PV-PP Decision Framework

On the Non-Necessity of Scalar Aggregation in a Bounded Crisis Case

Submission Draft (V1.5)

Working contribution: In a narrow class of acute nested-persistence crises, a sacrificial act can become the only feasible and adequate preserving policy without scalar aggregation across persons serving as the primary decision mechanism.

Abstract

Formal treatments of crisis choice often begin by compressing outcomes across persons into a single ordered metric. This paper asks a narrower methodological question: in a tightly bounded class of crisis problems, is that scalar compression explanatorily necessary, or merely one available representation? The paper answers with a constructed stress case rather than a general theory of sacrifice.

It develops a non-scalar decision architecture in which the decisive explanatory work is done by scope identification, feasibility screening, and adequacy screening rather than by a cross-person ranking function. The grenade benchmark is used only as a severe test environment in which the difference between representational sufficiency and explanatory necessity can be made visible under controlled conditions.

The claim is limited. Scalar aggregation remains a sufficient way to represent the outcome. The narrower claim defended here is that, once the decision problem is framed in terms of crisis-conditioned scope update and candidate elimination, scalar aggregation need not serve as the primary explanatory mechanism in this bounded class. The result is methodological non-necessity, not a general refutation of scalar models.

Keywords: economic methodology; decision theory; scalar aggregation; explanatory necessity; non-scalar decision architecture; model pluralism

1. Introduction

Formal treatments of sacrifice and crisis choice are often written as though scalar aggregation is the natural starting point: outcomes across persons are compressed into a single ordered metric, and the sacrificial act is explained by the ranking that results. That route is coherent, but it hides a prior methodological question. Must a crisis-choice model explain the result by way of cross-person scalar ordering, or can the explanatory burden in some cases be carried by a non-scalar structure that first identifies the relevant preserved scope and then eliminates candidates through feasibility and adequacy constraints?

That question matters for economic methodology because representational sufficiency and explanatory necessity are different claims. A model may reproduce an outcome while misdescribing what does the decisive explanatory work. The issue here is therefore not whether scalar models can mimic the result; plainly they can. The issue is whether scalar compression is methodologically mandatory in order to explain the path to the result in a bounded decision class.

The paper answers that question through a deliberately severe stress case. It develops a non-scalar decision architecture for an acute nested-persistence crisis and uses a constructed grenade benchmark only to force the modeling issue into the open. In the target class of cases, the critical explanatory sequence is: identify the crisis-relevant preserved structure, remove candidates that cannot be executed, remove candidates that fail to preserve that structure, and then select from the residual field. If one candidate survives those upstream filters, scalar trade-off is no longer doing the primary explanatory work.

The contribution is methodological rather than primarily case-specific. The paper does not offer a general theory of altruism, battlefield psychology, or military virtue. It argues only that there exists a bounded crisis class in which scalar aggregation is not explanatorily necessary as the primary mechanism, even though scalar representation remains available. The grenade case matters only because it is a hard test of that narrower claim.

1.1 Methodological stakes

The methodological stakes are broader than the surface drama of the example. First, the paper bears on the difference between a model that is sufficient to represent an outcome and a model that is needed to explain how that outcome becomes selectable. Second, it bears on whether the core explanatory unit in some decision problems should be a ranking over realized joint outcomes or a structured elimination process operating over live candidates. Third, it bears on whether certain crisis cases are more adequately modeled through multi-level viability relations than through immediate outcome compression. These are recognizable questions in the methodology of economics even when the worked example is highly stylized.

The paper therefore positions itself against an overstrong methodological presumption rather than against scalar modeling as such. Economic models often function as selective, purpose-relative representations rather than exhaustive mirrors of the world, and different representational forms can be legitimate for different explanatory tasks. On that view, showing that a scalar model can reproduce a result does not yet show that scalar ranking is the only serious explanatory route. The relevant methodological question is what structure must be in the model for the target explanatory burden to be carried.

This orientation also clarifies the paper's modesty. It does not claim to overturn expected utility theory, welfare aggregation, or lexicographic modeling. It claims only that, in one bounded crisis class, a non-scalar architecture is methodologically non-redundant: it captures the selection path through crisis-conditioned scope update and candidate elimination. That places the paper closer to debates over explanation, idealization, and model pluralism in economics than to debates over the empirical frequency of heroic sacrifice.

1.2 Position relative to economic methodology and decision-theory literature

The paper also sits inside a recognizable methodological literature rather than outside it. One background issue is the status of idealized decision models in economics and neighboring fields. Classic methodology disputes asked whether highly simplified models should be judged primarily by predictive success, by the realism of their assumptions, or by the explanatory structure they isolate (Friedman, 1953; Hausman, 1992; Cartwright, 1999; Reiss, 2013). The present paper enters that terrain in a narrower way. It does not argue that idealization is illegitimate. It argues that one familiar idealizing compression-cross-person scalar aggregation-should not be treated as methodologically compulsory in every bounded crisis case.

A second background issue concerns the role of models as explanatory surrogates. Work in economic methodology and philosophy of science has stressed that models often function by isolating specific structures, mediating between theory and target systems, or constructing credible worlds in which a mechanism can be inspected under controlled conditions (Morgan & Morrison, 1999; Maki, 2009; Sugden, 2000; Morgan, 2012). That is the status claimed for the benchmark here. The grenade environment is not

offered as a literal miniature of battlefield reality. It is a purpose-built discriminating device that makes visible whether explanatory work is being done by scalar ranking or by scope update plus candidate elimination.

A third background issue concerns plurality, comparability, and compression. Methodological debates around welfare, collective choice, and cost-benefit reasoning have long warned that a single scalar ordering can hide structurally important distinctions among persons, domains, and losses (Sen, 1970; Sen, 2000; Hausman, 2012). The present paper does not claim that scalar ordering is incoherent. It claims that in the bounded crisis class examined here, forcing the explanation to begin with a scalar compression can obscure the prior architecture that determines which candidates remain live in the first place.

Seen in that light, the paper's ambition is limited but real. It does not establish a general replacement for scalar decision theory, and it does not prove that non-scalar models are always explanatorily superior. It argues for a more modest methodological point: model evaluation should track what carries the explanatory burden in the target problem. If the key burden in a bounded crisis case is discharged upstream by scope identification and candidate elimination, then scalar representation may be optional at the level that matters most for explanation. That is why the paper is best read as a claim about explanatory architecture and model individuation, not as a manifesto against utility theory.

2. Scope and limits

2.1 Exclusions

- Not a predictive theory of who will sacrifice
- Not a moral defense of sacrifice
- Not a general critique of expected utility or scalar decision theory
- Not a full exposition of the broader PV-PP architecture
- Not a claim that every grenade event should end in sacrifice

The paper isolates one narrow class of case: an acute local shock inside a nested mission-bearing structure, modeled through a compressed grenade event in a squad retrieval/extraction scenario. The analysis is deterministic and architectural rather than statistical or psychological. The claim is only that there exists a class of governing-critical nested-persistence case for which scalar aggregation is not structurally required as the primary modeling mechanism.

3. Minimal architectural scaffold

Only a restricted subset of the broader framework is needed here. The paper assumes that both individuals and organized units can carry viability constraints. The individual soldier is one persistence-bearing entity. The squad, understood not as a mere sum of bodies but as an organized retrieval/extraction structure carrying mission continuity and coordinated survival burden, is another.

The model remains non-scalar. States are described across domains, and viability is defined by whether a given entity remains inside its admissible region. The domains needed here are intentionally narrow: individual integrity, mobility, and exposure on the one hand; squad survival, extraction continuity, mission viability, and cohesion on the other. The paper does not require a total ordering over all joint outcomes.

The key structural move is governing-critical structure. Under ordinary conditions, the acting soldier's own viability may remain the operative preserved scope. In the target case, however, the crisis geometry makes the extraction-bearing squad structure governing-critical. Once that happens, candidate responses are

screened not only by whether they preserve the acting individual, but by whether they preserve the structure whose collapse would terminate the local mission-bearing possibility.

3.1 Feasibility, adequacy, and selection

The paper needs three filters and no more. Feasibility asks whether a response can actually be executed under the event geometry and time compression. Adequacy asks whether an executable response preserves the governing-critical structure rather than merely changing the local path. Selection is then downstream and relatively light: if only one candidate remains both feasible and adequate, the architecture does not need a scalar trade-off across persons to explain why it survives.

Filter	Question asked	Role in the argument
Feasibility	Can the response actually be executed inside the event geometry and time window?	Eliminates impossible or too-slow candidates before value comparison
Adequacy	If executed, does the response preserve the governing-critical structure?	Eliminates executable but non-preserving candidates
Selection	What remains after the earlier filters?	Needs only light downstream choice structure if one candidate survives

The paper's burden is therefore not to rank every imaginable outcome. It is to show that, in the core case, the earlier filters remove the ordinary non-sacrificial alternatives before scalar comparison becomes necessary.

4. Scenario environment

The benchmark is a constructed discriminating device rather than the paper's subject. It uses a 12×12 retrieval/extraction grid with cover, directional exposure, constrained movement, and localized explosive events to separate ordinary danger from genuinely governing-critical compression. Its role is methodological: to test whether a non-scalar elimination architecture can explain the result without prior scalar unification.

4.1 Baseline scenario assumptions

- A recoveree remains dependent on immediate squad extraction.
- Hostile pressure and movement constraints leave only a small number of live local maneuvers.
- Grenade events vary in placement and severity rather than being constructed to force sacrifice every time.

4.2 Case family

Case	Shock geometry	Architecture outcome	Paper use
A	Remote or irrelevant blast	No governing shift	Sanity check
B	Dangerous but	Ordinary movement	Control

	escapable	remains adequate	
C	Damaging but non-governing	Local loss possible without squad collapse	Control
D	Compressed extraction bottleneck	Sacrificial blast absorption may become only adequate preserving policy	Core case

5. Control cases

The controls do defensive work. The paper must show not only that sacrifice can emerge in the core case, but also that the architecture does not produce sacrifice whenever danger appears.

In Case B, the blast is serious but escapable. Ordinary movement or repositioning remains both feasible and adequate, so no sacrificial act is needed.

In Case C, the event may be damaging but does not collapse the governing structure. Local injury may occur, but the extraction-bearing squad remains viable without sacrificial interposition.

5.1 Worked control: dangerous but escapable

In Case B, the grenade lands near the formation but outside the compressed extraction bottleneck. At least one withdrawal path remains open enough for the recoveree-bearing structure to clear the blast envelope inside the detonation clock.

Because a non-sacrificial withdrawal remains both feasible and adequate, sacrificial interposition is not selected. Case B therefore shows that danger alone is insufficient.

5.2 Worked control: damaging but non-governing

In Case C, the grenade is locally damaging but non-governing. It can injure one element of the formation without collapsing the recoveree-bearing extraction structure as a whole.

The event therefore does not produce the governing shift seen in Case D. Sacrificial interposition is unnecessary because local harm does not rise to governing-critical collapse.

6. Core case: compressed governing-critical grenade event

The core case occurs near extraction, where geometry, timing, actor placement, and mission dependence collapse into a narrow response window. The threat becomes governing-critical because ordinary escape, dispersal, or shielding no longer preserve the squad-level persistence structure.

6.1 Event compression

The core configuration is a local extraction bottleneck. The recoveree is already near the extraction lane, multiple squad members are committed to the immediate withdrawal geometry, and the grenade lands close enough to the clustered recovery structure that the whole unit cannot clear in time.

Operationally, lateral movement is blocked or too short, rear withdrawal is too slow, and preserving only the acting soldier leaves the recoveree-bearing structure inside the blast envelope. For present purposes, the grenade is treated as operating on a 3–5 second detonation window.

6.2 Governing shift

Under ordinary conditions, the soldier's own viability can remain the operative preserved scope. In the compressed extraction event, however, the relevant persistence-bearing structure is the withdrawal-capable squad-with-recoveree unit because the recoveree, the carriers, and the immediate extraction architecture now share one survival envelope.

A structure counts as governing-critical here when, under the local crisis geometry, its collapse would terminate the active mission-bearing viability of the nested system. In the core case, once that shift occurs, actions that save only the acting soldier while allowing the extraction structure to fail are no longer adequate.

6.3 Candidate policies

The candidate field is intentionally small: immediate self-escape, dispersal, dragging or advancing the recoveree, taking cover in place, and sacrificial blast absorption. The methodological point depends on screening these candidates in order rather than redescribing the final choice after the fact.

Candidate response	Feasible?	Adequate?	Reason eliminated / retained
Immediate self-escape	No / marginal	No	Clock and geometry do not preserve squad structure
Dispersal command	No	No	Formation cannot clear in time
Drag recoveree only	No / partial	No	Too slow; structural collapse remains
Take cover in place	Yes	No	Blast envelope still collapses extraction-bearing structure
Absorb blast	Yes	Yes	Only candidate that preserves the governing-critical structure

6.4 Why absorb-blast survives

Absorb-blast is not selected because the actor's life is assigned lower scalar worth. It survives because the competing candidates fail in sequence: some cannot be executed inside the detonation window, while others remain executable but do not preserve the governing-critical structure.

The claim is therefore local rather than global. In this narrowly specified event, sacrificial interposition remains the only feasible and adequate preserving action left in the live field.

6.5 Compact decision-path trace

1. Local state: the squad is compressed near extraction with the recoveree still structurally dependent on the immediate formation.
2. Shock event: a grenade lands within the shared local survival envelope.

3. Governing update: the extraction-bearing squad structure becomes governing-critical under the event geometry.
4. Candidate generation: self-escape, dispersal, drag, cover-in-place, and absorb-blast enter the live field.
5. Feasibility filter: dispersal and drag fail the clock; some escape paths fail the geometry.
6. Adequacy filter: surviving non-sacrificial actions do not preserve the governing-critical structure.
7. Residual candidate: absorb-blast remains as the only feasible and adequate preserving act.
8. Selection: the sacrificial act is therefore structurally selectable without requiring prior scalar unification across persons.

7. Hidden scalar equivalence and the methodological objection

7.1 The objection stated in methodological form

The strongest hostile objection is methodological: the proposed architecture may do nothing more than redescribe a scalar ranking under different labels. Once the squad is treated as the preserved structure, perhaps a higher-order preference for group survival has already been smuggled in, with governing-critical structure and adequacy serving only as renamed utility weights.

7.2 The architectural reply

The reply is not that scalar models are wrong. It is that the governing-critical designation is triggered here by local crisis structure rather than by a standing cross-person ordering. The update is crisis-conditioned and local, not a general thesis that groups outrank individuals across contexts.

A scalar model can reproduce the same outcome by assigning the squad's survival sufficiently high priority. The paper's narrower claim is that, once the crisis-conditioned scope is identified, candidate elimination can proceed through feasibility and adequacy without requiring a prior ordered metric across persons.

That distinction matters because extensionally similar models can still differ in explanatory structure. In a scalar account the decisive work is done by the ranking function; in the present account it is done by scope update plus sequential elimination.

7.3 Position relative to existing models

- Expected utility and allied scalar models remain sufficient ways of representing sacrifice cases and are not being challenged at that level (von Neumann & Morgenstern, 1944; Hausman, 2012).
- Lexicographic systems and welfare-comparative approaches matter because the strongest hostile objection is precisely that governing-critical designation may smuggle in a hierarchy under different language (Chipman, 1960; Sen, 1970, 2000).
- Methodological work on models and explanation matters because the paper's central issue is not prediction alone, but what structure must be present in an explanatory model of crisis choice. On that question, the paper is closer to debates about idealization, surrogate systems, and model individuation than to debates about military behavior as such (Hausman, 1992; Morgan & Morrison, 1999; Sugden, 2001; Mäki, 2009; Cartwright, 1999).
- Model-pluralist and surrogate-model views matter because they underwrite the paper's narrower claim: a constructed benchmark can justify itself by isolating explanatory structure, even when it is not a realistic micro-description of the world (Morgan & Morrison, 1999; Sugden, 2000; Morgan, 2012; Reiss, 2013).

8. Scalar non-necessity as an explanatory result

Scalar aggregation remains available as a sufficient representation of the crisis outcome. The paper's narrower implication is explanatory: once the governing-critical structure is identified and the candidate field is filtered through feasibility and adequacy, there exists a non-scalar representation in which the sacrificial act becomes selectable without scalar aggregation carrying the primary explanatory burden.

This matters methodologically because it separates representational convenience from explanatory necessity. The benchmark does not prove universal nonequivalence between scalar and non-scalar models. It shows only that one bounded crisis class can be modeled non-scalar-first without explanatory loss, which is enough to block a stronger necessity claim.

9. Limits

9.1 Scope conditions for the claim

- A real nested persistence-bearing structure must be present.
- The crisis must make that structure governing-critical locally.
- Ordinary non-sacrificial candidates must fail feasibility or adequacy.
- The sacrificial act must survive as the only preserving candidate in the live field.

The argument is class-bounded. It does not show that all self-sacrifice is non-scalar, that all military sacrifice has the same structure, or that every grenade case should end in sacrificial interposition. It does not provide a psychological theory of courage, fear, loyalty, or training. It does not show that scalar models are false, only that they are not required as the primary mechanism in the narrow class examined here.

Richer stochastic modeling, heterogeneous agents, and wider scenario families remain future work.

10. Conclusion

The paper's contribution is methodological. It identifies a bounded crisis class in which an extreme self-sacrificial act can become selectable through crisis-conditioned scope update, feasibility screening, and adequacy screening without scalar aggregation serving as the primary explanatory mechanism. That result does not show that scalar models fail. Scalar aggregation remains a sufficient way to represent the outcome, and in some contexts it may remain the most economical device.

The benchmark matters only as a stress test. It provides a controlled case in which the explanatory work performed by scope identification and candidate elimination can be separated from the explanatory work performed by outcome ranking. If that separation is real, the paper establishes a limited but genuine point for economic methodology: representational sufficiency should not be confused with explanatory necessity.

11. References

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