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Research Article

Wellbeing, VUCA(t), and BANI: The Unequal Human Burden of Global Disruption (A Formative-Vector Framework and Country-Year Panel Evidence, 2005–2022)

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ABSTRACT: The acronyms VUCA (Volatility, Uncertainty, Complexity, Ambiguity) and BANI (Brittle, Anxious, Nonlinear, Incomprehensible) have organised much management and strategy discourse over the last decade, but they have rarely been operationalised in a way that lets them be tested against data. This paper proposes that the two should be understood dynamically rather than as competing acronyms: VUCA(t) as an external field of disruption (a common, time-varying load of financial, policy, and geopolitical shocks to which all national social systems are exposed, and which can strain their normal functioning), and BANI as a *formative* vector of failure modes whose appearance depends on whether disruption exceeds adaptive capacity. We construct a global VUCA(t) composite from financial-volatility, world-uncertainty, economic-policy-uncertainty, and geopolitical-risk indices (1998–2025), and combine it with World Happiness Report panel data on anxiety / negative affect, social support, healthy life expectancy, and confidence in national government for 160 countries from 2005 to 2022 (N = 2,126 country-years). Three contributions emerge in descending order of strength. **The primary contribution is measurement-theoretical:** BANI must be modelled as a formative vector rather than a reflective scale. This is grounded conceptually — brittleness, anxiety, nonlinearity, and incomprehensibility are structural, affective, dynamic, and epistemic phenomena respectively, and there is no theoretical reason to expect them to co-move as interchangeable indicators — and confirmed empirically by a model that yields strongly negative interactions with anxiety / negative affect as the dependent variable but a flat null with institutional distrust as the dependent variable. **The secondary contribution is descriptive-empirical:** low-capacity countries' anxiety / negative affect rose sharply during 2014–2022 while high-capacity countries' remained comparatively stable — a striking divergence that coincides with rising global VUCA. **The tertiary contribution is conceptual-policy:** wellbeing may function as adaptive infrastructure, with the relational form of capacity (social support) carrying more of the descriptive moderation than the biological form (healthy life expectancy). A clean year-by-year causal moderation by VUCA per se cannot be identified with global VUCA only; a capacity-specific linear-trend control absorbs the interaction, indicating the pattern is also consistent with a broader differential trend in low-capacity countries. The paper should therefore be read as a measurement frame and descriptive puzzle that establishes the empirical agenda for a follow-up paper using country-specific VUCA shocks to test the mechanism.

Keywords: VUCA, BANI, Adaptive capacity, Wellbeing, Negative affect, Formative measurement, Country-year panel, Phase change, Social resilience

1. INTRODUCTION

For nearly two decades the acronym **VUCA** — Volatility, Uncertainty, Complexity, Ambiguity — has organised how organisations and policymakers describe a turbulent

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operating environment. Originating in the United States Army War College in the late 1980s and migrating into management discourse through Bennett and Lemoine (2014) and others, VUCA captured a real intuition: that the modern world presents a different *kind* of difficulty than the more cyclical, predictable problems of earlier eras. Bennett and Lemoine (2014) define volatility as unexpected or unstable change, uncertainty as a lack of information about whether an event will matter, complexity as many interconnected parts and variables, and ambiguity as unclear causal relationships. A systematic review by Taskan, Junça-Silva, and Caetano (2022) finds that the four components overlap, each able to associate with, cause, or contextualise the others while keeping its own definition. Recently, the term **BANI** — Brittle, Anxious, Nonlinear, Incomprehensible — has been proposed by Jamais Cascio (2020) as a successor or complement, with the suggestion that VUCA's vocabulary no longer fits a world in which systems do not merely fluctuate but *fail unpredictably*, in which uncertainty is no longer just cognitive but emotional, and in which complexity has shaded into outright incomprehensibility.

Both acronyms have been productive in their domains. Neither has been substantially operationalised. The two are typically presented as alternatives, with one set of authors arguing for VUCA, another for BANI, and the empirical question — whether either set of dimensions actually behaves as the framework predicts — left largely untouched. An alternative reading treats them as successive steps in how management discourse frames uncertainty, from VUCA's instability under low information to BANI's fragility, anxiety, and epistemic breakdown (Madsen & Berg 2026). Our dynamic reading is consistent with that view. This is not unusual for taxonomies imported from practice into research, but it leaves the frameworks unfalsifiable in their strong forms. Without measurement, "the world has become more BANI" is a slogan rather than a claim.

This paper has three aims. First, to propose a *dynamic* reading in which VUCA and BANI are not competing acronyms but successive components of a single causal model: VUCA(t) describes the external load of disruption, BANI describes the failure modes that can emerge when that disruption exceeds adaptive capacity, and the relationship between the two is moderated by capacity. Second, to make this model operational, by building a global VUCA(t) composite from established uncertainty and risk indices and pairing it with a country-year panel of human-strain measures from the World Happiness Report. Third, to test the framework's strongest predictions against data and to be honest about which of those predictions survive. Composite indices of this kind are standard in the uncertainty literature (Ahir, Bloom, & Furceri 2022; Baker, Bloom, & Davis 2016), and the overlap among VUCA components (Taskan *et al*. 2022) supports combining them. The World Happiness Report variables used are negative affect, social support, healthy life expectancy, and confidence in national government (Table **1**). Although VUCA and BANI come from organisational discourse, we apply them to national social systems, treating countries, like organisations, as complex adaptive systems that adapt and self-organise under uncertainty (Taskan *et al*. 2022).

The findings turn out to be more interesting than a clean confirmation would have been. They fall into three tiers, in descending order of evidential strength:

[Strong evidence] BANI should be modelled as a formative vector of failure modes, not as a single reflective scale. The same model that yields a strongly negative VUCA × Capacity interaction when anxiety / negative affect is the dependent variable returns a flat null when institutional distrust is the dependent variable. The four BANI letters do not behave as interchangeable symptoms of one latent strain factor. Treating them as a composite would smear over real differences in mechanism.

[Strong descriptive evidence] Low-capacity countries diverged sharply from high-capacity countries in mean anxiety / negative affect during 2014–2022, a period of rising global VUCA. Anxiety in low-capacity countries (the bottom capacity tertile) rose by roughly 1.5 standard deviations across the window. In high-capacity countries (the top tertile) it remained essentially flat. The world did not simply become more disrupted; the human burden of that period was distributed unequally.

[Qualified] Whether this divergence reflects a causal year-by-year moderation of VUCA shocks by capacity, or a broader differential trend that coincides with rising VUCA, cannot be cleanly distinguished with global VUCA alone. A capacity-specific linear time-trend control absorbs the headline interaction. Country-specific VUCA shocks would be needed for causal identification, and are the natural next step.

The remainder of the paper is organised as follows. Section 2 develops the theoretical framework, including the formative-vector reading of BANI and the role of adaptive capacity. Section 3 describes the data and the panel design, with explicit attention to what the global-VUCA-only specification can and cannot identify. Section

4 reports the main descriptive and panel results, including the robustness pass that qualifies the strong causal claim. Section 5 discusses what the findings mean for the framework, with particular attention to wellbeing as adaptive infrastructure. Section 6 outlines limitations and the path to a more strongly identified follow-up. Section 7 concludes.

This paper should be read as a measurement and descriptive foundation rather than a final causal test. Its contribution is to show that BANI is best treated as a formative vector of failure modes; that anxiety / negative affect is the most empirically tractable human-strain channel in available global panel data; and that the human burden of the recent high-VUCA period has been highly unequal, rising sharply in low-capacity countries while remaining comparatively stable in high-capacity countries. The causal claim that adaptive capacity moderates the year-by-year conversion of VUCA into anxiety remains plausible but not identified with global VUCA alone. Country-specific disruption shocks are required for that next step, and Section 6 outlines the design. A companion paper (Ricketts & Beaumont 2026) extends this analysis to AI.

2. THEORETICAL FRAMEWORK

2.1. VUCA(t) as an External Field of Disruption

VUCA was originally proposed as a description of operating conditions, not as a measurable construct. To make it measurable we treat it as a time-varying scalar field: a global level of external disruption that varies year by year and to which all countries are exposed (with the qualification, addressed in Section 3, that this is a strong simplification). The four VUCA dimensions correspond reasonably well to existing indices in the financial and policy literature — Volatility to financial-market volatility (the CBOE VIX), Uncertainty to the World Uncertainty Index (Ahir, Bloom, & Furceri 2022), the policy-economic component to the Global Economic Policy Uncertainty index (Baker, Bloom, & Davis 2016), and Ambiguity to the Geopolitical Risk index (Caldara & Iacoviello 2022). Complexity proves harder to operationalise globally and is acknowledged as a measurement gap; we discuss this in Section 6.

The VUCA(t) composite we construct is the simple z-mean of the standardised log of these four indices. It is best understood as a "disruption load" indicator rather than a precise measure of any single phenomenon. Unlike BANI (Section 2.2), VUCA can reasonably be combined into one composite, because its components are overlapping aspects of a common external load rather than distinct kinds of failure (Taskan *et al*. 2022). In the models below, VUCA(t) is the independent variable, anxiety / negative affect and institutional distrust are the dependent variables, and adaptive capacity is the moderator. As Figure **1** shows, the composite tracks the major episodes of the post-1990 period — the early-1990s recession, the late-1990s emerging-market crises, 9/11, the 2008 global financial crisis, the European debt crisis, Brexit, the COVID-19 pandemic, the Russia–Ukraine war, and the 2025 trade-policy episode — without being driven by any one of them. After roughly a decade of relatively low values from 2003 to 2013, the

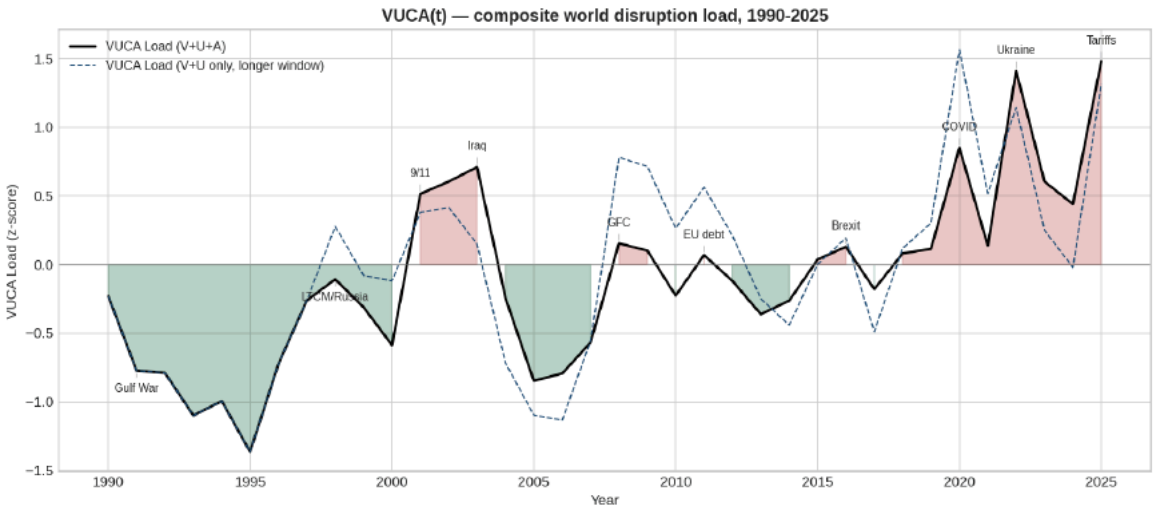


Figure 1: Global VUCA(t) composite, 1990–2025. The black line is the unweighted z-mean of the standardised logs of the VIX, the World Uncertainty Index, the Global Economic Policy Uncertainty index, and the Anglosphere Geopolitical Risk Factiva index. The dashed blue line shows the V+U-only composite (longer window) for comparison. Shaded regions indicate VUCA above (red) and below (green) the long-run mean. Annotations mark major historical episodes.

composite enters a sharply rising regime from 2014 onward, reaching its highest values in 2020–2025.

2.2. BANI as a Formative Vector, not a Reflective Scale

Cascio's BANI proposal has a particular structure. The four letters describe distinct failure modes: brittleness is a property of systems that snap rather than bend; anxiety is a property of human experience under pressure; nonlinearity is a property of how outcomes scale with inputs; incomprehensibility is a property of the relationship between events and our capacity to make sense of them. These are not four interchangeable symptoms of a single underlying state. They are four different ways things can go wrong.

This distinction matters for measurement. In psychometric terms, a *reflective* measurement model treats observed indicators as caused by an underlying latent variable — depression items are caused by depression, anxiety items by anxiety, and so on. Indicators of the same construct should therefore co-vary, and a measure like Cronbach's α should be high. A *formative* measurement model treats observed indicators as *constituting* the construct rather than being caused by it. Socioeconomic status is the canonical example: income, education, and occupation together *make up* SES, but they need not strongly co-vary, and their internal consistency is not the correct test of the construct's quality (Diamantopoulos & Winklhofer 2001).

The case for treating BANI as formative is conceptual first, empirical second. Brittleness, anxiety, nonlinearity, and incomprehensibility are different *kinds* of failure: brittleness is structural (a property of how systems break under load), anxiety is affective (a property of human experience), nonlinearity is dynamic (a property of how outcomes scale with inputs), and incomprehensibility is epistemic (a property of the relationship between events and our capacity to make sense of them). There is no theoretical reason to expect these four phenomena to co-move as interchangeable indicators of a single underlying state, any more than there is reason to expect a society's electrical grid, its rate of clinical depression, its earthquake risk, and its level of disinformation to load on a common factor. The four BANI letters together *constitute* a vector of failure modes, but they need not move on the same schedule, in the same direction, or in response to the same disturbances. The framework's value lies in naming distinct channels through which disruption can become harm, not in positing a latent "BANI factor" that all the channels measure. The empirical evidence we report below confirms this conceptual stance; it does not have to carry it on its own.

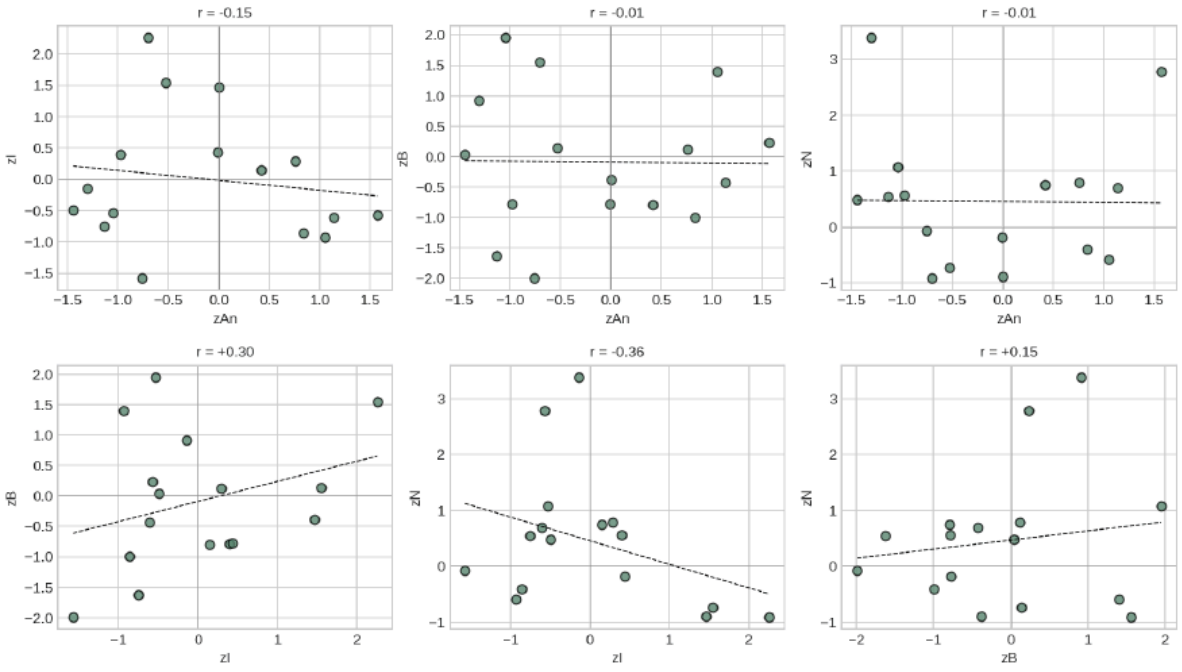


Figure 2: Pairwise scatter of BANI's four standardised letters at the world-aggregate annual level, 2005–2020 (n = 16 years). Pearson correlations are reported above each panel. Anxiety (zAn), institutional distrust proxy (zI), brittleness via disaster damages as a share of world GDP (zB), and nonlinearity via the within-year VIX p95-to-mean ratio (zN). Correlations are scattered between −0.36 and +0.30, with no consistent sign pattern. This is the empirical signature of a formative rather than reflective construct: the four letters do not behave as interchangeable symptoms of a single latent strain factor.

An earlier exploratory analysis (not reported here) computed Cronbach's α for our four BANI letters at the world-aggregate annual level and found α ≈ 0; under a reflective reading this would be a falsification, but under the formative reading we adopt it is exactly what one would expect, and it serves as a methodological clarification rather than a problem. Figure **2** illustrates this directly: pairwise correlations among the four letters at the world level are scattered and inconsistent in sign.

2.3. Adaptive Capacity as Moderator

If BANI is the failure-mode vector and VUCA is the load, the third element of the framework is the moderator: *adaptive capacity*. This is the property of a system that determines how much external disruption it can absorb before it begins to fail. Capacity in this sense is a familiar concept in resilience research, in disaster studies, and in the antifragility literature (Taleb 2012). What the present paper adds is the specific empirical claim that capacity, operationalised at the country-year level using social-support and health-system measures, should reduce the conversion of VUCA into human strain.

The framework's central falsifiable prediction can therefore be stated as a moderation:

$Strain_{i,t} = \alpha_i + \lambda_t + \beta_2 \cdot Capacity_{i,t} + \beta_3 \cdot (VUCA_t \times Capacity_{i,t}) + \varepsilon_{i,t}$, with the prediction that $\beta_3 < 0$.

That is: in countries with higher capacity, the conversion of any given level of VUCA into strain should be smaller. The same global shock should produce less anxiety where social support, health, and trust are more abundant. Adopting the phase-change metaphor that has been suggested in related work, we might say that wellbeing capacity *may* raise the social melting point — the threshold at which a disruption load translates into observable strain. We use the conditional "may" deliberately. The metaphor is a hypothesis the data can be consistent with; it is not yet a result the data have demonstrated.

2.4. Why this Matters Beyond the Acronyms

If wellbeing-related variables — social support, health, institutional trust, and orientation — function as adaptive infrastructure, this has implications well beyond the management literature in which VUCA and BANI are usually discussed. Each variable plausibly adds to adaptive capacity in a different way. Social support is the relational form: it buffers the effect of stress (Cohen & Wills 1985) and speeds recovery after shocks (Aldrich 2012). Healthy life expectancy is the biological form: the physical reserve available to absorb strain. Institutional trust enables coordinated response. Orientation is the shared ability to interpret change. It would mean that wellbeing is not merely a downstream outcome of well-functioning economies but an upstream input into how economies and societies absorb shocks. It would shift the policy frame around wellbeing from "what successful societies enjoy" toward "what determines whether societies remain functional under disruption." And it would suggest that the design response to a high-VUCA period is not only growth or sustainability — both of which assume a relatively stable operating environment — but the deliberate cultivation of antifragile wellbeing and orientation. This conceptual implication is what is at stake when we ask whether β_3 is negative.

3. DATA AND METHODS

3.1. Sources and Variables

Table **1** summarises the operationalisation. All data are publicly available; none of the analysis depends on proprietary indicators.

The VUCA(t) composite is built as the unweighted z-mean of z(log VIX), z(log WUI), z(log GEPU), and z(log GPR), with each variable standardised over its full available window. The composite covers 1998–2025 with all four components present. Capacity is built as the unweighted z-mean of standardised Social Support and standardised Healthy Life Expectancy, with the standardisation performed within the country-year analysis sample.

3.2. Sample and Panel Structure

Combining the WHR panel with the global VUCA(t) series, and restricting to country-years where Anxiety / negative affect, Social Support, and Healthy Life Expectancy are all observed, yields **2,126 country-year observations across 160 countries from 2005 to 2022**. Sixty-five countries have at least 15 years of complete data; 114 have at least 10 years. The panel is unbalanced. Sample composition by region is broadly representative of the world, with Sub-Saharan Africa, Latin America & the Caribbean, Western Europe, Central and Eastern Europe, and the Middle East & North Africa each contributing meaningful country counts.

3.3. Identification and the Limits of a Global-VUCA Design

The central methodological caveat of the paper concerns identification. Our VUCA(t) composite varies only across years; it does not vary across countries within a year. In a two-way fixed-effects regression with year fixed effects

Table 1: Variables, sources, and coverage

Construct	Operationalisation	Source	Frequency / coverage
Volatility (V)	Annual mean of daily log CBOE VIX close	Chicago Board Options Exchange	Daily, 1990–present
Uncertainty (U_1)	World Uncertainty Index, global simple average	Ahir, Bloom, & Furceri (2022); via FRED	Quarterly, 1990–present
Uncertainty (U_2)	Global Economic Policy Uncertainty (GEPU)	Baker, Bloom, & Davis (2016); via FRED	Monthly, 1997–present
Ambiguity (A)	Anglosphere Geopolitical Risk index (Factiva)	Caldara & Iacoviello (2022); via Schueler GitHub mirror	Monthly, 1998–2025
Complexity (C)	*Not operationalised at country-year level — measurement gap*	—	—
Anxiety / negative affect (BANI: A)	Negative Affect (averaged worry, sadness, anger items)	World Happiness Report / Gallup World Poll	Annual, 2005–2022, ~140+ countries
Institutional distrust proxy (BANI: I, partial)	1 − Confidence in National Government	World Happiness Report / Gallup	Annual, 2005–2021
Brittleness (BANI: B)	*World aggregate only (disaster damages % GDP); not used in main spec*	OWID / EM-DAT	Annual world, 1990–2020
Nonlinearity (BANI: N)	*Within-year VIX p95-to-mean ratio (global only); not used in main spec*	Derived from VIX	Annual, 1990–present
Capacity (composite)	z-mean of Social Support and Healthy Life Expectancy	WHR (Gallup item) and WHO Global Health Observatory	Annual, 2005–2022
Capacity (alternative forms)	Country mean (Cap_i); 2005–2008 baseline mean (Cap_{base}); within-country lag ($Cap_{i,t-1}$); HLE-only	Same as composite	Same
Log GDP per capita (control)	Used in Spec D	WHR (sourced from World Bank WDI)	Annual, 2005–2022

Brittleness and Nonlinearity are listed for completeness; both are available only at the world aggregate level in our build and are not used in the main country-year panel specifications.

(λ_t), the main effect of VUCA is therefore absorbed: we cannot separately estimate β_1. What *is* identified is the interaction $VUCA_t \times Capacity_{i,t}$, because this varies in both *i* and *t* — different countries have different Capacity, and so the interaction term differs across countries within any given year. The interaction coefficient β_3 measures whether countries with higher capacity exhibit systematically smaller anxiety responses to high-VUCA years.

This is a standard "global shock × local exposure" panel design and is identified in principle. The substantive caveat we emphasise in Section 4 is that, when global VUCA itself trends over the sample period (as ours does post-2014), the interaction is also statistically consistent with low-capacity countries having a different time trend in anxiety than high-capacity countries — even if VUCA per se does nothing year-by-year. The two are observationally equivalent in this design. We address this by adding a capacity-specific linear time-trend control (Spec G) which, if the moderation is real, should leave the interaction coefficient intact, and which, if the divergence is just a differential trend, should absorb the interaction.

3.4. Specifications

We report eleven specifications, organised into a v3 main set (descriptive moderation) and a v3.1 robustness set (added in light of methodological feedback during drafting). All standard errors are clustered at the country level, accommodating arbitrary within-country serial correlation and heteroskedasticity.

4. RESULTS

4.1. The Descriptive Divergence

Figure **3** shows the central empirical pattern of the paper. The top panel reproduces the global VUCA(t) trajectory from Figure **1**, restricted to the 2005–2022 sample window. The bottom panel shows the annual mean of the standardised anxiety / negative affect variable, broken down by terciles of country-mean Capacity.

Three features of this figure are worth highlighting. First, the divergence is large in absolute terms: the gap between the low-capacity and high-capacity terciles widens from approximately 0.1 standard deviations in 2005 to approximately 1.7 standard deviations in 2022. Second, the divergence is largely concentrated in the

Table 2: Panel specifications

Spec	Description	Identifies
0	Pooled OLS with VUCA, Capacity, and their interaction	All three coefficients (without absorbing trends)
A	TWFE with time-varying $Capacity_{i,t}$ and the interaction	β_2 and β_3
B (headline)	TWFE with country-mean $Capacity_i \times VUCA_t$	β_3 only — the cleanest moderation test
C	TWFE with Capacity decomposed into Social Support and Healthy Life Expectancy	Differential moderation by capacity component
D	Spec A + log GDP per capita control	Whether the moderation is just an income effect
G	Spec B + ($Capacity_i \times$ linear time trend) — capacity-specific trend control	Whether moderation survives a competing trend explanation
H	Spec B with Capacity defined as 2005–2008 country mean (no future information)	Whether the result is driven by retrospectively defined capacity
I	Spec A with within-country lagged $Capacity_{i,t-1}$	Simultaneity check
J	Spec B with Region × Year fixed effects (instead of Year FE)	Most demanding spec; identifies off within-region variation
K	Spec B with Healthy Life Expectancy alone as Capacity (non-Gallup measure)	Common-method covariance check
L	Same model as Spec B but with institutional distrust proxy as DV	Formative-construct check across BANI letters

Specs 0–C and L test the framework's main predictions; Spec D and Specs G–K are robustness checks. Spec G is the most informative robustness test and is the one whose result requires the qualified language used throughout this paper. We deliberately avoid the term "placebo" for Spec G because it is not a fake treatment; it is a serious competing explanation that the data do not let us rule out.

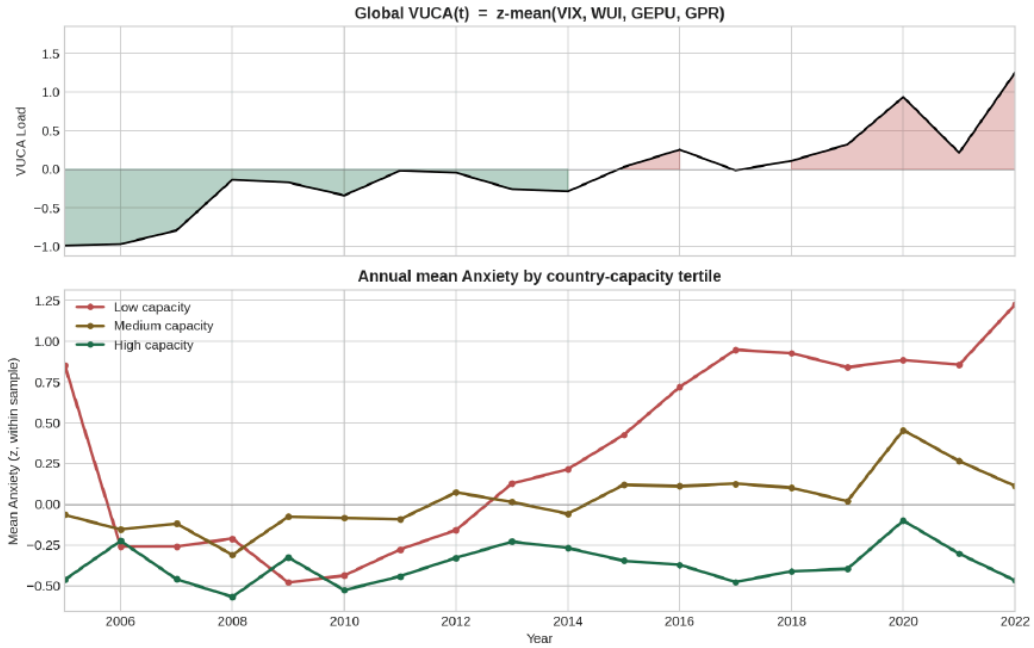


Figure 3: Top panel: global VUCA(t) composite over the 2005–2022 country-year analysis window. Bottom panel: annual mean anxiety / negative affect (sample-standardised) by country-capacity tercile. Capacity terciles are defined by the country mean of the z-Social-Support and z-Healthy-Life-Expectancy composite over the full sample. The high-capacity tercile (green) remains essentially flat near −0.4 SD across the period. The low-capacity tercile (red) drifts upward modestly through 2014, then rises sharply to +1.25 SD by 2022. The medium tercile (yellow) follows a milder version of the same trajectory. The divergence coincides with the rise in global VUCA but is also consistent with a broader differential trend; see Section 4.3.

post-2014 period that also saw the sharp rise in global VUCA. Third, the high-capacity tercile shows essentially no trend — its mean anxiety in 2022 is statistically indistinguishable from its mean anxiety in 2008. The pattern is not "everyone got more anxious"; it is "low-capacity countries became dramatically more anxious while high-capacity countries did not." In BANI terms, Figure **3** tracks the Anxiety letter only; Section 4.5 tests a second letter.

Table 3: Spec 0: pooled OLS, n = 2,126

Coefficient	Estimate	Cluster SE	p	Interpretation
β_1 ($VUCA_t$)	+0.398	0.037	< 0.001	Higher global VUCA is associated with higher anxiety / negative affect.
β_2 ($Capacity_{i,t}$)	−0.382	0.053	< 0.001	Higher capacity is associated with lower anxiety / negative affect.
β_3 (VUCA × Capacity)	−0.404	0.040	< 0.001	Capacity reduces the slope of anxiety on VUCA — the moderation prediction.

Standard errors clustered by country.

Whether one interprets this as VUCA being differentially absorbed by capacity, or as a broader divergence in the conditions of low-capacity countries during a period that also saw rising VUCA, is the substantive question the rest of the analysis addresses.

4.2. Pooled and Panel Results

Table **3** reports the framework's three main predicted coefficients in the pooled OLS specification (Spec 0). All three are signed as predicted and statistically significant.

The pooled OLS results are consistent with all three framework predictions, but they leave open many obvious confounds. Countries with low capacity may differ from countries with high capacity in ways that have nothing to do with VUCA-style disruption. Adding country and year fixed effects addresses both kinds of confounding: country FE absorb time-invariant national differences, year FE absorb common global shocks (including the main effect of VUCA itself).

Specs A and B push this further. Spec A retains the full time-varying $Capacity_{i,t}$ alongside the interaction, with both country and year fixed effects. The Capacity main effect is estimated at −0.82 ($p < 0.001$), and the interaction coefficient is $\beta_3 = -0.42$ ($p < 0.001$). Spec B replaces the time-varying Capacity with the country mean Cap_i, whose main effect is then absorbed by the country fixed effects, leaving only the interaction $VUCA_t \times Cap_i$. This is the cleanest implementation of the moderation test, and it returns $\beta_3 = -0.419$ (cluster-robust SE = 0.046, $p < 0.001$). The 95% confidence interval is [−0.51, −0.33].

Decomposing capacity into its two components (Spec C) is informative. Both the Social Support × VUCA interaction (−0.19, $p < 0.001$) and the Healthy Life Expectancy × VUCA interaction (−0.15, $p = 0.013$) are negative and significant, but Social Support carries more of the moderation. In the language of the framework, the *relational* form of capacity is descriptively more strongly associated with the moderation pattern than the

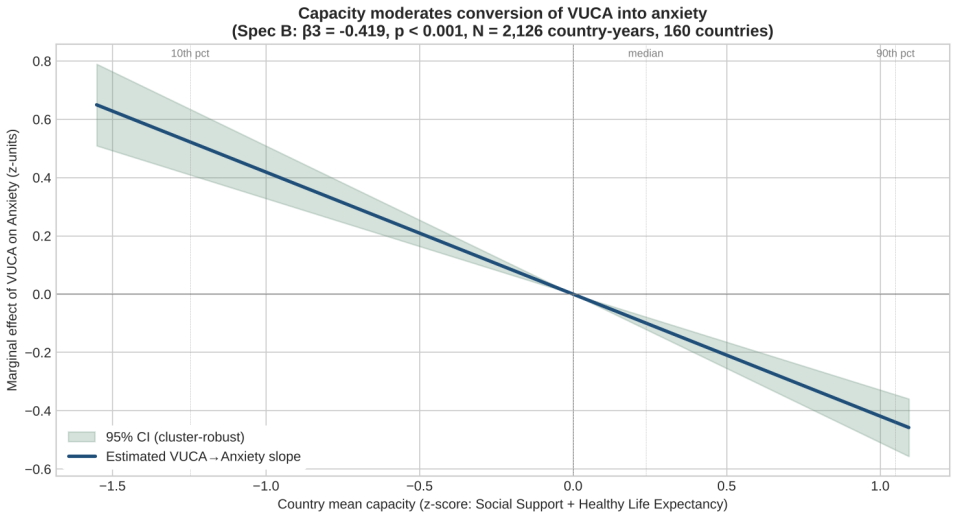


Figure 4: Estimated marginal effect of VUCA on anxiety / negative affect as a function of country mean Capacity, from Spec B. The dark line is the point estimate ($\beta_3 \cdot Cap_i$); the shaded band is the 95% cluster-robust confidence interval. Vertical dotted lines mark the 10th, 50th, and 90th percentiles of the country-capacity distribution. **Caveat on interpretation:** because year fixed effects absorb VUCA's main effect, this slope is the *differential* anxiety response by capacity to high-VUCA years relative to the global year mean. The fact that the slope turns negative at high capacity should be read as "high-capacity countries have systematically less anxiety in high-VUCA years than the global pattern would suggest," not as a literal soothing effect of VUCA on high-capacity societies.

biological form. We return to this point in the discussion, with the Spec G qualification carrying over.

Adding log GDP per capita as a control (Spec D) does not absorb the moderation: β_3 remains at −0.42 ($p < 0.001$) and GDP itself enters at −0.41 ($p < 0.001$). Capacity is doing work that income alone does not.

Figure **4** visualises the Spec B result as a marginal-effect plot.

4.3. The Capacity-Specific Trend Control (Spec G)

The Spec B headline can be read in two ways. The first reading — the framework's reading — is that countries with higher capacity have systematically smaller anxiety responses to common high-VUCA years, and that this is what the data are showing. The second reading is more deflationary: low-capacity countries' anxiety has been on a strong upward trend over 2005–2022 for reasons that need not have anything to do with VUCA per se; global VUCA *also* trends upward over the same window; the apparent VUCA × Capacity interaction is therefore mechanically picking up two trends that happen to align rather than a causal moderation.

These two readings are observationally equivalent in the global-VUCA design unless we add some way of distinguishing them. The natural way is to add a capacity-specific linear time trend — that is, to allow countries with different capacity levels to have different linear trends in anxiety, independent of VUCA. If the moderation is real, the interaction coefficient should remain negative and significant after this addition. If the divergence is just a differential trend, the trend term will absorb the interaction.

The result is unambiguous: the interaction does not survive. With $Cap_i \times t$ added, the new coefficient on VUCA × Cap_i is +0.079 (cluster-robust SE = 0.048, $p = 0.098$) — sign-flipped, statistically indistinguishable from zero. Meanwhile, the $Cap_i \times t$ coefficient itself is −0.063 ($p < 0.001$), confirming that low-capacity countries have indeed been on a strongly negative differential trend in standardised terms (or equivalently, an upward trend in raw anxiety) over the sample period. **The strong causal interpretation of the Spec B headline is therefore not robust.**

It is important to be precise about what this does and does not show. It does *not* show that the descriptive divergence in Figure **3** is artefactual; the divergence is real, and it remains the most striking single feature of the data. It does *not* show that capacity is irrelevant; specs that do not include the capacity-specific trend (B, H, I, K) all return interaction coefficients in the −0.35 to −0.47 range. What it does show is that, with global VUCA only, we cannot distinguish a year-by-year causal moderation by VUCA from a coincident differential time trend in low-capacity countries. Both stories generate the same observational pattern. Country-specific VUCA shocks would be needed to separate them (see Section 6).

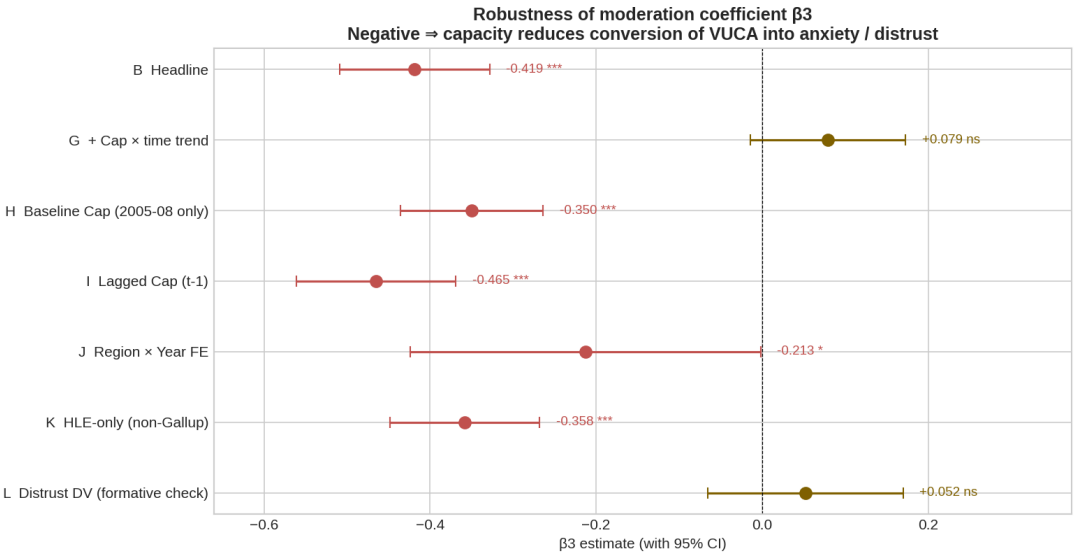


Figure 5: Robustness of the interaction coefficient β_3 across specifications. Each row is one specification; horizontal bars are 95% cluster-robust confidence intervals. Red bars do not cross zero (significant at the 5% level); brown bars are not significant at the 5% level. The headline (B) and most robustness specs (H, I, K) lie around −0.35 to −0.47. Spec G (the capacity-specific time-trend control) shifts the estimate to a small positive value with a CI that crosses zero. Spec J (Region × Year FE) preserves significance but at roughly half the magnitude. Spec L (Distrust as DV) is null, as predicted by the formative-construct reading.

4.4. Other Robustness Specifications

Figure **5** plots the interaction coefficient and 95% confidence interval across the headline and all six robustness specifications.

The pattern across specifications is mixed and informative. Spec H, which uses only pre-2009 Capacity (so the Capacity definition cannot be retrospectively contaminated by post-2009 anxiety changes), returns $\beta_3 = -0.350$ ($p < 0.001$). Spec I, which uses within-country lagged Capacity to address simultaneity, returns $\beta_3 = -0.465$ ($p < 0.001$). Spec K, which uses only Healthy Life Expectancy (a non-Gallup measure, so unaffected by any common-method covariance with the Gallup-sourced anxiety variable), returns $\beta_3 = -0.358$ ($p < 0.001$). Spec J, the most demanding specification, replaces year fixed effects with region-by-year fixed effects so that the interaction is identified only off within-region differences in country capacity. The estimate halves to $\beta_3 = -0.213$ ($p = 0.048$) — surviving at conventional significance but markedly weaker.

The honest reading of this robustness pass: a substantial portion of the apparent moderation reflects a between-region pattern, in which low-capacity regions (such as Sub-Saharan Africa) and high-capacity regions (such as Western Europe) have moved differently over a period of rising global disruption. The specifications that allow capacity-specific linear trends or that absorb regional-year heterogeneity weaken the result substantially. The specifications that simply use alternative Capacity definitions (baseline, lag, HLE-only) reproduce something close to the headline. Both stories are consistent with the data we observe.

4.5. The Formative-Construct Check (Spec L)

The cleanest single test in the analysis is Spec L. We re-estimate the headline Spec B model with the institutional distrust proxy (1 − Confidence in National Government, standardised) as the dependent variable instead of anxiety / negative affect. If BANI were a single reflective construct — that is, if anxiety and distrust were both surface symptoms of a common underlying strain that VUCA × Capacity should affect — we would expect β_3 to look similar to the Spec B headline. If BANI is formative — that is, if the four letters are distinct channels with distinct mechanisms — there is no reason to expect the same coefficient.

The result: $\beta_3 = +0.052$, cluster-robust SE = 0.060, $p = 0.388$. The interaction is statistically indistinguishable from zero, and the point estimate is in the wrong direction. The same model, the same standard-error structure, and the same predictor — the main change is the dependent variable, from one BANI letter to another — produces a completely different result. **Capacity moderates the descriptive VUCA → anxiety pattern; it does not moderate the descriptive VUCA → institutional-distrust pattern.**

The two constructs differ: anxiety / negative affect is an individual emotional state (self-reported worry, sadness, and anger), whereas institutional distrust is an evaluative attitude towards government (lack of confidence in national government). This is the clearest evidence in the paper that the four BANI letters cannot be averaged into a single composite without smearing real differences in mechanism. It is also a finding that does not depend on resolving the trend-versus-moderation question raised by Spec G: even if one is sceptical of the headline interaction, the comparison *between* letters within the same model is still informative. Anxiety and institutional distrust are not interchangeable indicators of one underlying BANI. They behave differently and should be modelled separately.

5. DISCUSSION

5.1. The Descriptive Divergence is the Central Empirical Finding

Stripped of the causal inferential machinery, the result the paper most clearly establishes is the one in Figure **3**. Across 2014–2022, a period in which global indicators of disruption rose sharply, anxiety / negative affect in low-capacity countries rose by more than a standard deviation, while in high-capacity countries it remained essentially flat. The world did not simply become more disrupted; the human burden of that period was distributed unequally across countries, and the distribution maps onto a measure of social-support-and-health adaptive capacity in a striking way.

This pattern, by itself, has policy weight. It suggests that whatever has driven the elevation of human strain in the post-2014 world — VUCA in our framework, or the various more specific causes that VUCA tries to summarise — has hit low-capacity societies much harder than high-capacity ones. A wellbeing-focused policy frame implies that "managing VUCA" cannot mean only damping the external load; it has to mean attending to the internal capacity to absorb what cannot be damped. The descriptive finding makes this case without requiring a clean causal estimate of moderation. It is what

reviewers and policy audiences should remember from this paper even if every causal claim were stripped out.

5.2. The Trend-Versus-Moderation Problem

The Spec G result requires care. The honest reading is that the data are consistent with two stories that the global-VUCA design cannot separate. In the first story, year-by-year fluctuations in global VUCA cause differential anxiety responses by capacity, and the period 2014–2022 happened to feature large positive VUCA innovations whose effects on low-capacity countries cumulated into the divergence we observe. In the second story, low-capacity countries entered a period of broad deterioration during 2014–2022 — reasons might include climate exposure, demographic pressure, governance erosion, conflict, or failures of public-health response to the pandemic — and global VUCA happened to be rising over the same window. Both stories generate the patterns we see. Both are plausible. Both are likely to be partly true.

What the existing data *cannot* do is decide between them. The natural design that would decide is one in which VUCA varies across countries within a year, so that we observe how anxiety responds when one country experiences a high-VUCA year while a peer country with similar capacity does not. Country-specific versions of the World Uncertainty Index exist for 143 countries (Ahir, Bloom, & Furceri 2022), country-specific Economic Policy Uncertainty for 22 countries (Baker, Bloom, & Davis 2016), and country-specific Geopolitical Risk for 18 emerging economies (Caldara, Iacoviello, & Markiewitz). A v4 paper that incorporates one or more of these series would let the moderation be identified off within-country VUCA changes, and would resolve the ambiguity that Spec G exposes here.

5.3. BANI is Formative, not Reflective

The Spec L null is the paper's cleanest empirical contribution because it is the one finding that does not depend on resolving the trend-versus-moderation question. The same model produces a strong descriptive interaction with one BANI letter and a flat null with another. That comparison is meaningful regardless of whether the descriptive interaction survives Spec G. It tells us that the four BANI letters do not behave as interchangeable symptoms of one latent strain factor, and that any analysis treating them as a composite scale will smear over mechanisms that move on different schedules and respond to different moderators. VUCA differs: its components are overlapping aspects of one external load, which is why they can be combined (Section 2.1).

For research using BANI as an organising vocabulary, this has direct methodological implications. Cronbach's α and other internal-consistency measures are inappropriate as quality tests for a formative construct. Composite "BANI scores" should not be averaged from the four letters as if they were Likert-scale items measuring one thing. The right approach is to model each letter separately, with its own theory of why VUCA should produce that particular form of failure and what would moderate that conversion. The paper's analysis only directly tested two letters (Anxiety and Distrust); we suspect that Brittleness and Nonlinearity would similarly behave on their own schedules, but this is a hypothesis for future work given that we have no country-year measures of either.

5.4. Wellbeing as Adaptive Infrastructure (Qualified)

The framework's deepest implication — that wellbeing should be conceptualised as adaptive infrastructure rather than as a downstream outcome — is what is conceptually at stake in whether β_3 is negative. Our results are *consistent* with that implication but, in light of Spec G, do not yet *demonstrate* it causally. The honest formulation is therefore that the data we have provide suggestive but not yet conclusive support for the claim. The metaphor that "wellbeing may raise the social melting point" is appropriate; the unconditioned form ("wellbeing raises the social melting point") would over-claim.

What does survive is the following weaker but still meaningful claim. Across this country-year panel, in non-trend-controlled specifications, capacity moderates the descriptive VUCA → anxiety pattern in the predicted direction; in the formative-construct check it does not moderate the corresponding distrust pattern; and decomposing capacity, the relational component (social support) does more of the work than the biological component (healthy life expectancy). The first two findings are robust to several alternative capacity definitions, to common-method-covariance concerns (Spec K), and to GDP controls. The third finding has direct conceptual implications for what kinds of wellbeing investment are likely to function as adaptive infrastructure.

The single line we would put on a slide:

Wellbeing is not only what societies enjoy when systems work. It may be part of what allows systems to keep working under disruption.

5.5. Why Social Support Carries More of the Moderation

One of the more interesting incidental findings, surviving the robustness pass, is that the Social Support component of capacity carries more of the descriptive moderation than the Healthy Life Expectancy component. Both individually significant, but Social Support is roughly 25% larger in absolute magnitude. We resist over-interpreting this, but two readings seem worth noting.

The first is straightforward: anxiety is a relational phenomenon, and the most direct buffer for anxiety is having someone to count on. The Gallup item that anchors the Social Support measure ("If you were in trouble, do you have relatives or friends you can count on to help you whenever you need them, or not?") gets very close to the immediate context in which negative affect rises or falls. This makes the moderation almost mechanical: more available support, less anxiety, holding the load constant.

The second reading is more theoretically interesting. If wellbeing is adaptive infrastructure, the kind of infrastructure that does the absorbing may not be principally biological or material. It may be principally relational. Healthy bodies and long lives matter, but so does the felt presence of trustworthy others. In an era when discussions of "resilience" tend to focus on hard infrastructure, supply-chain redundancy, or financial buffers, the data here suggest that the relational form of capacity is at least as important. The formulation that captures this most compactly:

Relationship is infrastructure.

This is a hypothesis the paper's data are consistent with, not a conclusion they prove, but it is consistent enough to be worth stating. It also carries practical weight: if the relational form of capacity is what does the absorbing, then the policy levers that protect a society against future high-VUCA periods may be different from the levers usually invoked under the heading of "resilience," and weight should be placed on social-protection systems, civic infrastructure, and the design of everyday spaces of mutual presence. Ricketts and Beaumont (2026) develop this implication, arguing that capacity released by AI should be directed into relational and developmental infrastructure.

6. LIMITATIONS AND THE V4 PATH

Several limitations constrain how strongly the findings can be read. They also indicate the natural shape of a follow-up paper. We call that follow-up v4 because it would extend the present analysis (v3.1) with country-specific disruption measures.

The trend-versus-moderation ambiguity, addressed at length in Section 5.2. This is the most consequential limitation and the one most clearly addressable by additional data. Country-specific VUCA shocks would resolve it.

Brittleness and Nonlinearity are not measured at the country level. In our build, the only available country-year measures of human strain that map onto BANI letters are Anxiety / negative affect and the institutional distrust proxy. The framework's claim that Brittleness and Nonlinearity also behave as formative channels is therefore not tested here, only assumed. Plausible country-level proxies exist for both — supply-chain pressure, infrastructure outage frequency, debt-to-GDP fragility, food and energy import dependence for Brittleness; tail measures of asset-return distributions, return-to-volume scaling, or cross-asset comovement for Nonlinearity — but constructing them requires data we did not have access to in this build.

Single-source human-strain panel. All anxiety and distrust data come from the World Happiness Report panel, which in turn relies on the Gallup World Poll. Triangulation with non-Gallup measures of strain — for example, suicide rates from WHO mortality data, anxiety-disorder DALYs from the Global Burden of Disease, mental-health prescription panels from OECD health statistics, or trust measures from the European Social Survey, the Edelman Trust Barometer, or the Reuters Digital News Report — would strengthen the descriptive divergence finding considerably. The Spec K result with Healthy Life Expectancy alone provides one form of mitigation against common-method covariance, but only on the capacity side.

Capacity is largely a country-level slow-moving feature. Our composite Capacity has limited within-country variation, so the moderation in Spec A is identified primarily from cross-country differences in Capacity rather than from within-country reform episodes. A more demanding identification strategy would exploit within-country changes in capacity (such as the introduction of a major social-protection scheme) and look for changes in anxiety responsiveness around those reforms.

Causal identification more broadly. Even setting aside the trend issue, capacity is endogenous to many things

that also affect anxiety responsiveness — quality of governance, history of social capital, institutional design, demographic composition. Our two-way fixed-effects strategy controls for time-invariant country differences and for common time shocks, but it does not address simultaneous determination of capacity and anxiety, nor reverse causation in which a more anxious population invests less in social support.

Time period is post-2005 only. The framework's "phase change" claim — if it is to be evaluated as a structural shift in how disruption is converted into strain — would benefit from a longer time series that included the great moderation, the global financial crisis, and the early-2000s period of relatively low VUCA. Our human-strain data do not extend back that far in panel form.

Anglosphere bias in the VUCA inputs. The Geopolitical Risk component is constructed from English-language newspapers, the Economic Policy Uncertainty component is dominated by US sources in its construction, and the World Uncertainty Index is based on Economist Intelligence Unit reports written for an English-speaking audience. Our composite is plausibly tilted toward measuring globally-relevant disruption as filtered through anglophone media. Region-specific or non-anglophone alternatives (the euro-area GPR of Bondarenko *et al*. 2024, for example) could complement it.

The v4 path is therefore reasonably clear, and is best read not as a list of limitations but as the empirical agenda this paper opens up:

1. Country-specific VUCA — country WUI or country EPU — to identify moderation off within-country VUCA variation rather than global VUCA only.

2. Event studies around discrete shocks (COVID-19, the 2008 financial crisis, the Russia–Ukraine war from 2022) that ask how anxiety jumps in low- vs high-capacity countries within ±2 years of each event. This identification strategy is robust to differential linear trends because it asks about discrete shocks against the country's own pre-trend.

3. Construction of country-year proxies for the Brittleness and Nonlinearity letters of BANI.

4. Triangulation of human-strain measures with non-Gallup sources (WHO mortality, GBD anxiety DALYs, OECD mental-health prescriptions, ESS, Edelman, Reuters Digital News Report).

5. Further extensions: separate z-scores for each VUCA component; more country-level instruments for BANI outcomes; analysis of why low-capacity countries are more affected; and separating wellbeing into political, economic, and other facets.

The division of labour between this paper and the next is therefore: **this paper establishes the measurement frame and the descriptive puzzle. The next paper tests the mechanism.** The two together would constitute a much stronger empirical case for the wellbeing-as-adaptive-infrastructure thesis than either could alone.

7. CONCLUSION

This paper has tried to make the VUCA and BANI vocabularies do empirical work, and to be honest about how much weight they can carry. Three contributions emerge in descending order of strength. The **primary** contribution is methodological: BANI is a formative vector of failure modes, not a reflective scale, and the four letters do not behave interchangeably under common shock-and-moderator structures. The **secondary** contribution is descriptive: low-capacity countries experienced a sharp rise in anxiety / negative affect during 2014–2022 while high-capacity countries did not. The **tertiary** contribution is conceptual: the framework that emerges treats wellbeing as part of a society's adaptive infrastructure rather than as a downstream outcome of well-functioning systems, with the relational form of capacity (social support) descriptively associated with more of the moderation than the biological form. The strongest causal claim — that VUCA is converted into anxiety differentially by capacity, year by year — is consistent with the data but cannot be cleanly identified with global VUCA alone.

We would not yet rest a strong policy claim on this, but the implication is suggestive enough to warrant the next round of empirical work, which should focus on country-specific disruption shocks and event-study designs that can identify the moderation more cleanly. The division of labour between the present paper and that follow-up is the right one: this paper establishes the measurement frame and the descriptive puzzle; the next paper tests the mechanism.

Two slogans capture the framework's positive content while respecting what the data have shown. The first is descriptive: *VUCA does not strike empty space — it enters societies with very different levels of social support, health, trust, and orientation, and the human consequences differ accordingly*. The second is hypothetical, and we offer it as a hypothesis the data are consistent with rather than a

result the data have demonstrated: *wellbeing may raise the social melting point — the threshold at which external disruption translates into chronic human strain.* Whether that hypothesis is right is the question the next round of work should answer.

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INSTITUTIONAL REVIEW BOARD STATEMENT

Not applicable. The study used only aggregated, publicly available country-level secondary data and did not involve human or animal subjects.

INFORMED CONSENT STATEMENT

Not applicable.

DATA AVAILABILITY STATEMENT

All input data are publicly available from the sources listed in Section 3 (Table **1**). The full analysis dataset (2,126 country-years × 33 variables, including all derived interaction terms used in Specs A–L), regression output, and a complete column dictionary are provided in the companion file vuca_bani_v3_1_data.xlsx. The reproducible build script is provided as build_v3_1.py. Correspondence should be addressed to J.R.

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CONFLICTS OF INTEREST

The authors declare no competing interests.

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APPENDIX A. FULL REGRESSION RESULTS

Table **A1** reports all regression coefficients and cluster-robust standard errors discussed in the body of the paper. Significance flags use the convention *** p < 0.001, ** p < 0.01, * p < 0.05, + p < 0.10, ns p ≥ 0.10. Where year fixed effects are included, the main effect of $VUCA_t$ is absorbed and is reported as "absorbed". Where country fixed effects are included, the main effect of any time-invariant Capacity construction is absorbed similarly.

Table A1: Full regression results

Spec	Term	β	Cluster SE	p	Sig
0 Pooled OLS	$VUCA_t$	+0.398	0.037	<0.001	***
0 Pooled OLS	$Capacity_{i,t}$	−0.382	0.053	<0.001	***
0 Pooled OLS	VUCA × Capacity	−0.404	0.040	<0.001	***
A TWFE $Cap_{i,t}$	$Capacity_{i,t}$	−0.824	0.119	<0.001	***
A TWFE $Cap_{i,t}$	VUCA × Capacity	−0.418	0.036	<0.001	***
B TWFE Cap_i × $VUCA_t$	**VUCA × Cap_i**	**−0.419**	**0.046**	**<0.001**	*******
C TWFE decomposed	z Social Support	−0.485	0.056	<0.001	***
C TWFE decomposed	z Healthy Life Expectancy	−0.083	0.116	0.474	ns
C TWFE decomposed	VUCA × SS	−0.189	0.043	<0.001	***
C TWFE decomposed	VUCA × HLE	−0.152	0.061	0.013	*
D Spec A + ln GDP	$Capacity_{i,t}$	−0.779	0.116	<0.001	***
D Spec A + ln GDP	VUCA × Capacity	−0.423	0.038	<0.001	***
D Spec A + ln GDP	z log GDP per capita	−0.408	0.108	<0.001	***
G Cap-specific trend	*VUCA × Cap_i*	*+0.079*	*0.048*	*0.098*	+

G Cap-specific trend	*Cap_i × time*	*−0.063*	*0.009*	*<0.001*	***
H Baseline Cap (2005-08)	VUCA × Cap_{base}	−0.350	0.044	<0.001	***
I Lagged Cap	$Cap_{i,t-1}$	−0.272	0.121	0.024	*
I Lagged Cap	VUCA × $Cap_{i,t-1}$	−0.465	0.049	<0.001	***
J Region × Year FE	VUCA × Cap_i	−0.213	0.108	0.048	*
K HLE-only Capacity	VUCA × HLE_i	−0.358	0.046	<0.001	***
L Distrust as DV	*VUCA × Cap_i*	*+0.052*	*0.060*	*0.388*	*ns*

Bold row (B) is the headline. Italic-warning rows (G, L) are the substantive null results that constrain the paper's claims: G constrains the strong causal version of the moderation, and L confirms the formative-construct reading (capacity moderates VUCA → anxiety but not VUCA → distrust). N = 2,126 country-years from 160 countries, 2005–2022, except Spec I (n = 1,966 due to lag operator) and Spec L (n = 1,795 due to availability of the trust-in-government item). Standard errors clustered by country throughout.

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World Health Organization. Global Health Observatory data repository. Healthy life expectancy at birth.

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