirical analysis, but it does not invalidate our arguments that the selected case is typical, given the general meaning of a typical case and its specific meaning in post-QCA case selection.

Crisp-set QCA and Process Tracing

Necessity

The analysis of necessity reveals that the condition positive growth (*posgr*) has a consistency of 0.86 for the statement that it is necessary for the outcome "incremental trade liberalization." Among all conditions of interest, this comes closest to the conventional consistency level of 0.90 (Ragin 2006b). Still, its consistency is too low and none of the single conditions or any of their negations is necessary for the outcome. In analyses of necessity, however, it can make sense to combine two conditions by the logical OR operator in order to create a higher-order construct of which these conditions are functionally equivalent indicators (Ragin 2000:174; Schneider 2008:110). This can be argued to hold true for the conditions positive growth and normal inflation (*norminf*). Both can be interpreted as instances of a set called "conducive economic environment" and can be joined by the logical OR operator. While both conditions on their own are not necessary, their logical union passes the threshold consistency of 0.90 with a score of 0.92. Furthermore, their joint coverage of 0.65 indicates that it is not trivial.

Types of Cases in a csQCA of Necessity. A statement of necessity entails that the condition is a superset of the outcome (Most and Starr 1989: chap. 3). The implications of this definition for case selection are exemplified with a 2 $\times$ 2 table that plots each case's membership in the solution *posgr+norminf*

against its membership in the outcome *inc* (Table 2). In this table, *typical cases* are located in cell 1. Cases in this cell are in line with the set-theoretic statement of necessity and show both the condition and the outcome. In our example, 34 cases qualify as typical.

However, the mere classification of cases as typical does not suffice here as it fails to do justice to the idea of *causal heterogeneity* (Ragin 1987:chap. 2). Causal heterogeneity, denoting the fact that social phenomena usually come about in various and mutually nonexclusive ways, is a pervasive feature in analyses of sufficiency (see below). Yet, diversity also plays a role in the analysis of necessity when different conditions serve as substitutable indicators of the same concept. Such causal heterogeneity has two important ramifications for QCA-based case selection. First, one should select at least one case for each term contained in the solution.[13] As regards the solution for necessity, one should pick one case for process tracing of the condition "positive growth" and one case for the condition "normal inflation." We summarize this consequence of causal heterogeneity in the *principle of diverse case selection*:

Choose at least one case for each term of the solution.

Applied to our empirical example, the principle of diverse case selection yields 32 cases that are typical for the condition "positive growth" and 31 typical cases for the condition "normal inflation." This principle has further implications for the generalization of process tracing insights because it is intimately linked to the notion of contingent generalization, a concept known from the case study literature (George and Bennett 2005:111-13). In QCA-based MMR, this means that the insights derived from process tracing should only be generalized to cases that are members of the same term. This follows directly from the idea of causal heterogeneity, for it means that there are *qualitatively* different ways in which a condition is tied to the outcome.[14]

The second ramification of causal heterogeneity is related to the phenomenon that a typical case may be a member of more than one term. We refer to such cases as *joint members* and the corresponding phenomenon as *joint membership*. Cases that are not members of any term are instances of *nonmembership*. In contrast, cases are *unique members* and have *unique membership* if they are a member of only one term of the solution. Cases characterized by unique membership are superior choices for within-case analysis compared to cases with joint membership.

The goal of process tracing is to focus on one term and to unravel the mechanism through which it contributes to the outcome in the case under

study (George and Bennett 2005:252). Cases that meet this requirement have been recently called pathway cases (Gerring 2007) which are equivalent to what we call cases with unique membership in a term. In contrast, the analysis of joint members makes process tracing unnecessarily complicated because the outcome is empirically overdetermined (Gerring 2007:240-41). We therefore propose the *principle of unique membership* for handling this issue.

Choose cases that are members of just one term.

Of course, this principle can only be followed if there are uniquely covered cases. In the absence of such cases, we are left with the second-best choice of joint members. The application of this principle to the empirical example yields three typical cases with unique membership in "positive growth" and two cases with unique membership in "normal inflation."[15] This example highlights that the number of suitable typical cases with unique membership is often much smaller than a simple look at the membership of cases in the solution may suggest. Argentina from 1973 to 1974, and Peru from 1980 to 1985 and 1985 to 1990 are unique members of the condition "positive growth." Process tracing in one of these cases should address the counterfactual whether the country would not have engaged in incremental trade liberalization if it were not characterized by positive economic growth (see Goertz and Levy 2007). Argentina from 1999 to 2001 and Venezuela from 1999 to 2003 are typical cases and unique members for condition "normal inflation." For these countries, the relevant counterfactual for process tracing is whether they would not have committed incremental trade liberalization if it were characterized by non-normal inflation.

Deviant cases regarding consistency are located in cell 4 of Table 2. They display the outcome in the absence of the purported necessary conditions, thus contradicting a statement of necessity. In our empirical example, there are three administrations that engaged in incremental trade liberalization although they have neither of the two necessary conditions present. These cases are Bolivia 1982 to 1985 and 1985 to 1989, and Venezuela 1994 to 1999. With respect to the sources of deviance, one can distinguish three broad reasons for anomalous cases. The first two reasons belong to the pre-QCA stage (see upper half of Figure 1). First, the population of cases has been misspecified and the case should be excluded (Mahoney and Goertz 2004; Ragin 2000: chap. 2; 2006a:335-37). Second, the conditions and/or the outcome have not been correctly calibrated. For necessity and csQCA, this could mean for example that the threshold for set membership in the conditions has been set too high. By

slightly lowering the threshold (based on theoretical arguments and empirical insights), the deviant case would become a member of the recalibrated condition and turn into a typical case.

Third, the reason for deviance can be model related and is handled in post-QCA process tracing. As we show in the following, "model related" means that one has either omitted a condition (or more) or included too many conditions in the analysis. One specific model-related reason for the occurrence of deviant cases for consistency can be the *omission* of a necessary condition from the solution. This condition can only be added to the solution via the logical OR operator, which means that the missing condition must be a functional equivalent to the necessary conditions that is already part of the solution (Ragin 2000:174). Adding another condition through the logical OR operator turns the deviant cases into typical cases for the new, expanded higher-order construct if the deviant cases are members of the added condition. This is so because the logical OR operator requires assigning cases the maximum set membership across all conditions combined by logical OR (Ragin 2000:175).

With respect to our empirical example, suppose that process tracing in one of the three deviant cases for consistency points to a nonstable exchange rate ($\sim$*stabrate*) as a necessary condition, a condition that was not considered during the original analysis. This empirical evidence can be complemented with the theoretical argument that a nonstable exchange rate is also an indicator for the higher-order construct "conducive economic environment" in relation to the outcome "incremental trade policy liberalization."[16] Moreover, one should answer in the affirmative the counterfactual that if this deviant case was described by a stable exchange rate, it would not be an empirical instance of incremental trade liberalization. If these requirements are met, one should add condition $\sim$*stabrate* to the expression *posgr*+*norminf* in order to determine whether this turns the deviant cases for consistency into typical cases. Indeed, all three formerly deviant cases are members of $\sim$*stabrate*, producing a consistency of 1 and a coverage score of 0.61 for the expression *posgr*+*norminf*+$\sim$*stabrate*. In this example, process tracing helps forming a fully consistent and non-trivial necessary expression.

In addition to consistency, one can describe a set relation with the descriptive measure of coverage (Ragin 2006b). At first glance, one might think that cases can also be deviant with respect to the coverage of a necessary condition. In contrast to sufficiency (see below), though, there is no point in subjecting this type of case to process tracing in the realm of necessity. Cases in cell 2 of Table 2 do not qualify as deviant from a pattern of necessity because there is no reason to expect the outcome to be in place when the necessary condition is present (in this instance, X would be sufficient and a subset of Y). Since there is nothing puzzling about cases in cell 2, we deem it futile to argue that there are empirically relevant deviant cases with respect to the coverage of a necessary condition. These cases are, thus, no suitable object for process tracing. Consequently, we declare cases in cell 2 to be irrelevant in QCA on necessity.

This is different for cases located in cell 3, which we label *individually* irrelevant (IIR). They are neither a member of the condition nor of the outcome. Process tracing in these cases cannot provide relevant empirical insights on why the presence of the condition is necessary for the presence of the outcome (Goertz 2008:12). However, cases in cell 3 of Table 2 can become valuable in comparative process tracing (see below). This is why we call them individually irrelevant as opposed to the entirely irrelevant cases in cell 2.[17]

Comparative Process Tracing After a csQCA of Necessity. So far, our discussion has been concerned with identifying typical and deviant cases. Single-case studies have merit, but there are two reasons in favor of comparative process tracing. First, insights gathered in one typical case can be strengthened by selecting another typical case (Goertz 2008; Lieberman 2005) or, as we show below, by comparing a typical case with an IIR case. Second, without knowledge of the causal processes operative in a typical case, one can hardly discern the reason(s) for the deviance of a case (Tarrow 2010). In fact, the added value of comparative process tracing vis-à-vis single-case studies is the enhanced ability to search for model-related reasons *why* a case is anomalous (Lieberman 2005).

The general goal of QCA and process tracing in set-theoretic MMR is to find the necessary and sufficient conditions for an outcome and to explain how each term is related to the phenomenon of interest (Berg-Schlosser et al. 2009; George and Bennett 2005: chap. 10). It follows that any comparison must involve at least one case that is a member of that outcome. We formulate the *positive outcome principle* in order to emphasize this salient issue, which holds regardless of whether one is interested in necessity or sufficiency:

> At least one case must be a member of the outcome in comparative process tracing.

The positive outcome principle allows for two different forms of comparison. The *similar-outcome comparisons* match cases that are qualitatively identical with regard to their membership in the outcome. In combination with the positive outcome principle, this implies that all cases must be members of the

outcome. The *dissimilar-outcome comparison* includes one case that is a member of the outcome and one case that is a member of the negated outcome. On the basis of our previous discussion of types of cases in a QCA of necessity, it becomes apparent that the similar-outcome comparison can consist of two (or more) typical cases, or one typical case and one deviant case for consistency. The only viable form of dissimilar-outcome comparison in analyses of necessity contrasts a typical case with an IIR case from zone 3.[18]

The rationale for the *comparison of multiple typical cases* is to bolster our confidence that the necessary condition indeed is tied to the outcome and that the causal mechanism is operative in different cases (Goertz 2008). Following the principle of unique membership and presuming causal heterogeneity, this means that two (or more) typical cases are members of the outcome and unique members of a necessary condition. With respect to the condition "positive growth," such a comparison could include, for example, Peru 1980 to 1985 and 1985 to 1990. Since the original solution comprises two necessary conditions, the principle of diverse case selection requires performing three pairwise comparisons.

The second type of similar-outcome comparison matches a *typical case and a deviant case for consistency*. We argued above that an omitted condition may account for such anomalous cases. The comparative analysis should thus focus on the search for a condition that meets three criteria. First, the deviant case is a member of the omitted condition because only then it will become a typical case once the condition is added to the new solution. Second, the newly discovered condition is a functional equivalent of all conditions that are part of the original solution. Third, the condition must pass the counterfactual that if it were absent in the typical case, the outcome would be absent as well for this case. On the basis of these criteria, a comparison of a typical case and a deviant case for consistency promotes the focused search for an omitted condition. For illustration, imagine we select the case of the Venezuelan government from 1994 to 1999 as a deviant case and the same country's government from 1999 to 2003 as a typical case. These two cases permit us to perform a longitudinal comparison within the same country (George and Bennett 2005:166). In order to corroborate the claim that the condition "nonstable exchange rate" can be subsumed under the construct "conducive economic environment," one should collect evidence indicating that political actors in Venezuela perceived an unstable currency as conducive to incremental trade liberalization.[19] If theoretical and conceptual arguments can be substantiated with such evidence, it is justified to add a necessary condition to the existing solution.

As regards the realization of this similar outcome comparison, we specifically recommend comparing a deviant case for consistency with as many qualitatively different typical cases as there are conditions in the solution. Concerning our empirical example, this would involve the contrast of a deviant case for consistency—like Venezuela from 1994 to 1999—with a typical case for the condition "normal inflation"—such as Venezuela from 1999 to 2003—and a typical case for the condition "positive growth"—such as Peru from 1985 to 1990. This strategy, which we only recommend in analyses for necessity, is mandated because of the requirement that the new condition is a functional equivalent for all existing necessary conditions.

The only viable dissimilar-outcome comparison in a QCA of necessity contrasts *a typical case with an IIR case*. Two requirements must be met for an intelligible comparison of these two types of cases. First, if the QCA of necessity points to causal heterogeneity, the typical case should be a unique member of one term.[20] The IIR case is, by definition, a nonmember of all terms. Second, the cases to be compared should be described by two truth table rows that only differ in the outcome and the purported necessary condition. A comparison of a typical and IIR case along these lines represents a good strategy for replacing the counterfactual that one is confined to when performing a single-case study of a typical case (see above). From the typical case, we know that the configuration of conditions—the truth table row—describing this case is sufficient for producing the outcome. Since the IIR case is characterized by the same configuration except for the absence of the necessary condition, we now have an empirical basis for evaluating the claim that the condition is necessary: We can investigate how its absence is connected to the absence of the outcome in a case that is otherwise similar to the case for which we observe the outcome.[21] We capture this procedure in the *truth table principle for necessity*:

> When comparing a typical case and an IIR case, choose two cases that differ in their membership in the necessary condition and the outcome, but share the qualitative membership in all other conditions that constitute the truth table row.

Applying this principle to our empirical example, one should follow both the principle of unique membership and the principle of diverse case selection and compare an IIR case with a typical case for *norminf* and *posgr*, respectively. For the condition "positive growth," there exists a pair of cases that meets the truth table principle for necessity. Peru 1980 to 1985 is a typical case described by the row $\sim$*weakman**$\sim$*stabrate**$\sim$norminf**neggr**posgr, whereas Peru 1990 to 1995 is an IIR case and member of the row $\sim$*weakman**$\sim$*stabrate**$\sim$norminf**neggr**$\sim$*posgr*.

Table 3. Descriptive Measures of the Parsimonious Solution for Outcome *inc*.

Number	Terms	Consistency	Raw Coverage	Unique Coverage
1	weakman* ~ neggr	0.92	0.30	0.27
2	stabrate* ~ posgr	1.00	0.05	0.05
3	weakman* ~ stabrate*norminf	1.00	0.08	0.05

Note. Solution consistency: 0.94; solution coverage: 0.41.

Table 4. Types of Cases in a csQCA of Sufficiency.

Crisp-Set Membership in Outcome *inc*	1	(4) Deviant Cases Coverage ($n = 22$)	(1) Typical cases ($n = 15$; 10 unique members of term 1)
	0	(3) Individually irrelevant cases ($n = 23$)	(2) Deviant cases consistency ($n = 1$)
		0	1
		crisp-set membership in QCA solution (*X*)	

For the other necessary condition—"normal inflation"—the principle of unique membership cannot be fulfilled because none of the typical cases holds unique membership in it (see above). The second best option in such a situation for a comparison—which, however, would render process tracing and causal inference more complicated—contrasts the nonunique typical case Argentina 1974 to 1976 (member of ~*weakman**~*stabrate***norminf**~*neggr***posgr*) to the IIR case of Brazil 1985 to 1990 (member of ~*weakman**~*stabrate**~*norminf**~*neggr***posgr*).[22] This example shows that while, in principle, our case principles are not in a trade-off relation, in research practice it will not always be possible to follow all of them.

Sufficiency

Table 3 presents the most parsimonious csQCA solution for sufficiency.[23] From the three terms that produce the outcome, two have a consistency score of 1, meaning that these terms do not display any deviant cases for consistency (see below). However, the measures for raw and unique coverage show that their empirical relevance is very low. In contrast, the consistency of the first term—the combination of a weak manufacturing sector and nonnegative growth (*weakman**~*neggr*)—has a less than perfect consistency of 0.92. At the same time, its empirical importance is higher with a raw coverage of 0.30 and a unique coverage of 0.27. In the following, we focus on the first term in order to explain the location of typical and deviant cases in relation to sufficiency and the feasible variants of comparative process tracing.

Types of Cases in a csQCA of Sufficiency. The basis for our discussion is Table 4. It presents the classification of cases as typical, deviant for consistency, deviant for coverage, and individually irrelevant. The table highlights one important difference to the analysis of necessity: Deviant cases for consistency and for coverage constitute two different types of anomalous cases lending themselves to process tracing with ramifications that we detail below.

In general, *X* is sufficient for an outcome if the set of *X* is a subset of the set of the outcome *Y*.[24] The cases that meet this definition are located in cell 1 and represent typical cases because they are empirical manifestations of both the outcome and the sufficient condition. In our empirical example, 15 cases count as typical with respect to the entire solution. Following the principle of unique membership and taking term 1 for illustration, we find that 10 cases are unique members of this term and suitable for finding out how the conjunction of a weak manufacturing sector and nonnegative growth is linked to the occurrence of incremental trade liberalization.

If a pattern of cases is fully consistent with the statement that a term is sufficient for the outcome, cell 2 would be void of cases. In empirical research, though, it is common that some cases contradict a statement of sufficiency and fall into cell 2. In our empirical example, Bolivia from 1971 to 1978 is such a case and thus qualifies as a deviant case for consistency. It is a unique member of the term *weakman**~*neggr*, but is not an empirical instance of the outcome "incremental trade liberalization." Bolivia from 1971 to 1978 represents a puzzling case because 10 cases are a unique member of the same term and are members of the outcome too. In analyses of sufficiency, the most likely model-related reason for deviance is the *underfitting* of a term, that is, the term lacks a relevant condition.[25] This clue directly follows from the fact that deviant cases have a higher membership in the term than in the outcome. The only way to lowering the membership of a case in the term is to add a condition in which the case is not a member. Due to the minimum-scoring rule for the assignment of set memberships in conjunctions (Ragin 2000:174), the deviant case then becomes a nonmember of the expanded term and turns from a deviant case into an IIR case for the statement of sufficiency.

Regardless of whether or not there are deviant cases for consistency, one may observe cases in cell 4 of Table 4, which we call *deviant cases regarding*

coverage. From a strict set-theoretic perspective, this type of deviant case does not provide evidence against the statement of sufficiency because we do not expect the outcome to occur when no sufficient term from the solution is present. Nevertheless, these cases are puzzling because they are members of the outcome and not covered by the solution. In our empirical example, 22 cases qualify as deviant cases with respect to coverage. From the perspective of QCA as a case-based method, it is necessary to take a closer look at these cases in exploratory process tracing.

The most plausible model-related reason for the existence of deviant cases for coverage is the *underfitting of the QCA solution* because there must be a missing term of which the deviant case is a member. Adding this missing term to the solution should turn the deviant into a typical case. In the analysis of deviant cases for coverage, process tracing should therefore aim at identifying this missing term. When choosing a deviant case for coverage, the only information we get from the cross-case analysis is that it is *not* a member of any term. Therefore, these terms cannot form the basis for process tracing here. As a starting point for the search for the missing term, we recommend to return to the truth table and determine the row to which the deviant case for coverage belongs. Given the conditions chosen at the outset of the QCA, this is the conjunction that best describes the case. We summarize this line of reasoning in the *truth table principle for sufficiency*:

> For the choice of a deviant case for coverage, determine the truth table row to which the case belongs.

When implementing the truth table principle, the principle of diverse case selection should also be followed. This means that deviant cases for coverage falling into different truth table rows need to be analyzed separately. Process tracing should aim at identifying a condition that is missing from the truth table row. The rationale is that the deviant case for coverage displays the outcome of interest, while a majority of cases that is described by the same configuration lacks the outcome. The discrepancy between the deviant case, on one side, and the IIR cases in the same truth table row, on the other side, can be resolved by adding a condition to the original row. If the deviant case and the other cases have opposite set memberships in the new condition, they will fall into two different rows in the new, expanded truth table and the contradiction is resolved (Ragin 1987:113-18).

At first sight, one may believe that the truth table principle requires a prohibitively high number of case studies because each deviant case for coverage may fall into a different truth table row. In practice, three reasons are likely to reduce the number of case studies that need to be performed. First, the number of deviant cases for coverage is limited by the phenomenon of limited diversity. This means that not all logically possible combinations of conditions will materialize in the data and that many of the empirically observed deviant cases tend to populate a relatively small number of truth table rows (Ragin 1987:106-13). Second, deviant cases for coverage can only fall into those truth table rows that are not implied by any term in the QCA solution. Third, deviant cases for coverage cannot be members of any of the truth table row that is fully consistently linked to the negation of the outcome.

Comparative Process Tracing After a csQCA of Sufficiency. Just like with necessity, similar-outcome and dissimilar-outcome comparisons are feasible in analyses of sufficiency. The only viable form of a similar-outcome comparison involves the contrast of multiple typical cases from cell 1. The rationale for this comparison is the same as in a QCA of necessity, namely to increase our confidence that there is a link between the term and the outcome and to enhance knowledge of how the underlying causal mechanism works.

The other two logically possible similar-outcome comparisons are not feasible in inquiries into sufficient conditions. First, the comparison of a deviant case for consistency with an IIR case is futile because it is in discord with the positive outcome principle. Second, a typical case and a deviant case for coverage are both members of the outcome, but a comparison is not insightful either. The typical case is a member of one or more terms of the solution, whereas the deviant case for coverage is not a member of any term in the solution. Consequently, one would compare two cases that are members of qualitatively different terms. This variant of a similar-outcome comparison offers helpful insights neither for improving the QCA model, nor for the better understanding of the deviant case for coverage. This is an interesting insight because the comparison of typical and deviant cases is usually seen as one of the key benefits of qualitative case studies (George and Bennett 2005:20). In QCA-based MMR, though, one must be cautious in following the logic of such a comparison blindly because it does not extend to the intuitively plausible comparison of typical cases and deviant cases for coverage.

Dissimilar-outcome comparisons offer two different variants in analyses of sufficiency: a comparison of a typical case with a deviant case for consistency and a comparison of a deviant case for coverage with an IIR case. On the first comparison, a typical case and a deviant case for consistency are both members of the same term, but have a different membership in the outcome. Concerning our empirical example and the term *weakman* ∼ neggr*, this would apply to a within-country comparison of Bolivia from 1989 to

1993 and from 1971 to 1978. Bolivia in the early 1990s is the typical case and an empirical instance of incremental trade liberalization in the presence of a weak manufacturing sector and nonnegative economic growth. Bolivia in the 1970s constitutes the deviant case that is described by the same configuration, but is an empirical instance of nonincremental trade liberalization.

Following our previous arguments, the goal of the analysis must be to identify an omitted condition that should be added to the sufficient term under investigation. In the ideal scenario, the deviant case is not a member of the omitted condition while the typical case is in the corresponding set. The inclusion of such an omitted condition into the sufficient term should imply that the typical case remains typical and that deviant case turns into an IIR one. For Bolivia from 1989 to 1993 and 1971 to 1978, the omitted condition could be the presence of an unconstrained executive because the Bolivian executive was constrained in the early 1990s and unconstrained in the 1970s. This could explain the striking dissimilarity between the two cases because nonincremental (i.e., rapid) trade liberalization causes political costs (Samford 2010a). A constrained executive may be unable to impose these costs on the society and has to engage in incremental liberalization. An unconstrained executive like in Bolivia from 1971 to 1978, on the other hand, had the necessary room of maneuver and could implement rapid liberalization.

If comparative process tracing led to the identification of a condition that should be added to the analysis, the question is: What are the implications of this insight for the analysis? As indicated in Figure 1, we recommend determining the membership of all cases in the new condition, to add this condition to the original truth table, and to run a new QCA on the expanded truth table. Running a new QCA is warranted because the inclusion of a new condition may change the truth table row into which a case falls. In fact, the reassignment of cases to enlarged truth table rows is the rationale behind the comparison of typical cases and deviant cases for consistency.[26] If we add the condition ''unconstrained executive'' (*execunco*) to the model and rerun the QCA, we find that Bolivia from 1989 to 1993 remains a typical case and is a member of the new solution term *weakman*norminf* ~ execunco*. At the same time, Bolivia 1971 to 1978 changes from an anomalous case for consistency into an IIR case. Since Bolivia from 1971 to 1978 was the only deviant case for consistency, its comparison with a typical case successfully resolved the puzzle.

The second variant of a dissimilar-outcome comparison brings together a deviant case for coverage with an IIR case. Our truth table principle for sufficiency extends here to comparative process tracing because two

nonmembers of the solution are involved. Case selection thus requires the choice of two cases that belong to the same truth table row. This is an ideal setting for comparative process tracing because both cases display the same combination of conditions, yet differ in their membership in the outcome. The logic behind this design is the same as for a comparison of a typical case and a deviant case for consistency. Process tracing should search for a condition that separates the deviant case for coverage from the IIR case. If one finds a condition in which the deviant case is a member and the IIR case is not, the two cases fall into different truth table rows once the condition is added to the truth table. For the reasons detailed before, one should rerun the QCA after the truth table has been expanded. If the deviant case for coverage is a member of this condition and the IIR case a nonmember, the former is now likely to be included in the minimization process and becomes a typical case for the new solution. In contrast, the IIR case will not be included in the solution.

In our empirical example, Venezuela from 1984 to 1989 is one deviant case for coverage out of nine that belongs to the truth table row in which all five conditions are present. This row is not included in the solution because it also contains three cases that are not a member of the outcome, thus making it too inconsistent to be included in the minimization process (consistency is 0.75). The three nonmembers of the outcome are IIR cases. One of them is Venezuela from 1974 to 1979. This case could be fruitfully compared with Venezuela from 1984 to 1989 in a longitudinal within-country analysis so as to discern a potentially omitted condition. Due to the principle of diverse case selection, separate pairwise comparisons are required for each deviant case for coverage falling into different truth table rows.

We conclude our discussion of comparative case studies with a table that summarizes all viable forms of similar and dissimilar-outcome comparisons for analyses of necessity and sufficiency, respectively. As the following sections shows, the basic logic of comparative process tracing is similar in fsQCA. This means that the types of comparisons and the underlying rationales presented in Table 5 are generic and extend to csQCA and fsQCA alike.

Fuzzy-Set QCA and Process Tracing

FsQCA allows for more fine-grained set memberships than csQCA (Ragin 2000: chap. 6), which makes the latter a special and restricted version of the former. As a consequence of this, all the case selection principles that we elaborated so far extend to fsQCA. Beyond this, the more nuanced measurement approach of fsQCA provides additional leverage for meaningful post-QCA

Table 5. Forms of Comparisons in Set-Theoretic MMR.

	Necessity	Sufficiency
Similar-outcome comparison	*Typical case vs. typical case:* Building or testing hypothesis on causal mechanisms *Typical case vs. deviant case for consistency:* Finding condition omitted from term	*Typical case vs. typical case:* Building or testing hypothesis on causal mechanisms
Dissimilar-outcome comparison	*Typical case vs. IIR case:* Building or testing hypothesis on causal mechanisms	*Typical case vs. deviant case for consistency:* Finding condition omitted from term *Deviant case for coverage vs. IIR case:* Finding condition omitted from truth table row and specification of a new term

case selection. In addition to the choice of cases that are similar or different *in kind*, which is integral to csQCA, fuzzy-set memberships allow one to establish differences *in degree* among cases that are similar in kind. In fsQCA, two cases are qualitatively identical if their fuzzy-set membership falls on the same side of the qualitative anchor at 0.5. Accordingly, two cases are qualitatively different if their membership scores are on different sides of this anchor (Ragin 2000:159). In addition to establishing differences in kind, fuzzy sets express differences of degree among cases that are on the same side of the anchor at 0.5. In the following, we show how the degree of set membership should be used for case selection. The major implication is that it is possible to distinguish between more or less typical and deviant cases and to determine better and worse pairs of cases for single-case and comparative process tracing.

Relations between fuzzy sets can be visualized with a so-called *XY plot*, the equivalent to a 2 × 2 table in csQCA (Ragin 2000:221; Schneider and Grofman 2006). It plots the fuzzy-set membership of a case in a term *X* against its fuzzy-set membership in the outcome *Y*. Since the presence of a set-relational pattern depends on whether the membership in *X* is higher (necessity) or lower (sufficiency) than the membership in *Y*, the secondary diagonal is a useful aid in *XY* plots. Following the logic of fuzzy-set relations (Ragin 2000: chaps. 8-9), *X* is a perfect subset of *Y* and fully consistent with the statement of sufficiency if all cases are located above the secondary

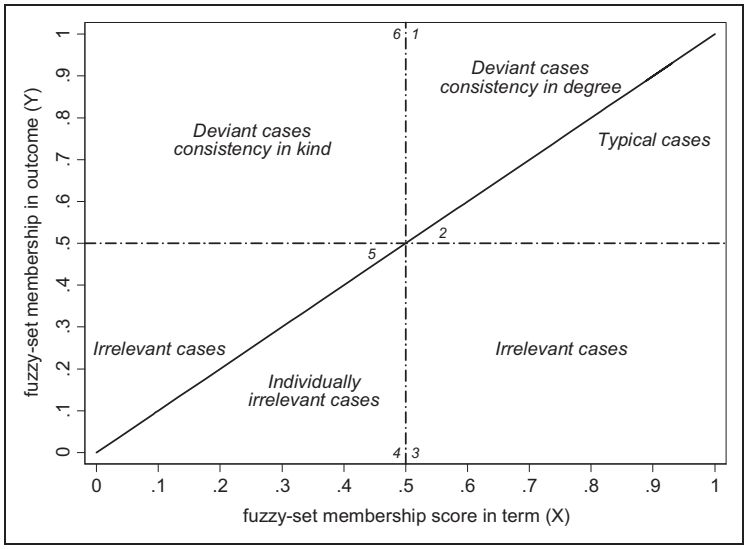

Figure 2. Enhanced *XY* plot and types of cases in fsQCA of necessity.

diagonal. In turn, a condition is fully consistent with the statement of necessity if all cases are below the secondary diagonal.

Though important, the secondary diagonal alone comes short of providing systematic guidance for case selection because it does not offer information about differences in kind. As a means to highlight the important role that differences in kind play for case selection, we superimpose a 2 × 2 matrix on the *XY* plot by adding a horizontal line and vertical line that run through the qualitative anchors of 0.5 for *X* and *Y*. The resulting *enhanced XY plot* comprises six zones (or areas or cells) that result from the intersection of the secondary diagonal and the 2 × 2 matrix. We now elaborate on the role of the zones for case selection and particularly focus on the differences between the choice of cases in csQCA and fsQCA. Since the available types of cases for post-QCA process tracing differ in a QCA of necessity and sufficiency, we present the enhanced *XY* plots for the two types of set relations separately.

Necessity

The enhanced *XY* plot for necessity is presented in Figure 2. In fsQCA, there are five different types of cases in analyses of necessity.

An fsQCA of the necessary condition(s) for incremental trade liberalization shows that positive growth (*posgr*) can be considered necessary for

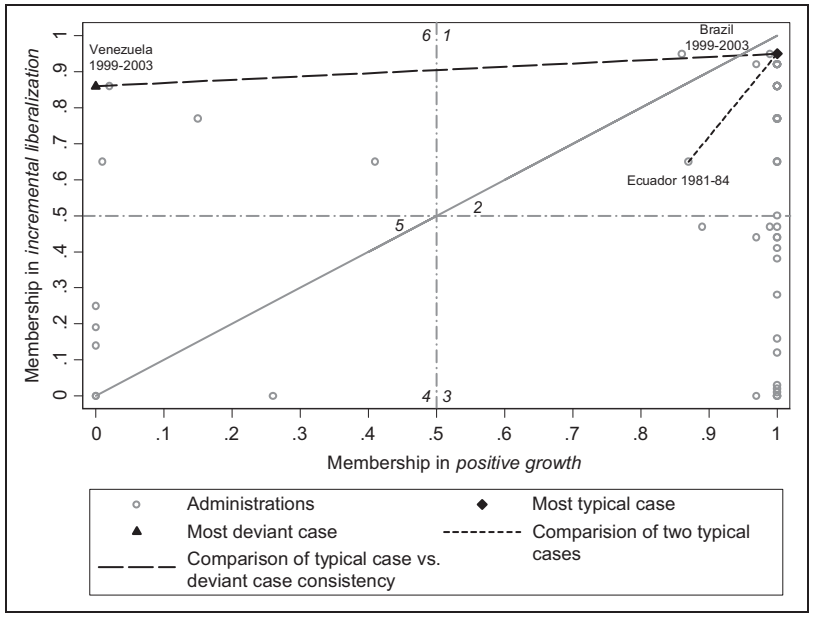

Figure 3. Enhanced *XY* plot for necessity of *posgr*.
Note. This plot does not visualize the comparison of a typical case with an IIR case because the plot displays membership in term *posgr*, whereas this specific comparison requires matching cases based on their membership in specific truth table rows. For the same reason, the plot for sufficiency does not display the comparison of a deviant case for coverage with an IIR case.

incremental trade liberalization. The condition has a consistency of 0.89 and a coverage score of 0.62. The enhanced *XY* plot in Figure 3 displays this sut relation. The three markers differentiate between the various types of cases that are relevant to distinguish in this context. The short-dash line connects the best pair of typical cases for comparison, while the long-dash line denotes the best comparison of a typical case with a deviant case for consistency.

Types of Cases in an fsQCA of Necessity. Typical cases for necessity are all cases in zone 2. These cases are members of the term and the outcome and have a higher membership in the former than in the latter. In our empirical example, 30 cases qualify as typical for the condition "positive growth." Without the requirement that the membership in the condition is higher than in the outcome, cases in zone 1 would count as typical as well. This would be wrong, however, because they are in discord with a set relational pattern of

necessity. This is an important difference to csQCA where all cases in the upper-right quadrant of the 2 × 2 table are typical. In fsQCA, the criterion for the assignment of cases as typical thus is more restrictive than in csQCA. Cases in areas 3 and 4 are also formally consistent with a pattern of necessity in fsQCA. However, these cases are not suitable targets for single-case process tracing. Cases in area 3 are entirely irrelevant because process tracing cannot deliver relevant empirical insights when the necessary condition is present while the outcome is not. Cases in area 4 are formally typical cases, but individually irrelevant because they are neither members of the outcome nor of the condition. They become relevant in comparison with a typical case, though (see above and below).

Apart from establishing deviance in degree and in kind (see below), a further difference to csQCA is that fsQCA renders it possible to determine the *most typical case* among all cases in area 2. The ideal-typical typical case has a membership of 1 in the condition and the outcome because the usefulness of a typical case for process tracing increases with the strength of its set membership in *X* and *Y*. The rationale is that it is easier to unravel the causal mechanisms linking the condition and the outcome in cases where both are strongly present (Ragin 2006b). In practice, cases with a set membership of 1 in *X* and *Y* might not always be available. The most typical case then is the one that falls closest to the upper-right corner of the *XY* plot. We capture this recommendation in the *principle of maximum set membership*:

> The most typical case displays maximum set membership scores in the subset and the superset.

An application of this principle to the condition "positive growth" reveals that Brazil from 1999 to 2003 is the most typical case among the 30 typical cases in zone 2.[27] It has a membership of 1 in the condition and a membership of 0.95 in the outcome "incremental trade liberalization." This distinguishes Brazil 1999 to 2003 from all other cases that have the same membership in the set "positive growth," but a lower membership in the set "incremental trade liberalization," or the same membership in the outcome but a lower membership in the term.

All cases located above the secondary diagonal are deviant because they are in discord with a statement of necessity. However, once we take into account the qualitative differences between cases in terms of their set membership in *X* and *Y*, only one of three areas in the upper-left triangle is relevant for post-QCA case studies. The only relevant zone is zone 6 comprising *deviant cases with regard to consistency in kind*. Their membership in the outcome exceeds that in the condition and they are located on different sides of the qualitative

anchor of 0.5 for *X* and *Y*. In our empirical example, five cases meet these criteria and are empirical instances of incremental trade liberalization, but are not good instances of the set "positive growth." These cases are more puzzling and interesting than cases in zones 1 and 5. Cases in area 5 are irrelevant because they are bad empirical instances of the outcome and the necessary condition (see above). This is different for inconsistent cases in zone 1 because they are members of the outcome but violate the subset relation of necessity. At the same time, they are also members of the condition "positive growth" and thus are similar to the typical cases from a qualitative perspective. Because of this, we refer to these cases as *deviant cases in degree*. Since these deviant cases are less puzzling, one should only opt for deviant cases in degree if there are no deviant cases in kind.

We put the distinctive feature of deviant cases in kind on a more general footing and formulate a principle that applies both to studies on necessity and sufficiency. From a set-relational perspective, the puzzle about a deviant case for consistency of necessity is its low membership, compared to a typical case, in the superset, which, in an analysis of necessity, is the set of *X*. As we show below, the same is true for deviant cases for consistency of sufficiency. It holds a puzzlingly low membership in the superset compared to a typical case—just with the difference that in statements of sufficiency, the superset is the set of *Y*. We therefore formulate the:

> Choose deviant cases for consistency that are qualitatively different from typical cases in their membership in the superset.

Again, it is possible to draw on the fuzzy-set memberships in order to identify the *most deviant case* for consistency. The ideal-typical deviant case for consistency is located in the upper-left corner of the *XY* plot. It is the strongest and most puzzling deviance from the alleged subset relation with a membership of 1 in *Y* and a membership of 0 in *X*. Framed in more general set-theoretic terms, the ideal deviant case has a maximum difference between the set membership in the subset (*Y*) and the superset (*X*). Since such a case may not exist in a given study, the more general criterion is to choose a case with maximum difference between the set memberships in *X* and *Y*. We condense this reasoning in the form of a general principle that applies to the selection of deviant cases for consistency and coverage and that we term the *principle of maximum set membership difference*:

> The most deviant case displays maximum difference in its set membership in the subset and the superset.

The application of this principle to the five cases in zone 6 identifies Venezuela from 1999 to 2003 as the most deviant case with a membership of 0 in the condition and of 0.86 in the outcome.[28] In other words, Venezuela in this period is a good empirical instance of incremental trade liberalization despite the complete absence of the necessary condition "positive growth."

Comparative Process Tracing After an fsQCA of Necessity. Our general distinction between similar-outcome and dissimilar-outcome designs fully extends to fsQCA. A *similar-outcome comparison* matches cases that are qualitatively identical with regard to their membership in the outcome set, that is, the fuzzy-set membership in *Y* is above 0.5 for all cases that are compared. Consequently, *dissimilar-outcome designs* match cases with qualitative differences in their membership in *Y*. Building on these similarities between csQCA and fsQCA, the benefits of fuzzy-set measurement can be made fruitful for the choice of cases for comparative process tracing.

In a comparison of multiple typical cases, the inferential aim is to increase the confidence that there is a causal mechanism linking *X* to *Y*. This is achieved by showing that the same mechanism is at play in typical cases that span the maximum range of fuzzy set membership in the condition and the outcome. On a broader, set-theoretic level, the requirement is that the two typical cases establish the maximum difference in the set membership in the superset and the subset. The ideal-typical pair of cases matches the case in the upper-right and lower-left corner of zone 2 in Figure 3. The goal should be to compare the case that is the best empirical instance for a necessary relationship (membership of 1 in *Y* and *X*) with a typical case that is barely more in than out of both the condition and the outcome (membership of 0.51 in *Y* and *X*). Again, it holds that if the two most adequate cases do not exist empirically, one should select those that come closest to them. We summarize these arguments in the *principle of max-max difference*:

> When comparing two typical cases, maximize the difference of the cases' set membership in the superset and the subset.

In our example, we need to identify the typical case to compare with Brazil 1999 to 2003 as the most typical case. It turns out that Ecuador 1981 to 1984 ($X = 0.87$; $Y = 0.65$) comes closest to the ideal of a "just-so" typical case. Although its memberships in *X* and *Y* are relatively high, there is no other case that is farther away from the most typical case.

In a comparison of a typical case with a deviant case for consistency, the second form of a similar-outcome comparison, the ideal comparison naturally includes the ideal typical and deviant cases. The contrast between the high and identical membership in *Y*, the subset, and maximum difference in *X*, the superset, is what makes the two cases the best match for comparative process tracing. For our empirical example, the comparison would focus on Brazil from 1999 to 2003 and Venezuela from 1999 to 2003 (see Figure 3). The rationale underlying this form of comparison can be generalized and summarized in the *principle of maxi-min difference*:

> When comparing a typical case with a deviant case, maximize the difference of the cases' set membership in the superset and minimize the difference in the subset.

Finally, one can perform a dissimilar-outcome comparison by matching a typical case with an IIR case from zone 4. These two cases hold qualitatively identical membership scores in all conditions except the necessary condition and the outcome, that is, they meet the truth table principle for necessity. In addition, the comparison of a typical and IIR case should follow the principle of max-max difference because process tracing becomes the easier, the larger the difference between the set membership in the superset and the subset. A look at our data shows that all IIR cases—Argentina 1976 to 1983, Chile 1973 to 1990, and Peru 1990 to 1995—fall into the truth table row *~posgr*neggr*~weakman*~norminf*~stabrate*. It turns out, though, that all of the typical cases are located in truth table rows that differ in more than one condition from that of the IIR cases. We then can opt for a counterfactual analysis or, alternatively, pick a typical case that differs on two conditions. In our analysis, this applies to the typical case of Peru 1985 to 1990 (row *posgr*~neggr*~weakman*~norminf*~stabrate*) because it differs from the IIR case in the conditions *posgr* and *neggr*. Peru 1985 to 1990 is best compared with Peru 1990 to 1995 because, under given circumstances, they achieve the best match of fuzzy-set membership scores.

Sufficiency

The enhanced *XY* plot underlying our discussion of sufficiency is presented in Figure 4. In contrast to necessity, the plot for sufficiency yields six types of cases.

The parsimonious fuzzy set solution for sufficiency on which we draw in the following is presented in Table 6.[29] There are two sufficient terms for the

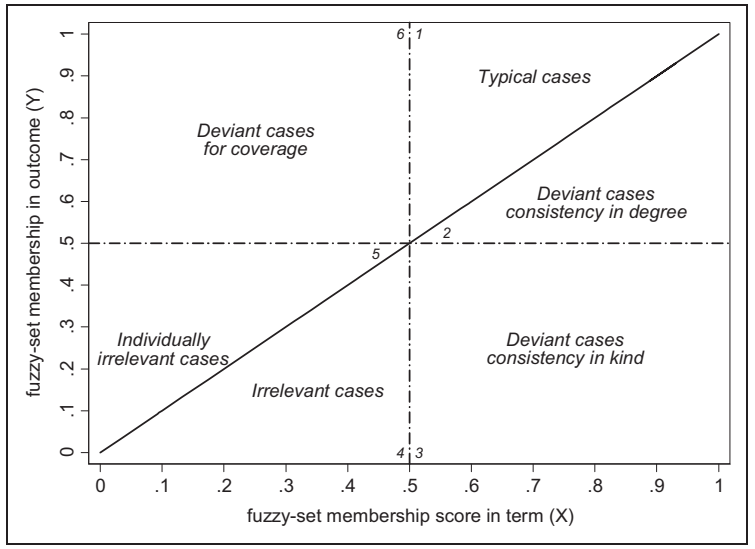

Figure 4. Enhanced *XY* plot and types of cases in fsQCA of sufficiency.

Table 6. Measures of Fit for Sufficient fsQCA Solution for the Outcome *inc.*

Number of Term	Term	Consistency	Raw Coverage	Unique Coverage
1	norminf*stabrate	0.74	0.71	0.31
2	norminf*neggr	0.81	0.48	0.07

Note. Solution: consistency = 0.74; coverage = 0.78.

outcome "incremental trade liberalization" each of which involves two conditions.[30] The consistency and coverage of both terms is high, but leave room for improvement and thus renders process tracing in typical and deviant cases warranted.[31]

For the illustration of case selection, we focus on the first term *stabrate* norminf*. Figure 5 presents the *XY* plot for this specific term.[32]

Types of Cases in an fsQCA of Sufficiency. In fsQCA, *typical cases for sufficiency* are located in zone 1 in the enhanced *XY* plot (Figures 4 and 5). Among the group of typical cases, the ideal-typical typical case for sufficiency has a membership of 1 in the term and the outcome. In the absence of the ideal typical

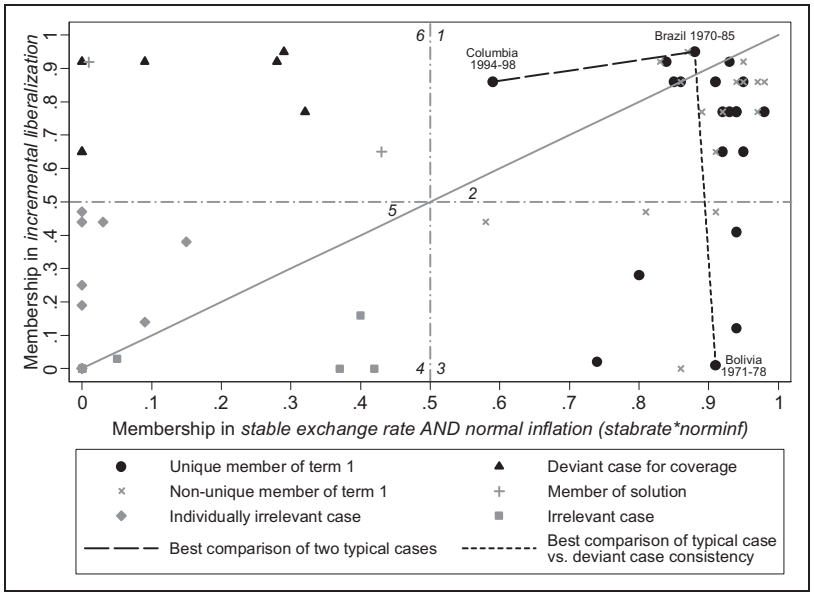

Figure 5. Enhanced *XY* plot for term *stabrate*norminf*.

case, the best typical case for sufficiency is located as closely as possible to the upper-right corner of area 1 in the *XY* plot. Applying the principle of unique membership and maximum set membership to the cases in zone 1, we obtain Brazil 1970 to 1985 as the most typical case for the term *stabrate*norminf*. From the perspective of fsQCA, cases in areas 5 and 6 are typical as well. However, they should not be taken for the analysis of causal mechanisms underlying the pattern of sufficiency. Cases in zone 5 are consistent with a statement of sufficiency, but they are not members of the condition and the outcome. This turns these cases into IIR cases and limits their inferential benefits to comparative process tracing in ways described below.

Cases in zone 6 are consistent with a statement of sufficiency in fsQCA. As explained above, though, they are better-coined *deviant cases with regard to coverage* because, qualitatively seen, they are members of the outcome and nonmembers of the term. In our empirical example, seven cases qualify as such. Following the truth table principle for sufficiency, we need to determine to which truth table rows these deviant cases coverage belong best. They fall into five different truth table rows, four of which being populated by only one deviant case. Three of the seven deviant cases coverage—Bolivia 1982 to 1985 and 1985 to 1989, and Venezuela 1994 to 1999—fall into

the row *weakman*∼stabrate*∼norminf*neggr*∼posgr*. The ideal deviant case coverage has a membership of 1 in both the outcome and the truth table row. A look at the three cases shows that the case of Bolivia 1982 to 1985 comes closest to the ideal and lends itself to exploratory process tracing. Its membership in the row is 0.97 and 0.65 in the outcome, whereas Bolivia 1985 to 1989 has membership scores of 0.59 in the row and 0.65 in the outcome and Venezuela a score of 0.68 in the row and 0.77 in the outcome.

With regard to cases below the secondary diagonal, we again distinguish between *deviant cases for consistency in kind and degree* and irrelevant cases. Irrelevant cases are located in zone 4 because they are inconsistent and nonmembers of the solution and the outcome. Deviant cases in degree are located in zone 2. They are inconsistent with a pattern of sufficiency, but share qualitatively identical memberships in X and Y with the typical cases in zone 1. In contrast, cases in area 3 are deviant cases in kind. They are members of the term of interest, but are not good empirical instances of the outcome "incremental trade liberalization." Following the idea of ideal-typical deviant cases in kind and applying the principle of maximum difference, Bolivia from 1971 to 1978 is identified as the most puzzling case with a membership of 0.01 in the outcome and 0.91 in the term *stabrate*norminf*.

In light of the discussion of types of cases in fsQCA, we want to conclude by highlighting the benefits of considering differences in kind and degree. An exclusive focus on differences in kind is not meaningful as it would fail to take advantage of the more fine-grained information contained in fuzzy-set membership scores. At the same time, an exclusive emphasis on differences in degree would also be flawed as it ignores important qualitative differences among cases on the same side of the secondary diagonal of an *XY* plot. We summarize our argument in the *principle of differences in kind and degree*:

> Differences in degree should only be established among cases that are similar in kind and located on the same side of the secondary diagonal.[33]

Comparative Process Tracing After an fsQCA of Sufficiency. The logic of case selection for comparative process tracing after an fsQCA for sufficiency follows the general principles laid down in the discussion of necessity. A comparison of multiple typical cases should follow the principle of max-max difference and span the maximum range of membership in the outcome and the term. Applied to our example, the two typical cases one should compare are Brazil 1970 to 1985 ($X = 0.88$; $Y = 0.95$) and Colombia 1994 to 1998 ($X = 0.59$; $Y = 0.86$). The ideal comparison of a typical case and a deviant

case for consistency includes two cases that display the maximum membership in the term X, the subset in analyses of sufficiency, and the maximum difference between the memberships in the outcome Y, the superset. Two cases that meet these criteria are Brazil 1970 to 1985 ($X = 0.88$; $Y = 0.95$)—the typical case—and Bolivia 1971 to 1978 ($X = 0.91$; $Y = 0.01$)—the deviant case for consistency.

The comparison of a deviant case for coverage with an IIR case follows the same logic. The ideal-typical pair of cases comprises a deviant case for coverage (zone 6) and an IIR case (zone 5). Following the truth table principle for sufficiency, these cases share a membership of higher than 0.5 in the same truth table row. In addition, according to the principle of maxi-min difference, they should have similar values in the row and a maximum difference in the membership in the outcome. In order to illustrate the logic of comparison, we focus on the truth table row *weakman* ~ stabrate* ~ norminf*neggr* ~ posgr*. As noted before, three deviant cases for coverage are members of this row: Bolivia 1982 to 1985 ($X = 0.97$; $Y = 0.65$), Bolivia 1985 to 1989 ($X = 0.59$; $Y = 0.65$), and Venezuela 1994 to 1999 ($X = 0.68$; $Y = 0.77$). The only IIR case in the same row is Venezuela 1989 to 1993 ($X = 0.73$; $Y = 0.14$). We identify Venezuela 1994 to 1999 as the best case for comparison with Venezuela 1989 to 1993 because they have similar membership scores in the truth table row, but display a large difference in the membership in the outcome.

Drawing Together and Looking Ahead

The rigorous combination of QCA and post-QCA case studies yields added inferential value compared to the application of one of the methods alone. Case studies benefit from QCA by disciplining the analysis of set-relational patterns that are difficult, if not impossible to identify in small-n research (Lieberson 1991). At the same time, process tracing is an invaluable complement for QCA in order to discern the causal mechanisms behind a set-relational pattern and further improve the theory and QCA model. Depending on the parameters of the study (necessity vs. sufficiency, etc.), we have shown how to use QCA results for systematic case selection, how to derive clues about the potential reasons of deviance from the results, and how process tracing insights feed back into the pre-QCA stage and the actual QCA.

Our discussion of post-QCA case studies further shows that they are different from pre-QCA case studies and are not a simple reinvention of the currently better-known pre-QCA wheel. Post-QCA process tracing can rely on QCA results for the choice of typical and deviant cases, which is

impossible in pre-QCA research. There is nothing like an empirically typical case during the pre-QCA phase. It is true that the cases that give rise to contradictory truth table rows in the pre-QCA stage are equivalent to what we call deviant cases in the post-QCA stage. Therefore, process tracing in cases from contradictory rows prior to a QCA and in deviant cases after a QCA can serve similar purposes (Ragin 1987 chap. 7; Rihoux and Lobe 2009): a reconsideration of the shape of the population, the reconsideration of concepts, the improvement of measurement, and the recalibration of conditions and/or the outcome. For several reasons, however, pre-QCA process tracing of cases from contradictory truth table rows is less useful for discerning model-related sources of deviance than post-QCA process tracing. First, model-related reasons can only be investigated once a model has been established with a QCA based on a well-crafted truth table. Second, post-QCA process tracing is based on a broader empirical basis because it draws on multiple truth table rows, whereas pre-QCA analysis is limited to a single row. Third, pre-QCA case studies tend to focus more on deviant cases with regard to consistency when investigating contradictory truth table rows, whereas in post-QCA process tracing the distinction between deviance in consistency and coverage is crucial. Finally, in post-QCA, the differences between statements of necessity and sufficiency are fully taken into account. In pre-QCA case studies, in contrast, the implications of these two set-theoretic relations for meaningful process tracing have received little consideration.

We emphatically underscore that our principles should not be applied in a mechanistic manner. The combination of QCA and process tracing may point to ways for improving the model, but not necessarily. The main purpose of our case selection principle is *not* to boost the consistency and coverage of a QCA solution, but rather to use them as a yardstick in the process of making theoretical sense of the empirical insights. If one can make a credible point that a condition should be added (or dropped) on the basis of evidence *and* theoretical reasoning, it is justified to modify the QCA model and rerun the QCA. No design and (multi-)method research is a remedy for weak theory, though. Along these lines, we note that it might seem that our principles, taken together, add up to an insurmountable task as they stipulate the need for multiple single-case and comparative case studies. Ideally, one would compare multiple typical cases, typical cases to IIR cases, typical cases to deviant cases, and deviant cases coverage to IIR cases. In practice, though, we are confined by limited resources. In this instance, the state of research in the field in which the study is located should drive the decision for a specific form of case study. If little is known about the causal mechanisms that underlie the set-relational patterns, it is best to start with the analysis of at

least one typical case. In a second step, it is worthwhile to broaden the perspective and include a deviant case into the analysis. Whether this is, in a QCA of sufficiency, a deviant case for consistency or coverage does not matter from our point of view. In both instances, the most likely source of deviance is the omission of a condition and, provided that such a condition is discerned in process tracing, a new QCA should be run on the expanded truth table.

We see two lines for further work on QCA-based MMR. First, the identification of the best typical case and deviant case and of the best-matching pairs of cases for comparison could be formalized for fsQCA. Selecting cases by eyeballing an *XY* plot, as we have done here, can be challenging. These challenges could be overcome by developing formulas that incorporate our case selection principles (see Rohlfing/Schneider 2013). A second line of research could elaborate the differences (and similarities) of QCA based MMR vis-à-vis regression-based MMR. It is certainly not meaningful to perform a beauty contest between the two forms of MMR since the choice between a set-theoretic and correlational MMR must be driven by theoretical considerations. Nevertheless, a comparative discussion of QCA-based and regression-based MMR would have the merit of avoiding misunderstandings about their respective nature, because what is a good practice for one design is not necessarily recommendable for the other.

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Notes

1. See Coppedge (1999), Fearon and Laitin (2008), Lieberman (2005), Rohlfing (2008), and Seawright and Gerring (2008) for methodological discussions.
2. Lieberman (2005:437), in passing, asserts that his protocol for nested analysis also applies to MMR including QCA. Readers familiar with regression-based MMR will notice that this does not hold because of the salient differences between correlational and set-theoretic causation.
3. Set-theoretic methods in the social sciences subsume a wide range of approaches (Byrne and Ragin 2009), including Mill's methods (Mahoney 1999), typological theory (George and Bennett 2005: chap. 11), and sequence elaboration (Mahoney, Kimball, and Koivu 2009). Among them, QCA is the most formalized set-theoretic method (Bennett and Elman 2006; Schneider and Wagemann 2012). Typological theory differs from QCA in that it does not aim at eliminating logically redundant conditions in order to obtain more parsimonious solutions.
4. See, for example, Kaeding (2007), Samford (2010a), Schneider (2008), and Segura-Ubiergo (2007).
5. The figure is inspired by Lieberman's (2005) visual summary of the combination of regression analysis and case studies. Rihoux and Lobe (2009) graphically present the research process in QCA but focus more on pre-QCA case studies. Our figure details the post-QCA part, which is called "interpretation" by Rihoux and Lobe.
6. See Caramani (2009), Ragin (1987, 2000, 2008), Rihoux and Ragin (2009), Schneider and Wagemann (2012), and Smithson and Verkuilen (2006).
7. For details on process tracing, see, for example, Beach and Pedersen (2012), George and Bennett (2005), Hall (2008), Goertz and Mahoney (2012), and Rohlfing (2012).
8. One should return to the pre-QCA part after the actual QCA when a *term* of a QCA solution does not meet the consistency threshold. A term can be a single condition, a conjunction of conditions (sufficiency), or the logical union of two conditions (necessity). The recommended minimum thresholds are 0.90 for necessity and 0.75 for sufficiency (Ragin 2006b). If these thresholds are not reached, one should reconsider the truth table with the conventional pre-QCA means. The focus on the consistency of individual terms as opposed to the entire solution is warranted due to causal heterogeneity (Ragin 1987:chap. 2), that is, the fact that QCA solutions usually consist of multiple terms.
9. This implies for our discussion that we presume familiarity with the key elements of QCA. For readers who are less familiar with the fundamentals of set theory and QCA, we provide an Online Appendix (which can be found at http://smr.sagepub.com/supplemental/) with introductions to those concepts that are core to our argument and http://hdl.handle.net/1902.1/20469.
10. We are greatly indebted to Steven Samford (2010b) for providing us with his data. For presentational purposes, we use the logical negation of Samford's original conditions and outcome and recalibrated the outcome set such that membership in it becomes easier.
11. The truth tables for our crisp-set and fuzzy-set data are provided in the Online Appendix to this article. The Online Appendix further includes all detailed QCA results and measures of fit that we do not report in this article and the classification of all cases for each of the QCA that we perform.
12. We perform an "ordinary" QCA. Two-step QCA (Schneider and Wagemann 2006) and particularly temporal QCA (tQCA; Caren and Panofsky 2005; Ragin and Strand 2008) would be at least equally suitable for set-theoretic MMR, for the latter's temporal component nicely matches the longitudinal perspective of process tracing.

13. Goertz (2008:11) calls this "choosing cases diversely."
14. If complemented with a counterfactual, a single case suffices to examine the mechanisms underlying a set relation (Mahoney et al. 2009). However, confidence in generalization increases with the number of cases subjected to process tracing. In relation to this, note that it is possible that different mechanisms are operative in different cases covered by the same set relation. However, unless there is process-tracing evidence that empirically shows such equifinality on the level of mechanisms, it is justified to assume causal homogeneity in the sense of identical causal mechanisms among cases of the same path.
15. Cases belonging to the same cell in csQCA (and to the same cell in fsQCA, see below) are qualitatively identical. In order to avoid cherry picking (Fearon and Laitin 2008) among qualitatively identical cases in csQCA, random selection procedures of one or more cases could be employed.
16. Exchange rates and trade policies are closely linked to each other. A nonstable currency makes it difficult to predict future trade flows and is conducive to incremental liberalization.
17. See the debate between Seawright (2002a; 2002b), Braumoeller and Goertz (2002), and Clarke (2002) on which cases are relevant for evaluating set relations.
18. A dissimilar-outcome comparison cannot include a case from zone 3 because these cases lack any inferential value in inquiries into necessary conditions. The comparison of a deviant case for consistency and an IIR case is not meaningful either. Process tracing in a deviant case for consistency aims at the identification of an omitted condition. Because this condition must be a functional equivalent for an existing necessary condition of which a typical case is a member, an omitted functional equivalent can only be examined via comparative process tracing involving at least one typical case.
19. Such evidence could be statements like "We did not see any reason to engage in more rapid liberalization because the unstable exchange rate increased economic uncertainty and therefore was more conducive to incremental change."
20. This again implies that one should perform as many comparisons as there are terms in the solution.
21. This comparison also demonstrates why an IIR case is not suitable for a single-case study. The relevant counterfactual that one should ask would be whether the outcome would be present if the necessary condition was present. This is not a relevant counterfactual for necessary condition analyses because a statement of necessity does not imply anything about the outcome if the necessary condition is present. We further note that the difference between the typical case and the IIR case could be due to an omitted condition that differs between the two cases. This should be checked in the process tracing stage.

22. An alternative would be to not engage in this type of comparative case study for condition *posgr* and to only perform a counterfactual analysis of a typical case (see above).
23. We use a frequency threshold of 1 and a consistency threshold of 0.90 for the assignment of outcome scores to the truth table rows. For our argument, it is irrelevant whether or not simplifying assumptions are made.
24. "X" can stand for a condition or a conjunction, called term, for multiple terms, or for the solution term.
25. Another logically possible, yet highly unlikely, reason for deviance for consistency is the overfitting of the solution. If process tracing suggests that there is no link between an entire term and the outcome, and there are no overwhelming theoretical reasons to suggest otherwise, it is justified to drop the term. Dropping the term turns the deviant case for consistency into an IIR case (it moves from cell 2 to cell 3), provided that it is not a member of any other term, which, according to the principle of unique membership, should hold.
26. We note the circularity problem that is inherent to this strategy (Rohlfing 2008). If process tracing in a deviant case for consistency points to an omitted condition, one has chosen a case on the basis of a QCA solution that is of questionable validity, which in turn casts doubt on the validity of the case selection strategy. However, the original QCA solution is the best basis for case selection that one can have for QCA-based MMR.
27. This follows from our principle of unique membership.
28. In our csQCA example, Venezuela from 1999 to 2003 was identified as a typical case. Note, however, that the statement of necessity for which this case was a typical example was *norminf* rather than *posgr*.
29. We use a frequency threshold of 1 and a consistency threshold of 0.81 for assigning set memberships to the outcome in the truth table.
30. The solution can be rewritten as *norminf**(*stabrate*+*neggr*), which does not mean that there is only one way in which the outcome can be produced. An integration of two terms into a single one would require identifying—on the basis of theory—the higher-order construct that manifests itself through either *stabrate* or *neggr* or both.
31. A consistency of 0.74 is low, but still high enough to enable meaningful case selection for process tracing.
32. The label "member of solution" subsumes both cases with joint membership and with unique membership in the second term.
33. One might argue that these principles are too rigid and that a case close to a qualitative anchor (or the secondary diagonal) could be said to be almost on the other side of the anchor. We want to make a plea for taking serious the diagonal and the anchors. Otherwise, case selection is entering muddy water and the follow-up question would be at what distance to the secondary diagonal and anchors one would say that the case is qualitatively different. Relaxing the importance of the

diagonal and the anchors simply shifts the problem of assigning cases to specific types into a much less tractable grey zone. The issues of proper set calibration and measurement error are discussed in the QCA literature and one should rely on proper tools for handling these problems (Eliason and Stryker 2009; Schneider and Wagemann 2012: chapter 11. 2; Skaaning 2011) rather than diluting the principles of case selection.

References

Beach, Derek and Rasmus Brun Pedersen. 2013. *Process tracing methods*. Ann Arbor: University of Michigan Press.

Bennett, Andrew and Colin Elman. 2006. "Qualitative Research: Recent Developments in Case Study Methods." *Annual Review of Political Science* 9:455-76.

Berg-Schlosser, Dirk and Gisèle De Meur. 2009. "Comparative Research Design: Case and Variable Selection." Pp. 19-32 in *Configurational Comparative Methods*, edited by B. Rihoux and C. Ragin. Thousand Oaks, CA: Sage.

Berg-Schlosser, Dirk, Gisèle De Meur, Charles C. Ragin, and Benoît Rihoux. 2009. "Qualitative Comparative Analysis as an Approach." Pp. 1-18 in *Configurational Comparative Methods*, edited by B. Rihoux and C. Ragin. Thousand Oaks, CA: Sage.

Braumoeller, Bear F. and Gary Goertz. 2002. "Watching Your Posterior: Comment on Seawright." *Political Analysis* 10:198-203.

Byrne, D. S. and Charles C. Ragin. eds. 2009. *The SAGE Handbook of Case-based Methods*. Los Angeles, CA: Sage.

Caramani, Daniele. 2009. *Introduction to the Comparative Method with Boolean Algebra*. Los Angeles, CA: Sage.

Caren, Neal and Aaron Panofsky. 2005. "TQCA: A Technique for Adding Temporality to Qualitative Comparative Analysis." *Sociological Methods & Research* 34:147-72.

Clarke, Kevin A. 2002. "The Reverend and the Ravens: Comment on Seawright." *Political Analysis* 10:194-97.

Coppedge, Michael. 1999. "Thickening Thin Concepts and Theories—Combining Large N and Small in Comparative Politics." *Comparative Politics* 31:465-76.

Eliason, Scott R. and Robin Stryker. 2009. "Goodness-of-Fit Tests and Descriptive Measures in Fuzzy-Set Analysis." *Sociological Methods Research* 38:102-46.

Fearon, James D. and David Laitin. 2008. "Integrating Qualitative and Quantitative Methods." Pp. 756-76 in *The Oxford Handbook of Political Methodology*, edited by J. M. Box-Steffensmeier, H. Brady, and D. Collier. Oxford: Oxford University Press.

George, Alexander L. and Andrew Bennett. 2005. *Case Studies and Theory Development in the Social Sciences*. Cambridge, MA: MIT Press.

Gerring, John. 2007. "Is There a (viable) Crucial-Case Method?" *Comparative Political Studies* 40:231-53.

Goertz, Gary. 2006. "Assessing the Trivialness, Relevance, and Relative Importance of Necessary and Sufficient Conditions in Social Science." *Studies in Comparative International Development* 41:88-109.

Goertz, Gary. 2008. "Choosing Cases for Case Studies: A Qualitative Logic." *Newsletter of the APSA Section on Qualitative & Multi-Method Research* 6:11-14.

Goertz, Gary and Jack S. Levy. 2007. "Causal Explanation, Necessary Conditions, and Case Studies." Pp. 9-45 in *Explaining War and Peace: Case Studies and Necessary Condition Counterfactuals*, edited by J. S. Levy and G. Goertz. London, UK: Routledge.

Goertz, Gary and James Mahoney. 2012. *A Tale of Two Cultures: Contrasting Qualitative and Quantitative Paradigms*. Princeton, NJ: Princeton University Press.

Grofman, Bernard and Carsten Q. Schneider. 2009. "An Introduction to Crisp-Set QCA, with a Comparison to Binary Logistic Regression." *Political Research Quarterly* 62:662-72.

Hall, Peter A. 2008. "Systematic Process Analysis: When and How to Use It." *European Political Science* 7:304-17.

Kaeding, Michael. 2007 *Better Regulation in the European Union: Lost in Translation or Full Steam Ahead?* Amsterdam, The Netherlands: Amsterdam University Press.

Lieberman, Evan S. 2005. "Nested Analysis as a Mixed-Method Strategy for Comparative Research." *American Political Science Review* 99:435-52.

Lieberson, Stanley. 1991. "Small Ns and Big Conclusions: An Examination of the Reasoning in Comparative Studies Based on a Small Number of Cases." *Social Forces* 70:307-20.

Mahoney, James. 1999. "Nominal, Ordinal, and Narrative Appraisal in Macrocausal Analysis." *American Journal of Sociology* 104:1154-96.

Mahoney, James. 2000. "Strategies of Causal Inference in Small-N Analysis." *Sociological Methods & Research* 28:387-424.

Mahoney, James and Gary Goertz. 2004. "The Possibility Principle: Choosing Negative Cases in Comparative Research." *American Political Science Review* 98:653-69.

Mahoney, James and Gary Goertz. 2006. "A Tale of Two Cultures: Contrasting Quantitative and Qualitative Research." *Political Analysis* 14:227-49.

Mahoney, James, Erin Kimball, and Kendra L. Koivu. 2009. "The Logic of Historical Explanation in the Social Sciences." *Comparative Political Studies* 42:114-46.

Most, Benjamin A. and Harvey Starr. 1989. *Inquiry, Logic, and International Politics*. Columbia: University of South Carolina Press.

Ragin, Charles. 1981. "Comparative Sociology and the Comparative Method." *International Journal of Comparative Sociology* 22:102-20.

Ragin, Charles C. 1987. *The Comparative Method: Moving Beyond Quantitative and Qualitative Strategies*. Berkeley, CA: University of Berkeley Press.

Ragin, Charles C. 2000. *Fuzzy-set Social Science*. Chicago, IL: University of Chicago Press.
Ragin, Charles C. 2006a. "How to Lure Analytic Social Science Out of the Doldrums: Some Lessons from Comparative Research." *International Sociology* 21:633-46.
Ragin, Charles C. 2006b. "Set Relations in Social Research: Evaluating Their Consistency and Coverage." *Political Analysis* 14:291-310.
Ragin, Charles C. and Sarah Ilene Strand 2008. "Using Qualitative Comparative Analysis to Study Causal Order. Comment on Caren and Panofsky (2005)", *Sociological Methods & Research* 36:431-441.
Ragin, Charles C. 2008. *Redesigning Social Inquiry*. Chicago, IL: Chicago University Press.
Rihoux, Benoît and Bojana Lobe. 2009. "The Case of Qualitative Comparative Analysis (QCA): Adding Leverage for Cross-Case Comparison." Pp. 222-42 in *The Sage Handbook of Case-Based Methods*, edited by D. Byrne and C. C. Ragin. Thousand Oaks, CA: Sage.
Rihoux, Benoît and Charles Ragin, eds. 2009. *Configurational Comparative Methods*. Thousand Oaks, CA: Sage.
Rohlfing, Ingo. 2008. "What You See and What You Get: Pitfalls and Principles of Nested Analysis in Comparative Research." *Comparative Political Studies* 41:1492-514.
Rohlfing, Ingo. 2012. *Case Studies and Causal Inference: An Integrative Framework*. Basingstoke, UK: Palgrave Macmillan.
Rohlfing, Ingo and Carsten Q. Schneider. 2013. Improving Research on Necessary Conditions: Formalized Case Selection for Process Tracing after QCA. *Political Research Quarterly* 66: 220-235.
Samford, Steven. 2010a. "Averting "Disruption and Reversal": Reassessing the Logic of Rapid Trade Reform in Latin America." *Politics & Society* 38: 373-407.
Samford, Steven. 2010b. "Replication Data for 'Averting "Disruption and Reversal": Reassessing the Logic of Rapid Trade Reform in Latin America'." http://www.stevensamford.com/wp-content/uploads/2012/11/COMPLETE-DATA1.pdf (accessed 13-03-10).
Schneider, Carsten Q. 2008. *The Consolidation of Democracy: Comparing Europe and Latin America*. London, UK: Routledge.
Schneider, Carsten Q. and Bernard Grofman. 2006. "It Might Look Like a Regression . . . but it's not! An Intuitive Approach to the Presentation of QCA and fs/QCA Results." Compasss Working Paper, WP2006-39. http://www.compasss.org/wpseries/SchneiderGrofman2006.pdf.
Schneider, Carsten Q. and Claudius Wagemann. 2006. "Reducing Complexity in Qualitative Comparative Analysis (QCA): Remote and Proximate Factors and the Consolidation of Democracy." *European Journal of Political Research* 45:751-86.
Schneider, Carsten Q. and Claudius Wagemann. 2010. "Standards of Good Practice in Qualitative Comparative Analysis (QCA) and Fuzzy Sets." *Comparative Sociology* 9:397-418.

Schneider, Carsten Q. and Claudius Wagemann. 2012. *Set-Theoretic Methods for the Social Sciences. A Guide to Qualitative Comparative Analysis*. Cambridge, UK: Cambridge University Press.
Seawright, Jason. 2002a. "Testing for Necessary and/or Sufficient Conditions: Which Cases are Relevant?" *Political Analysis* 10:178-93.
Seawright, Jason. 2002b. "What Counts as Evidence? Reply." *Political Analysis* 10:204-7.
Seawright, Jason. 2005. "Qualitative Comparative Analysis vis-à-vis Regression." *Studies in Comparative International Development* 40:3-26.
Seawright, Jason and John Gerring. 2008. "Case Selection Techniques in Case Study Research: A Menu of Qualitative and Quantitative Options." *Political Research Quarterly* 61:294-308.
Segura-Ubiergo, Alex. 2007. *The Political Economy of the Welfare State in Latin America: Globalization, Democracy, and Development*. Cambridge, UK: Cambridge University Press.
Skaaning, Svend-Erik. 2011. "Assessing the Robustness of Crisp-set and Fuzzy-set QCA Results." *Sociological Methods & Research* 40:391-408.
Smithson, Michael and Jay Verkuilen. 2006. *Fuzzy Set Theory: Applications in the Social Sciences*. Thousand Oaks, CA: Sage.
Tarrow, Sidney. 2010. "The Strategy of Paired Comparison: Toward a Theory of Practice." *Comparative Political Studies* 43:230-59.

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