

Fuzzy-set method in comparative social policy: a critical introduction and review of the applications of the fuzzy-set method

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Abstract This article critiques the Fuzzy-set Qualitative Analysis (fs/QCA) methodology by examining its applicability in three studies in the field of comparative social policy. In each of these three test cases, I focus on the validity of fuzzy-set's claimed function — its ability to combine theoretic discourse and evidence analysis. All three studies investigate welfare state reform in the late twentieth century and apply fs/QCA: (1) “Welfare Reform in the Nordic Countries in the 1990s: Using Fuzzy-set Theory to Assess Conformity to Ideal Types,” (2) “States of Welfare or States of Workfare? Welfare State Restructuring in 16 Capitalist Democracies, 1985–2002,” and (3) “The Diversity and Causality of Welfare State Reforms Explored with Fuzzy-sets.” This article begins by discussing the ontology and epistemology of comparative social policy. The fuzzy set logic and set theoretic nature of social science theory is then discussed to align the ontology with fuzzy set methodology. Next, a more detailed introduction of fuzzy-set method (fs/QCA) is followed. This study suggests that fs/QCA is a unique and useful method for comparative social policy. It advances quantitative analysis by exploring cases configurationally and also advances the qualitative analysis by applying the fuzzy set logic and the principle of calibration.

Keywords Fuzzy-set theory · fs/QCA · Comparative social policy · Welfare state reform

1 Introduction

Fuzzy-set qualitative comparative analysis (fs/QCA) is an ambitious attempt to bridge the deep chasm in social science methodology between qualitative analysis, known as case-oriented analysis, and quantitative analysis, referred to as variable-oriented analysis¹ (Ragin

¹ Ragin presented this methodology in his 2000 book. Compared to his 1987 book, which introduced dichotomous measurement, these methods use fuzzy-set measurement.

1987; Ragin 2000). The attempt started with the introduction of the Qualitative Comparative Method (QCA²) (Ragin 1987) and the later incorporation of ideas of fuzzy set logic into fuzzy-set qualitative comparative analysis(fs/QCA³) (Ragin 2000). This methodological approach is still in the process of development (Ragin 2006; Smithson 2005; Verkuilen 2005) but has already been subject of much comment, some of it negative (Lieberson 2004; Seawright 2004). Nevertheless, an increasing number of scholars are employing QCA⁴ or fs/QCA, possibly without adequately understanding its rationale and properties. The purpose of this article is to examine the potential and functions of this relatively new method by critiquing three studies that have applied fuzzy-set methods in comparative analysis. In each case I focus on the validity of the claim by proponents of fs/QCA that they are able to combine theoretic discourse and evidence-based analysis.

fs/QCA seeks to combine the strengths of qualitative and quantitative research. It recognizes the set theoretic nature of social science, particularly in comparative social research, and highlights the limitations of variable-oriented analysis in informing such theorizing while acknowledging that the latter provides measurement precision that case-orientated analysis often lacks. A case-oriented researcher often begins by orienting concepts within theoretical frameworks and then uses selected cases to help refine and elaborate those concepts (Ragin 2007). The fs/QCA draws on the set theoretic argument (from case-oriented analysis) to capture the nature of social science and the calibration of set membership (from variable-oriented analysis) to bolster measurement precision. This article does not discuss whether fs/QCA should, or even could, replace conventional approaches in social science. Instead, it examines the degrees of suitability for fs/QCA in social science research that attempts (1) to combine theoretical discourse and evidence analysis in (2) a comparative setting.

Against this background, it is not the intention to argue for the inherent methodological superiority of fs/QCA over other social science approaches. Rather it is presumed that there are different tools for different purposes of inquiries; imagine how futile it would be to argue the telescope's superiority over the microscope. I shall therefore examine whether fs/QCA offers a useful tool for comparative social science. To this end the article is divided into three sections. First, I begin by discussing the ontological and epistemological foundations of comparative social research before asking the question, "What is the ontology and epistemology of comparative social science?" Second, I explore the fuzzy set logic and set theoretic nature of social science theory, asking, "Do methodologies in comparative social science align with the ontology and epistemology from section one?" Third, I provide a detailed introduction of the fuzzy-set method (fs/QCA) and examine its suitability in three comparative studies:

- (1) *"Welfare Reform in the Nordic Countries in the 1990s: Using Fuzzy-set Theory to Assess Conformity to Ideal Types"* (Kvist 1999)
- (2) *"States of Welfare or States of Workfare? Welfare State Restructuring in 16 Capitalist Democracies, 1985–2002"* (Vis 2007)
- (3) *"The Diversity and Causality of Welfare State Reforms Explored with Fuzzy-sets"* (Pennings 2005)

All three of these comparative studies employ fs/QCA in an attempt to link theory discourse and evidence analysis and are representative comparative social policy articles using this technique applied to the welfare state. Thus, the third and final section of this article

² QCA often refers to only dichotomous Boolean methods.

³ fs/QCA describes the Fuzzy-set Qualitative Analysis. However it also applies Boolean methods as QCA does.

⁴ The number of published studies which applied QCA is more than 250 (Ragin 2004a, b).

examines how fs/QCA contributes to grasping the nature of the welfare state and tracking its change over time.

2 Ontology and epistemology of comparative social policy

Ontology relates to what exists in the world, the character of the world as it is; the epistemology refers to how one captures and understands this world. In social science, methodologies are based on different ontologies and epistemologies. Therefore, thinking about the underlying ontology and epistemology is a useful starting point for judging the appropriateness of a particular methodology such as fs/QCA.

2.1 Ontology

Following Hall (2003) who traced the ontological development of historical comparative politics starting with ‘institutionalism’, this section will commence with discussion of two alternative ontologies usually referred to as functionalism and conflict theory.

Functionalism views society as a unit and each institution within society as component having functions necessary for the well being of the society (Holmwood 2005). Popularized by Emile Durkheim, one of the founding fathers of sociology and comparative sociology in particular, **functionalism seeks to explain the presence of a phenomenon or an institution by reference to the contribution that it makes to broader society.** Society is assumed as a whole to adjust to reach an optimal equilibrium such that, whenever an imbalance occurs, it responds trying to restore equilibrium by modifying the functions of existing functions or by creating new institutions out of necessity. **A prominent explanation for welfare state development based on this ontology is that the welfare state developed as a necessary consequence of industrialization, modernization, or capitalism.** Cutright (1965) and Wilensky (1975), for example, argue that welfare states were indispensable components of industrial societal structures.

The second ontology, conflict theory, treats society as a continuing conflict. Max Weber (1949) subscribed to this approach. **He argued that all institutions, groups, or actors have interests of their own that are not necessarily consistent with the interests of others with which they interact. It is this interactive process and its eventual outcome that determines the presence or form of institutions, social policy and other social phenomena.** Compared to the functionalist approach, conflict theory approach focuses more on the level of individual behaviors. **While industrialism theory based on functionalism views social policy as a necessary product of industrialization, the class relation theory, power resource theory and social democratic theory in different ways all explain the evolution of social policy in terms of social and political interactions and conflicts; the result of choice rather than necessity.**

2.2 Epistemology

The central question tackled by epistemology is ‘How is it possible for us to gain knowledge of the world?’ (Hughes and Sharrock 1997, pp. 4–8). **Within comparative social policy, epistemology seeks to discover how the nature of society, institutions social policy, and the welfare state can be understood. To over-simplify, much of the debate is between epistemological externalism on the one hand, and epistemological internalism on the other.**

Externalism postulates that the factors influencing an outcome are ‘external’ to an individual. To answer the question of how we can gain knowledge about the world, externalist

Table 1 Ontology and epistemology of comparative social policy

Ontology	Epistemology	
	Internalism	Externalism
Functionalism	1. Examining the general functioning of institutions interpretively	2. Examining the general functioning of institutions empirically (Durkheim) ^a
Conflict theory	3. Examining conflicts between entities interpretively (Weber)	4. Examining conflicts between entities empirically

^a Hall (2003) states that the incipient field of comparative politics was less developed than those of sociology and economics categorizing both Durkheim and Weber together to be distinct from comparative research. However, Smelser (1976) and Ragin and Zaret (1983) recognize Durkheim and Weber as two of the foremost comparative analysts in the history of sociology

researchers avoid using conditions such as culture, religion, history and psychological states to explain outcomes (Smelser 1976). Instead, they rely on empirical data that is observable and measureable, which are called knowledge-yielding conditions. Externalistic researchers' reference statistical datasets as standardized expressions of social facts, instead of those generated from an individual's mind.

By contrast, internalism focuses on internal factors acting on individuals. Researchers explain social phenomenon after attempting to grasp the motive of an individual actor. The research's goal is to understand "what makes [the actor] do something at precisely this moment and in these circumstances" (Smelser 1976). In this sense, the context, history, and culture are fundamental both to examining and explaining human behavior. Typically, the cause of an outcome is multilayered and complex, which means that the theoretical significance of regularities between cases is found by interpreting subjective meanings. In short, an internalist comparative researcher would argue that statistical regularities in aggregated behaviors are meaningless unless reference is made to some kind of subjective explanation.

Methodologies are the means by which researchers verify, expand, and refine theories. Although it may reduce our understanding of both epistemologies by juxtaposing them with qualitative and quantitative research, we can assume that qualitative methodology is in most cases internalistic and quantitative methodology is externalistic.⁵

2.3 Combinations of ontology and epistemology in comparative social policy

The matrix in Table 1 describes how these components of ontology and epistemology relate.⁶ In reality these dichotomies are not as clear-cut as described above, and one might argue that there are sub-ontology and sub-epistemology categories that could be discussed in the discipline of social policy. That being said, this matrix provides an organizing framework for the purpose of our discussion. The dimensions that I have highlighted are among the most relevant to comparative social policy and capture many of the sub categories.

Some of the most prominent contributions to the comparative social policy literature are located in the shaded cells of Cell 2 or Cell 3. For example, the convergence theory of welfare state development is representative of Cell 2: Wilensky (1975) and Collier and

⁵ Some would refer these two categories as rationalism versus empiricism, positivism versus constructivism.

⁶ Methods for comparative social science are numerous. An overarching two branch could be *deterministic method* which assumes that the world is predicable given the right variables, methods, and measurement devices and *probabilistic method* which treat explanatory variables as to some specified degree such as *almost always* (see more on Mahoney 2003).

Messick (Collier and Messick 1975) have suggested that economic development and social modernization lead states to develop into welfare states. Literatures suggesting universality in the welfare state development as a necessity are included in this cell (Gough 1979; Offe 1984). After the so-called “Golden Age of Welfare States,” numerous authors have more recently suggested a *global* phenomenon of retrenchment of the welfare states using empirical data (OECD 1981). These arguments have been challenged by other scholars, such as Castles (2004), who empirically observed spending trends in all OECD countries from 1980 to 1998. He suggested a continuity of welfare states without crisis. Another group of scholars, though, have suggested an overall crisis and “race to the bottom” in social spending due to globalization (Mishra 1999; Garrett and Nickerson 2005). Yet another group of studies on the welfare state focuses on the impact of deindustrialization. Iverson (2001) suggests, based on analysis of fifteen OECD countries over a 35-year period that deindustrialization “has propelled much of the expansion of the welfare state since the early 1960s (Iverson 2001, p. 48)”. Despite the varying opinions about the welfare state evident in these examples, each study shares a common feature: all of them focus on the functioning of institutions (including state, market, social policy) or entities (including workers, employers, policy makers, family), rather than interactions between actors.

Variable-oriented analysis with empirical data is both feasible and appropriate in functionalist studies since universality in causation is assumed when explaining the function of institutions. Quantitative analysis of large samples is required to test hypotheses but is less applicable to be internalistic enquires because of three limitations. First, quantitative analysis often relies on regression equations to examine the effect of one explanatory variable on the outcome variable while controlling for other variables. This hinders any interpretative approach explaining causation with a set of variables moving jointly. Second, because quantitative analysis relies heavily on measureable empirical data, deemed to be objective, it reduces the possibility of diverse interpretations. Third, methods with empirical approach can only examine the correlations between explanatory variables and observed variables, which do not align with the set theoretic nature of most of the verbal statements of internalism — an idea I will develop in the next section.

Whereas Cell 2 relies on a functionalist ontology and externalist epistemology, Cell 3 combines an ontology that focuses on the interactions between actors with the epistemology of internalism. These researchers are more likely to draw on theories that prioritise interactions between actors, paying particular attention to context, issues of process, timing, and the historical trajectories of the selected cases. In fact, Amenta (2003) states that one of the reasons why there has been such progress in comparative historical analysis is because of the broad conceptual agreement on the domain of social policy but disagreement on the theoretical argument to explain social policy development.

Skocpol (1979) used within-case chronologies as a basis for making causal inferences about the collective motivations for revolution in four selected countries. Pierson (1994) focused on voter behaviors in his refutation of theories of welfare state retrenchment. Drawing on rational choice theory, he focused on the constituencies of welfare programs and the dynamic interplay between policy makers. Influential literatures about path dependence (Mahoney 2000; Pierson 2000a, b) show how interactions between actors at the beginning of an institution’s life shape subsequent development of social policy. In contrast to externalistic epistemology, internalistic epistemology allows more degrees of freedom in exploring explanatory variables derived from theoretic discourse. For example, Skocpol (1992) reinterpreted the variables and cases that were commonly used in social policy literatures. She claimed that, whereas the United States was commonly referred to as a laggard welfare state in many quantitative analyses, the benefits given to Civil War veterans were in fact more

generous than the European old age program and disability program (reviews in [Amenta 2003](#)). To account for this difference, Skocpol analyzed the interaction between the federal and state governments in United States in shaping the process of policy change.

Much feminist social policy is also located in Cell 3 ([Sainsbury 1996](#)). Feminist scholars criticized the typology of ‘three welfare states’ ([Esping-Andersen 1990](#)) which neglected the role of females in providing welfare services. The interaction between male bread winner and female house wives was not displayed in the commonly used empirical data of social spending distribution ([Lewis 1992](#)).

Comparative historical analyses are fit best within an internalistic epistemology for four reasons. First, interactions do not lend themselves to easy measurement and may not even be directly observable. Secondly, the researcher begins by orienting ideas and broad concepts and then uses empirical cases to help refine and elaborate concepts. In other words, cases are carefully and purposively selected based on researcher’s detailed knowledge and thus offend against the structures of quantitative analysts that seek to avoid selection bias through random sampling and large sample sizes. Thirdly, because of a limited number of cases, comparative historical analyses are less likely to rely on empirically determined correlations between variables. Externalism, with its large number of cases, tends to blur the heterogeneities in cases when researchers intend to examine the different interactions among the societies. Fourthly, externalistic research typically seeks to test specific hypotheses derived or the test competing theories rather than engaging with multiple theories as is more common with internalistic research concerned, for example, to understand interactions between policy actors.

Some prominent comparative studies may also be found outside the two cells above and are quite often difficult to categorize. For example, in [Esping-Andersen \(1990\)](#) study proposing that welfare states be categorised into three different regimes, it is suggested that the development of capitalism expanded the middle class (functionalism) and being supported by the expanded new class, the social democratic party played an important role in the development of welfare state (conflict theory). The epistemology of internalism and externalism are both also found in his study. Moreover, concepts and theories of de commodification and stratification across three different regimes were derived and supported through qualitative analysis but reinforced by regressions of empirical data. Korpi’s study on the social citizenship ([Korpi 1989](#)) also incorporated the power resource approach with an externalistic method.⁷

There is no presumption in the use of the above matrix that comparative studies are only found in Cells 2 or 3. However, it is not surprising to find that most studies in Cell 2 used quantitative analysis while studies in Cell 3 mostly applied qualitative analysis. Ragin explains that case-study researchers aim to show “how different aspects mutually constitute the whole case and compare and contrast the different wholes” while variable oriented studies “constructs a generic representation based on patterns observed across many cases” ([Ragin 2000](#), p. 23). These two methodologies can be complementary; fs/QCA attempts to leverage the complementarities to further develop comparative enquiries in social policy.

3 Understanding the fuzzy-set methods

Comparative research in social science generally refers to studies that address the experiences of two or more countries ([Lijphart 1971](#)), but it can also refer to studies on one-country that “situate empirical questions in a comparative context or make significant macro-level

⁷ If forced, it could be placed in cell 4.

comparisons in causal argumentations” (Amenta 2003). Beginning in the 1960s, however, comparative social research has been shifting to a large-N variable-oriented analysis and this approach has continued to gain momentum in recent years (Hall 2003). This imbalance in methods has not gone unnoticed (Hall 2003; Mahoney 2003; Mahoney and Rueschemeyer 2003; Ragin 1991). Although historical comparative analysis has also achieved impressive development (reviews in Mahoney and Rueschemeyer 2003; Amenta 2003), it was still recognized that the ontology of historical comparative analysis advanced the methodology (Hall 2003) and so historical comparative researcher perceived difficulties in engaging theories with data by applying conventional methods. **Comparative social research based on a functionalist ontology focuses more on outcomes (the effects of causes⁸) while studies adopting a conflict theory ontology focus more on causes (the causes of effects).** The *ideal* comparative research model is likely to be one where there is a balance between an emphasis on theory and one on empirical data, between an emphasis on cases and one on variables and one which balances subjectivity and objectivity. This article investigates whether fuzzy-set qualitative analysis might lead to a model for comparative research that creatively blurs these traditional divides.

3.1 Fuzzy set theory and fc/QCA

Fuzzy-set theory has many unique features that differ from variable- and case-oriented analysis. First, compared to quantitative analysis, more degrees of freedom are given to the researcher “to examine causal complexities under the rubric of multiple conjunctural causation” (Ragin 2000). The fundamental logic of case-oriented comparative analysis rests on examining cases configurationally. Since case-oriented analysis assumes “different parts of the whole are understood in relation to one another and in terms of the total picture or package that they form” (Ragin 2000, p. 68), researchers focus on understanding context. To make sense of the heterogeneity within the case in an encompassing manner, researchers engage with diverse theories and investigate multiple aspects of the cases. Likewise, rather than estimating the effect of one cause on the dependent variable holding the other independent variables constant, fs/QCA develops a joint causal system fully allowing for the interaction effects among each characteristic of case. **For example, instead of examining the independent effect of the presence of labor union and the presence of social democratic government on the development of the welfare states, fuzzy-set theory creates four causal configurative conditions and investigates their relationships with welfare state development:** X1 = Presence of labour union and the presence of social democratic party(L*S)⁹, X2 = Presence of labour union and the absence of social democratic party(L*s), X3 = Absence of labour union and the presence of social democratic party(l*S), X4 = Absence of labour union and the absence of social democratic party(l*s). When K is the number of attributes, 2^K configurations are possible.

The equation can be developed based on the qualitative analysis on cases applying “logical and” and “logical or.” “Logical and(*)” represents a compound set when two or more sets are combined. The “logical or(+)” refers to the union of sets and it is represented by and addition sign in the equation. For example, 12 cases are selected and eight of them are developed welfare states. Those eight cases are analyzed and the researcher finds that conditions

⁸ Comparison between the ‘effect of causes’ and ‘causes of the effect’ was discussed by Katz et al. (2005) to explain the different purposes of regression and fuzzy-set analysis.

⁹ In fs/QCA, the absence and the presence are presented by either big/small letters or by “~” to indicate the absence of certain aspects. For example, “~labor” for the absence of labour union. This is referred as the Boolean approach (Ragin 1987).

in each case are either L^*S or L^*s or I^*S but not I^*s . This implies that the conditions for the development of welfare state can be three different configurations.

$$\text{Welfare state development (W)} = L^*S + L^*s + I^*S^{10} \quad (1)$$

However, applying a Boolean approach, this can be further simplified into the equation below, which implies that “the presence of labor unions OR the presence of a social democratic party” ($L + S$) can create the condition for welfare state development.

$$\begin{aligned} W &= L^*S + L^*s + L^*S + I^*S = L(S + s) + S(L + I) \\ &= L + S^{11} \end{aligned} \quad (2)$$

Secondly, the fs/QCA approach allows more emphasis to be placed on cases rather than variables. In conventional variable orientated analyses, the historical and contextual nuances of each case is often veiled due to the pooling a large number of cases that causes individual cases to lose their uniqueness. The heterogeneity within the cases is easily neglected. The advantage of fs/QCA is that each case is consider as a whole and not disaggregated into variables. So, in the above example, the case ‘Sweden’ as a whole will be given a membership score for both L and I^*S .

Thirdly, fs/QCA allows for degree of flexibility in terms of the way a case is characterized. Cases are assigned to membership groups (sets) in accord with particular characteristics of interest, for example, the presence of trade unions or a social democratic party. However, whereas in simple set theory a case would definitively be assigned to one set or another, fuzzy logic allows for degrees of membership. Set membership is determined by the researcher who defines qualitative breakpoints of 1 (fully in) and 0 (fully out) with a scaling of membership scores between 0 and 1 to allow for partial membership. In short, fs/QCA is “a fine-grained, continuous measure that has been carefully calibrated using substantive and theoretical knowledge relevant to set membership” (Ragin 2000, p. 7). Calibration¹² allows qualitative concepts to be compared quantitatively. For example, whereas it might be comparatively straightforward to compare countries in terms of the generosity of their welfare provision, whether a country should be labeled advanced or not is likely to be less self-evident, a matter of degree. The method of calibration in fs/QCA, and hence the determination of the membership of sets can vary across concepts, reflecting the conceptual, theoretical, historical, and contextual considerations that the researcher prioritizes. (Vis 2007). This feature of fs/QCA has two benefits: first, it appropriately reflects the normal process of qualitative comparative study but, secondly, the careful calibration creates the potential for quantitative comparison.

Fourthly, fs/QCA echoes the set theoretic nature of social science and thereby facilitates a close correspondence between theory and data analysis (Ragin 2000, p. 4). Many theory based statements in comparative social research involve set theoretic relationships. For

¹⁰ The conditions for welfare state development are ‘Presence of labour union AND the presence of social democratic party(L^*S)’ OR ‘Presence of labour union AND the absence of social democratic party(L^*s)’ OR ‘Absence of labour union and the presence of social democratic party(I^*S)’.

¹¹ In set theory, $L^*S = L^*S + L^*S$. So substituting yields $W = (L^*S + L^*S) + L^*s + I^*S$ and re-arranging yields $W = (L^*S + L^*s) + (L^*S + I^*S)$. Therefore factoring yields $W = L(S + s) + S(L + I)$ and lastly simplifying yields $W = L + S$.

¹² Calibration in fuzzy-set method is the membership scoring scheme. It is a standard developed by the researcher which makes measurement directly interpretable. In natural science for example, a temperature of 20°C is interpretable because it is situated in between 0° and 100° (Ragin 2007).

example, in the theoretic statement “Economic development is essential to the development of advanced welfare state,” the development of advanced welfare states is the subset of the presence of economic development. In other words, economic development is a necessary condition for an advanced welfare state. Ragin suggests that “set relations are the building blocks of verbal statements” and because these kinds of set relationship described in theories are usually transformed into “hypotheses about correlations between variables oriented toward the evaluation of the *net effects* of causal variables,” quantitative analysis distances itself from theoretical discourse (Ragin 2007). To examine causality with set theory, the membership values of the characteristic or condition postulated to be a cause (X_i) need to be calculated as do the membership values of the outcome characteristic (Y_i) (Ragin 2000). A condition is necessary when its value is consistently higher than the outcome ($Y_i \leq X_i$) and a condition is sufficient when its value is consistently lower than the outcome ($X_i \leq Y_i$).

In order to assess the necessity or the sufficiency of the conditions, referring to the Equation 2 above, researchers should calculate each case’s membership score for conditions L(strong labour unions) and S(social democratic party). If membership scores for L and S are consistently lower than the membership score of W, then the conditions are sufficient. For example, eight countries that are considered welfare states will have different membership scores for L or S. If Denmark scores 0.7 for L, 0.5 for S and 0.8 for W, the maximum of causal expression is 0.7 and, since this is lower than the outcome score 0.8, the Denmark case supports the argument that (L+S) is a sufficient condition for welfare state development. If all of the eight countries consistently show the same result ($X_i \leq Y_i$), then one can conclude that the condition (L+S) is sufficient for welfare state development.



Thus, the basic steps for comparative research can be summarized in five points.

- (1) Attributes for the ideal type or potential causal conditions for the outcome are selected based on qualitative analysis of the cases and existing theoretical knowledge.
- (2) Possible configurative conditions are presented (2^k), which can may be simplified by applying Boolean approach.
- (3) A scoring scheme (calibration) is developed based on the substantive knowledge of the cases and related theories. Qualitative break points are then established.
- (4) Each case’s membership score is computed for each condition or configurative conditions.
- (5) Membership scores are calculated for both causal conditions and the outcome to assess the necessity and/or sufficiency of the conditions.

3.2 Potential solutions to bridge the quantitative/qualitative chasm

The fuzzy-set qualitative methodology obviates the need for certain of the assumptions associated with quantitative and qualitative methodologies while also addressing certain of their limitations. One of the most prominent restrictions of quantitative analysis is the limited lack of capacity to engage directly with theoretical discourse with data analysis. Since variable-oriented analysis relies on measurable, empirical data, it reduces the possibility of diverse interpretations and too much complexity. Put another way: quantitative methodologies struggle to accommodate a functionalist ontology with an internalistic epistemology. Moreover, since much quantitative analysis is used to examine associations between variables, it cannot capture the set theoretic nature in most of the verbal statements drawn from theories as explained above. However, the *configurational strategy*, *qualitative membership scoring* and use of *set-theory combined* in fs/QCA enable researchers to explore more theoretical possibilities. Another barrier is that fs/QCA also enables researchers to select cases for comparison

Table 2 Application of the fs/QCA in Comparative Social Science

		Epistemology	
		<u>Internalism</u>	<u>Externalism</u>
Ontology	<u>Functionalism</u>	1 	2
	<u>Conflict Theory</u>	3 	4

in ways not permissible in variable-oriented analysis that assumes homogeneity of cases, and hence to benefit from more degrees of freedom.

Furthermore, fs/QCA can address certain of the limitations that confront interactionist comparative researchers applying externalistic epistemology is that their data, most notably the fact that many of the concepts they employ are immeasurable or subjective thereby restricting methodologies to qualitative ones. However, the *calibration* and *fuzzy set logic* inherent in fs/QCA facilitates the quantification of qualitative data and can increase its objectivity. Since the aim of research interactionist comparative research is often to examine the diversity and heterogeneity within or among the cases, the aforementioned feature of Fs/QCA that it can embrace the careful selection of cases based on the knowledge of the researchers, rather viewing selection as adding bias, again emerges as a strength of the approach.

In summary, the unique features of fs/QCA make it a bridge for comparative social researchers between Cell 1 and Cell 2, and between Cell 3 and Cell 4 (Table 2). The Fs/QCA is perhaps most suited for comparative studies in “fuzzy” grey zones indicated in Table 2 where qualitative and quantitative methods are not in themselves wholly adequate under either functionalist or conflict theory ontologies.

4 Critiques on the selected studies

Among a number of comparative studies that have applied fs/QCA (Braumoeller 2003; Castles 2001, 2002; Ebbinghaus and Visser 1999; Hicks 1999; Koenig-Archibugi 2004; Kvist 1999; Pennings 2003; Schneider 2006; Stryker and Eliason 2003; Veugelers 2005; Katz et al. 2005) three studies are selected to examine and illustrate to applicability fs/QCA's. All three studies focus on the topic of welfare state reform and show how fs/QCA can contribute to *grasping the nature* of the welfare state and its change within a comparative perspective.

4.1 Welfare reform in the Nordic countries in the 1990s: using fuzzy-set theory to assess conformity to ideal type (Kvist 1999)

The purpose of Kvist's study is clear: To inquire into the “actuality of change through an empirical investigation of welfare reform in the Nordic counties in the 1990s.” After pinpointing the limitation in the literatures of quantitative and qualitative analysis in comparative welfare state research, Kvist concludes that neither method has been successful in accessing the recent change of welfare states and instead exploits fs/QCA to examine difference in the

kind of change by multiple configuration and difference in *degree* by through the concept of the partial membership of multiple sets. He “evaluates cases relative to their membership of specified ideal type” and investigates the changes in the four Nordic welfare states in 1990s (Kvist 1999).

Kvist’s conceptualization of the welfare state engages various theories, which are qualitative in nature, but by applying the fs/QCA succeeds a quantitative comparison. He identifies the main features of Nordic welfare states as “comprehensiveness, full employment, equality, universality, high-quality benefits and generous benefits.” and argues that these various aspects interact and reinforce each other and “only together do they constitute the whole that we may describe as Nordic welfare model.” The strength of fs/QCA and, hence of the study, is that it can engage with this conceptualization of the Nordic welfare state to facilitate the ordering and interpretation of empirical data. Kvist accordingly examines three welfare policy areas — Child and Family Support, Unemployment Measures, and Welfare for Elderly People — in a holistic view across five Nordic countries.

Drawing on Weber’s original definition that an ideal type is “an analytical construct that serves as a yardstick for social researchers to determine the extent to which real empirical phenomena are similar and they are different from some predefined measures” (Weber 1949), Kvist first constructs the ideal type Nordic welfare state. In so doing he undertakes an extensive and thorough review of relevant theories and complements this with in-depth knowledge of the Nordic countries, successfully underpinning his specification of a Nordic ideal type. Secondly, for each of the three policy areas, Kvist engages theories on various aspects of the Nordic welfare state and assigns a membership score to each country for each attribute of each policy. For example, for the family policy area, he considers the (1) generosity of cash benefits (G), (2) universality of child care (U), and (3) quality of child care (Q). Taking generosity to be “the impact of family allowance on family income after tax,” Kvist establishes thresholds such that an increase in income of 6 percent or more defines a country as “fully in” the Nordic set while an increase of 1.4 percent or less places it “fully out.” Both breakpoints are essentially qualitative ones. For Denmark in 1996/1997¹³ he allocates a membership score of 0.65 in terms of the ‘generosity of cash benefits (G)’ for ‘family support’.

Since Kvist views each policy area holistically, the final membership score for ‘family support’ is calculated according to the *minimum principle*¹⁴ in fuzzy-set theory. That means that the degree each country’s membership in the ideal “Nordic model of child and family” reflects all three attributes for each year.¹⁵ Kvist then repeats this method for the other two policy areas: unemployment measures and welfare for people elderly. Finally, each country’s total membership score is calculated with respect to the three constituent policy areas, again using the minimum principle ($C*U*O$) and compared. As the analysis is completed across three different time periods, Kvist is able to track the degree of change in each policy area and the overall change in the welfare state.

Kvist’s study exploits fs/QCA to engage theoretical discourse with data analysis through careful calibration of an otherwise qualitative study. He suggests that the consistently high membership scores in each country demonstrate that none of the countries have abandoned the “Nordic welfare model” despite the recent social, economic and political developments which have raised a question over the sustainability of this model. However, study also sug-

¹³ Kvist assess countries’ membership in three different time period, 1990/1991, 1993/1994, 1996/1997.

¹⁴ For example, if the country (case)’s membership score for G is 0.8, 0.2 for U and 0.4 for Q. By the minimum principle, the country’s membership score for ‘Nordic model of child and family’ = $G*U*Q$ becomes 0.2, the lowest score on the three attributes.

¹⁵ Kvist selected three time period 1990/1991, 1993/1994, 1996/1997.

gests that certain welfare areas and specific programmes with a high membership score are most vulnerable to cut-backs while those with low memberships have tended to expand. Applying fs/QCA, multiple attributes of the welfare state were viewed as joint conditions, which provided a more holistic understanding of the nature of the Nordic model. Furthermore, by examining the partial membership scores for (1) three attributes of each policy area, (2) each policy area as whole, and (3) each country in total, *diversity* within the Nordic welfare states was more clearly conveyed than in existing literature that has used conventional methods. This study demonstrates an appropriate application of fs/QCA and highlights its ability to explain the concept as a configuration and examine the diversity both within and among cases. However, it is rather a simple application of fs/QCA since it does not examine any causal relationships using more sophisticated set-theoretic principles.

4.2 States of welfare or states of workfare? welfare state restructuring in 16 capitalist democracies, 1985–2002 (Vis 2007)

Vis's study is similar to that of Kvist in that it aims to investigate the reality of welfare state change, rather than to examine causal conditions. However, Vis is specifically interested in discovering the nature of change distinguishing between two competing formulations found in the literature. The first, dominant in the "mainstream" literature, suggests a general resilience of welfare states with changes that do occur being specific to the type of regime. The second asserts a generalized movement affecting all types of welfare system from the Keynesian welfare state (KWS) to the Schumpeterian workfare regime (SWR) that prioritizes "the stimulation of innovation and flexibility" and in which social policy is subordinated to improvements in competitiveness. In pursuit of her objective, Vis conceptualizes two ideal types of welfare system, "welfare" and "workfare" states defined in terms of their attachment to three 'common denominator principles': (1) the obligation to work; (2) the objective of maximal labor participation; and (3) the provision of minimal income protection and examines 16 advanced industrial democracies from 1985 to 2002.

Vis's research design has both strengths and weaknesses. She further refines the ideal types distinguishing "generous workfare" from "lean workfare" and between "liberal welfare," "conservative welfare," and "social democratic welfare." These five types are defined with respect to three attributes, 'Activation(A)', 'Generosity(G)' and 'Protection(P)', such that, for example, Generous workfare = $A * G * p$ ('Strong Activation' and 'high generosity' and 'weak protection')¹⁶ Since combinations of the three attributes would allow for eight possible configurations (namely 2 to the power of 3, 2^3), Vis arbitrarily and without discussion defines three theoretical sets as empty. Indeed, Vis does not provide a thorough discussion of the theoretical basis for the various configurations that have to be taken on trust but can be contested. For example, one could argue that the nature of the social democratic welfare is not $A(\text{high activation}) * G(\text{high generosity}) * P(\text{high protection})$ ¹⁷ as she suggests, but rather, on account of recent discussions on the welfare state model of 'flexicurity' in Nordic welfare states, $A(\text{high activation}) * G(\text{high generosity}) * p(\text{low protection})$.

However, in her next step, which establishes the membership scoring scheme for each set, Vis incorporates theory discourse and sets qualitative breakpoints. For example, for the set 'Generosity', an index of replacement rates of unemployment insurance(UI) benefits and sick pay is measured as $[(\text{UI replacement rate} \times 2) + \text{sick pay rate} \div 3]$. Based on her

¹⁶ The rest are: Lean workfare = $A * g * p$, Liberal welfare = $a * g * p$, Conservative welfare = $a * G * P$, Social democratic welfare = $A * G * P$.

¹⁷ Vis suggests that 'the employment protection is measured by an index of the strictness of employment legislation for temporary as well as for regular employment'.

qualitative study, she sets below 20% as the ‘fully out’ breakpoint and 90% or higher as the ‘fully in’ breakpoint. Since all five ideal types have a certain configuration (joint conditions), the case membership of each ideal type can be calculated by means of negation and minimum principles.¹⁸ Then, the scores for each five ideal types were calculated for three different years (1985, 1995, and 2002) so the diversity in partially belonging to each ideal type is revealed among different countries for different years. Based on her findings, she concludes that in all countries, except Ireland, the majority of countries confirm the hypothesis of “an absence of radical change and the presence of regime-specific change.”

The strength of this study is that it advances knowledge about the nature of welfare state retrenchment by being able, though the application of fs/QCA, simultaneously to consider the multiple attributes of welfare systems rather than to treat each one independently. Moreover, by applying fs/QCA, Vis was able to assess both *quantitative change* and *qualitative change*. For example, in 1985 the membership score for New Zealand with respect to the “lean workfare” type was high (0.75) but by 1995, had dropped to 0.33, while that in relation to the “liberal welfare” type had risen to 0.67. Vis interprets these changes as constituting a shift in New Zealand from a lean workfare state to a liberal welfare state. Moreover, the shift was sustained through to at least 2002 since, although the membership score in that year had fallen back to 0.60, this, Vis determined, was still adequate for New Zealand to count as a liberal welfare state. Changes in the membership (if there were any) throughout time are traceable which is a common asset of qualitative comparative analysis. Finally, this study demonstrates the capacity of fs/QCA to handle a substantial number of cases, certainly many more than the conventional two-case comparison (Pierson 1994).

4.3 The diversity and causality of welfare state reforms explored with fuzzy-sets (Pennings 2005)

Pennings’ study of welfare reform is ambitious in that he endeavors to address many research issues with reference to 21 OECD countries over the period 1980 to 1998. He sets out to establish (1) whether the existence, nature and extent of cuts and retrenchment varies across welfare programs, the causal conditions for (2) high social expenditure, (3) cutbacks in general, and (4) cutbacks in different time periods and finally, (5) whether either generous or residual welfare states constitute a necessary and/or sufficient condition for economic prosperity.

He clearly states his conceptualization of the welfare state and his rationale for applying fs/QCA. Pennings argues that “welfare states have been confronted with similar problems which urged governments to introduce reforms in order to cope with the same problems.” (Pennings 2005 pp. 30). Due to similarity of the problems, states have adopted similar social policies, which make welfare states less heterogeneous. However, in opposition to conventional welfare state discourse since the introduction of Esping-Andersen (1990) introduction of the notion of regime types, Pennings believes it is important to conceptualize welfare states as differing in degree rather than in kind. He argues that welfare state regime typologies emphasize stability over change and state dependency rather than responsiveness whereas in reality certain countries may drift in and out of regime types. Therefore, Pennings’ conceptualizes welfare states as “sets” of welfare programs with imprecise boundaries that allow for a range of membership values from “fully out (a fully stringent one)” to “fully in (an ideally generous one)” according to which membership may vary over time.

¹⁸ For example, if the country (case)’s membership score for A is 0.8, 0.2 for G and 0.4 for P, by negation principle, membership score for p is 0.6. By the minimum principle, the country’s membership score for Generous workfare = $A * G * p$ becomes 0.2.

Clearly Pennings' conceptualization of the welfare state is highly congruent with fs/QCA. However, this study has its shortcomings, mainly revolving around the method of calibration and of assigning membership scores to each case. Eight categories of social expenditure are taken as indicators of welfare state membership with data extracted from the SOCX¹⁹ and expenditures grouped into three programme areas: namely, 'sickness'; 'family'; and 'elderly'. Pennings assigns membership scores for each area of social expenditure for each country by calculating the Z-score of the expenditure and multiplying it by the share of spending as a percentage of GDP. He uses a similar method to generate membership scores for other sets relating to 'social conditions', 'political conditions', 'economic conditions', 'demographic conditions', 'economic prosperity' and 'income equality'. Z-scores refer to the difference between the value of the variable and the mean of its probability distribution (Agresti and Finlay 1997). Their use requires the probability distribution of samples to normal and values of the variables to be normally distributed around the mean value, assumptions that underpin most variable-oriented analysis.

Pennings's approach to defining set membership arguably smacks too much of quantitative analysis, being empirically rather than theoretically driven. Most proponents of fs/QCA would argue that one of its great strengths is that it permits researchers to prioritize their qualitative knowledge and understanding of cases and concepts in calibrating set membership. Notions of full membership, full non-membership and cross-over points are inherently qualitative and ideally drawn directly from theory. This is not the case in Pennings's study which might therefore be criticized for its lack of engagement with theory.

The relative lack of theorisation is also evident in the conceptualization and operationalization of causality. For example, one of the possible causal conditions for welfare reduction, "economic conditions", is indicated by only "the sum of imports and exports as a percentage of GDP." However, many analysts would argue that welfare state spending has been much more influenced by processes of deindustrialization and the transition from a manufacturing to a service orientated economy than market openness and trade penetration (Iverson 2001; Pierson 2001). Since fs/QCA enables researchers to calibrate qualitative data while actively engaging with theoretical discourse, the different aspects of "economic condition" could, and arguably ought to, have been joined together to establish a configuration condition.

Pennings's study demonstrates that fs/QCA can successfully be utilized to investigate causality while, perhaps inevitably, also revealing scope for further refinement. He adopts a two stage approach to investigate the causes in public expenditure. First, he suggests possible conditions, defined as conjunctures of two or more causes, that are likely to be associated with high levels of social expenditure²⁰ and finds that different conditions turn out to be sufficient at three varying time periods (1980–1985, 1986–1991 and 1992–1998). For example, in the period of 1992–1998, the conjunct conditions are as follows.²¹

(High) Social expenditure = Openness*Left + Openness*Elderly + left*elderly²²

As a second stage, Pennings substitutes "cutbacks" in expenditure for expenditure levels as the dependent variable using, as a measure, simply the difference between the total social

¹⁹ OECD's Social expenditure database.

²⁰ This is done by the Boolean approach. QCA also applies this approach (see more in Ragin's 1987 and 2000).

²¹ See Table 2 of his study for more details.

²² 'Openness' is an indicator for 'Economic conditions' which he conceptualizes as 'the sum of imports and exports as the percentage of GDP'. 'Left' represents 'Political Conditions' which indicated by 'the Colour of Party Governemtn according to the Schmidt-index(Schmidt,1992). 'Elderly' refers to 'Demographic conditions' which is the percentage of people older than 65. Small letters indicate absence which Pennings sets as those below the membership score 0.5.

expenditure score of the period of 1992–1998 and the total score of 1980–1985. He relates this to total social expenditures in 1980–1985, 1986–1991, and 1992–1998 taken as possible causal conditions and finds that cutbacks were highest when expenditure was high during the first two periods but low during the last period, which is mathematically obvious. However, he concludes that cutbacks were most likely in those countries with high expenditure during the 1980s, which he refers to as the highly expanded Nordic welfare states.

Pennings's causal analysis is weakened by his reliance on a measure of total expenditure despite previously arguing that cuts in expenditure varied across the categories of “sickness,” “family,” and “elderly”. Also, when exploring exceptions to the conjunct conditions for high expenditure identified in the first part of his analysis, he focused exclusively on the period 1992–1998 and only calculated the sufficiency of “Openness(Left+Elderly).” Based on this restricted analysis, which revealed that some countries are in the exceptional group because they had a social expenditure score lower than the sufficiency condition²³, Pennings nevertheless offers the general interpretation that the “Anglo-Saxon world cannot be explained by the four conditions” and that expenditure in Portugal lagged behind. However, unlike the other two essentially descriptive studies, Pennings offers a glimpse of the potential of fs/QCA to exploit international comparisons to test causal hypotheses.

He uses various techniques of fs/QCA such as benchmark of 0.80 which incorporates probability concepts, setting 0.5 to define the absence and presence of certain attributes, adjustment score of 0.17 to interpret the sufficiency of conditions and so forth.

5 Conclusion

Fs/QCA is an ambitious methodology that attempts to catch the strengths of both qualitative and quantitative analysis. When executed properly, it acts as a bridge between the two methodological approaches. Nonetheless, recognizing fs/QCA's unique functions and applying them under the appropriate circumstances is critical. The above discussion of the ontology and the epistemology is not only intended to demonstrate when and where fs/QCA can be useful in comparative analysis but also it is to invite scholars to ruminate on the appropriateness of fs/QCA for their research before applying it.

Fs/QCA does not “seek to infer population properties from a sample nor does it seek to make casual inference” by examining correlations (Ragin 2007); its value is found in exploring cases configurationally and interpretatively. It advances quantitative comparative analysis by interpreting attributes as a configuration. By applying fuzzy set logic and the principle of calibration, it advances qualitative analysis by permitting theoretically-informed concepts to be quantified.

This article examined how fs/QCA can be applied in inquiries of comparative social policy. The studies of Vis and Kvist's both illustrate how welfare systems can be conceptualized in ways that do justice to the complexity of reality and how change in complex institutions can be traced over lengthy periods of time using moderately large numbers of cases. The Pennings study further demonstrates that fs/QCA can be applied to examine causation with a set theoretic approach and hence to begin to give real explanatory power to comparative social policy. Many other aspects in each study exemplify how inherently qualitative and quantitative concepts and characteristics can be handled and combined in complementary and cumulative ways within a single methodological framework, fs/QCA.

²³ For a condition to sufficient, outcome score needs to be higher than the condition score.

fs/QCA has advantages over other methods of comparative study when researchers are receptive to diverse theories and willing to countenance and exploit various interpretations of the phenomena of interest. It is of particular value to scholars who wish to view cases holistically and to those interested in complex causal chains. It facilitates the grounding of scientific measures on substantive and theoretical knowledge and, through the calibration and membership scoring features, makes measurable the inherently immeasurable, blending qualitative and quantitative approaches. However, the fs/QCA method is not suitable for all social science inquiries and, while John Locke was astute in recognizing that scientific knowledge is inherently successful because it possessed a method (Hughes and Sharrock 1997), he would no doubt also have recognized that comparative social policy is likely to continue to rely on many methods. Researchers require a method to suit their purpose of inquiry and have the knowledge of when and how to use it most effectively. Fs/QCA may become the tool of choice for comparative researchers interested in exploring questions that are veiled in the fuzzy zone between qualitative and quantitative inquiries.

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