Three Approaches to Longitudinal QCA: Opportunities and Challenges

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Incorporating time in QCA: three possible approaches

THE PROBLEM OF TIME IN QCA

• QCA has been originally designed as an approach to systematically compare cases at one point in time (Ragin, 1987).

• Thus, QCA has been criticized for being “atemporal”, obscuring “the sequential nature of paths of causation” (Caren & Panofsky, 2005: 147).

• QCA-enabled management research mostly neglects “how configurations evolve in form and substance over time” (Ketchen, 2013: 305).

3 APPROACHES TO TIME IN QCA

1. Analysis of temporally ordered configurations (tQCA) (e.g. Caren and Panofsky, 2005; Hak et al. 2013).

2. Analysis of configurations over time (lagged time windows) (e.g. Aversa Furnari and Haefliger, 2015; Meuer & Rupietta, 2015).

Analysis of Temporally Ordered Configurations (tQCA)  
(e.g. Caren and Panofsky, 2005; Hak, Jaspers and Dul, 2013)

The approach in a nutshell

- It focuses on causal conditions that occur in a specific temporal order:
  
  \[ A/B/C = A \text{ occurs first, then } B, \text{ then } C \]

- The key question is whether the sequence between conditions matter to produce an outcome (Abbott, 1998)
  
  \[ A/B/C \rightarrow Y? \]

  or \[ B/A/C \rightarrow Y \]

Opportunities

- Capture the extent to which the sequential order between conditions of a configuration matter and study “configurations of events”

Challenges

- Often difficult to specify order between conditions \textit{a priori} (lack of theory)

- Limited diversity in truth table increases exponentially. \textit{With 4 conditions, the logically possible configurations will be:}

  \[ 16 \text{ in QCA } (2^4) \]
  
  \[ 384 \text{ in tQCA } (4! * 2^4) \]
Analysis of Configurations over Time (lagged time windows)
(e.g. Aversa, Furnari, Haefliger, 2015; Meuer & Rupietta, 2015; Fainshmidt et al. 2017)

The approach in a nutshell

• It focuses on how the inner composition of the configurations associated with an outcome change over time (e.g. *do the same configurations recur regularly? How do configurations differ at different periods?*)

• It also focuses on changes of cases’ membership into different configurations and “moves” of cases between configurations over time

• Ideally, the analyst goes back to the cases to interpret changes and stability of configurations over time
An example from Formula 1 (Aversa, Furnari, Haefliger, 2015)

Table 5. High-performing configurations of business models identified via QCA

<table>
<thead>
<tr>
<th>Configurations</th>
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<th>Configurations</th>
<th>Configurations</th>
<th>Configurations</th>
<th>Configurations</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>b</td>
<td>c</td>
<td>d</td>
<td>e</td>
<td>f</td>
<td>c</td>
<td>d</td>
</tr>
<tr>
<td>Internal knowledge (BM1)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>External knowledge (BM2)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>F1 supply (BM3)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Talent (BM4)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Consistency</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Raw coverage</td>
<td>0.25</td>
<td>0.25</td>
<td>0.40</td>
<td>0.40</td>
<td>0.25</td>
<td>0.25</td>
<td>0.75</td>
</tr>
<tr>
<td>Unique coverage</td>
<td>0.25</td>
<td>0.25</td>
<td>0.40</td>
<td>0.40</td>
<td>0.25</td>
<td>0.25</td>
<td>0.20</td>
</tr>
<tr>
<td>Overall solution consistency</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Overall solution coverage</td>
<td>0.50</td>
<td>0.40</td>
<td>0.40</td>
<td>0.50</td>
<td>1.00</td>
<td>1.00</td>
<td>0.40</td>
</tr>
<tr>
<td>Number of cases per analysis</td>
<td>10</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>10</td>
<td>12</td>
<td>12</td>
</tr>
</tbody>
</table>

Note: The gray box highlights robust configurational patterns associated with high performance across time (robust to environmental and regulatory changes over time and to changes in the samples of cases examined over time).
Going back to the cases

Identification via QCA of cases whose “moves” between configurations over time resulted in outcome changes and qualitative analysis of mechanisms.
Analysis of Configurations over Time (lagged time windows)
(e.g. Aversa, Furnari, Haefliger, 2015; Meuer & Rupietta, 2015; Fainshmidt et al. 2017)

The approach in a nutshell

• It focuses on how the inner composition of the configurations associated with an outcome change over time (e.g. do the same configurations recur regularly? How do configurations differ at different periods?)

• It also focuses on changes of cases’ membership into different configurations and “moves” of cases between configurations over time

• Ideally, the analyst goes back to the cases to interpret changes and stability of configurations over time

Opportunities

• It allows to identify which configurations (or single conditions) are more regularly associated with an outcome over time (“robust configurational patterns”) and “punctuated equilibrium shifts” in the relationship between config. and outcome

Challenges

• It takes into account time in a limited way because it uses discrete time windows or “snapshots” (meaningful identification of time window is essential)
Case-oriented Calibration of Change Patterns  
(e.g. Ragin, 2014)

The approach in a nutshell

- Identify substantively meaningful change patterns of interest (in the conditions and the outcome) and label them (e.g. “quantum change” or “permanently failing”)

- Use Fuzzy-set calibration to assess cases’ degrees of membership in the change pattern identified.

- Use fs/QCA to investigate how both initial levels and change patterns in causal conditions are associated with change patterns in the outcome
Example (hypothetical): Patterns of change in org centralization

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm 1</td>
<td>0.76</td>
<td>0.67</td>
<td>0.23</td>
<td>0.09</td>
<td>1</td>
</tr>
<tr>
<td>Firm 2</td>
<td>0.96</td>
<td>0.65</td>
<td>0.25</td>
<td>0.23</td>
<td>0.76</td>
</tr>
<tr>
<td>Firm 3</td>
<td>0.79</td>
<td>0.66</td>
<td>0.33</td>
<td>0.11</td>
<td>0.66</td>
</tr>
</tbody>
</table>

- Examine data **horizontally** by time (rather than vertically as in panel data) and **identify longitudinal patterns in the fuzzy membership scores for the condition** (or outcome)
- Identify a substantively meaningful pattern of change in the condition
- **Use fuzzy-set calibration to assess the degree to which cases have membership in the specific change pattern** identified $\rightarrow$ change pattern as fuzzy set

A change pattern emerging from the data is “radical decrease in centralization”
Case-oriented Calibration of Change Patterns  
(e.g. Ragin, 2014)

The approach in a nutshell

- Identify substantively meaningful change patterns (in the conditions and the outcome) of interest and label it (e.g. “quantum change” or “stagnation”)

- Use Fuzzy-set calibration to assess cases’ degrees of membership in the change pattern identified.

- Use fs/QCA to investigate how both initial levels and change patterns in causal conditions are associated with change patterns in the outcome

Opportunities

- Identify qualitatively important change patterns in conditions and outcomes and analyze their set-theoretic intersections across cases

- More truthful to QCA case-oriented spirit (no artificial inflation of number of cases and change is calibrated at the case level).

Challenges

- Difficult to identify meaningful change patterns when the number of time periods (t) is high

- Adding change patterns increases model complexity (but less so than in tQCA)
The three approaches are better suited for different questions

<table>
<thead>
<tr>
<th>Approach</th>
<th>Analytical focus</th>
<th>Assumptions about time and cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporally-ordered configurations</td>
<td>• Focus is on sequence between conditions</td>
<td>• Time as ordered&lt;br&gt;• Cases as configurations of events</td>
</tr>
<tr>
<td>Analysis of configurations over time</td>
<td>• Focus is on inner composition of configurations and on case memberships</td>
<td>• Time as discontinuous&lt;br&gt;• Cases as trajectories between configs.</td>
</tr>
<tr>
<td>Calibration of change patterns</td>
<td>• Focus is on qualitative change patterns in config and/or outcome</td>
<td>• Time as discontinuous&lt;br&gt;• Cases as trajectories between configs.</td>
</tr>
</tbody>
</table>


Thank you!

If you have any questions, feel free to email me at santi.furnari.1@city.ac.uk