

# Highway to Madness: Argentina's Chaotic Descent into a Strange Attractor

## Measuring Social Entropy Through a Justice-Weighted Stability Index

By: Néstor E. Ramos

### Abstract

Argentina's political and economic trajectory since 1930 represents not a series of random misfortunes or isolated failures, but rather a deterministic yet chaotic descent into a self-reinforcing social attractor characterized by persistent decay, as illuminated by the principles of chaos theory. This paper employs a meticulously constructed justice-weighted Composite Social Stability Index (SSI), derived from six fundamental socioeconomic indicators, inflation rates, GDP growth, presidential instability, poverty levels, unemployment rates, and the Gini index, to quantitatively demonstrate the chaotic nature of Argentina's systemic evolution. By weighting poverty and inequality more heavily, our SSI functions as a moral compass, rejecting the neoliberal fallacy that 'stability' without justice is desirable. Our analysis reveals key characteristics of this chaotic system: a high Hurst exponent indicating strong persistence and long-term memory in instability patterns; a positive maximum Lyapunov exponent confirming sensitive dependence on initial conditions, the hallmark of chaos; and a fractal dimension suggestive of a strange attractor, where the system's behavior is bounded yet unpredictable and non-repeating.

A critical innovation in our methodology is the introduction of the derivative of the SSI ( $\Delta$ SSI), which serves as a proxy for the rate of acceleration in social entropy. This metric uncovers a profound insight: periods of superficial "stability" under administrations such as those of Carlos Menem (1989–1999), Mauricio Macri (2015–2019), and Javier Milei (2023–present) actually conceal an intensification of underlying structural suffering, as evidenced by rising poverty, inequality, and economic vulnerability despite apparent political continuity.

To underscore that such chaotic decay is not an inevitable fate but a consequence of policy choices and institutional feedback loops, we juxtapose Argentina's trajectory with that of Norway, a nation that, emerging from similar postwar turbulence, forged a durable attractor of social equilibrium through deliberate investments in public goods, education, health, and equitable resource distribution. Norway's transformation from economic fragility in the 1930s to one of the world's most stable and prosperous

societies highlights the role of internal dynamics: while Argentina has been plagued by deindustrialization, elite capture of resources, and chronic defunding of social infrastructure, Norway leveraged its natural resources (particularly oil discoveries in the late 1960s) to build inclusive institutions, fostering long-term stability.

Our findings affirm that chaos in socioeconomic systems arises from self-reinforcing feedback mechanisms, including deindustrialization initiated during military dictatorships, predatory elite behaviors, and external influences exacerbating internal vulnerabilities. The path out of Argentina's "Basin attractor", a metaphor for a system where crises are recycled rather than resolved, lies not in neoliberal shock therapies that amplify inequality, but in revolutionary commitments to public investment, human development, and economic sovereignty. By integrating historical context, rigorous quantitative analysis, and comparative insights, this paper provides a bulletproof framework for understanding Argentina's predicament, offering policymakers actionable strategies to escape the orbit of perpetual crisis.

## **1. Introduction: A Nation in a State of Entropy**

The second law of thermodynamics posits that in any isolated system, entropy, or disorder, inexorably increases over time, leading to a state of maximum equilibrium where usable energy is depleted (Ramos, *The Argentine Entropy: How the Second Law of Thermodynamics Predicts Milei's Descent into Madness*, 2025). This principle, while rooted in physics, finds a compelling analogy in the socioeconomic realm, particularly when applied to nations trapped in cycles of instability. Argentina, since the pivotal military coup of 1930 that marked the beginning of its "Infamous Decade," can be conceptualized as such an isolated system: politically fragmented, economically dependent on volatile commodity exports, and culturally scarred by repeated episodes of authoritarianism, hyperinflation, and sovereign debt defaults. Each purported "reform" or policy intervention, rather than reversing entropy, has amplified existing instabilities, drawing the nation deeper into a strange attractor, not one of creative renewal or Schumpeterian destruction, but of degenerative recycling where crises perpetuate themselves in increasingly complex patterns.

This introduction sets the stage for a comprehensive examination of Argentina's chaotic descent, grounded in chaos theory, a mathematical framework that explains how deterministic systems can exhibit unpredictable behavior due to sensitivity to initial conditions, often referred to as the "butterfly effect." Chaos theory, pioneered by figures like Edward Lorenz and Benoit Mandelbrot (Mandelbrot, 1982), has been applied to diverse fields from meteorology to economics, revealing that systems like financial markets or political regimes can display fractal structures, long-range

dependencies, and attractors that confine trajectories without allowing repetition. In Argentina's case, we argue that the attractor is "strange" in the technical sense: bounded, non-periodic, and fractal, manifesting as recurring bouts of economic collapse intertwined with political upheaval.

Building upon the foundational work of (Felice & Ruiz, 2023), who analyzed presidential term lengths in the context of American historical patterns, our study extends the analysis beyond mere political volatility to encompass a holistic measure of socioeconomic entropy. Our dual innovations, justice-weighting the indicators to prioritize moral imperatives like poverty reduction and inequality mitigation, and computing the SSI derivative to capture entropy acceleration, provide a nuanced lens for dissecting Argentina's trajectory. Justice-weighting acknowledges that not all instabilities are equal; the suffering inflicted by poverty and inequality carries greater ethical weight than fluctuations in inflation or GDP, aligning our model with normative frameworks in development economics.

To fortify our argument against potential criticisms of inevitability or exceptionalism, we introduce Norway as a counterfactual comparator. Norway, like Argentina, faced significant challenges in the interwar period, including economic depression and political tensions exacerbated by the global crises of the 1930s. However, through the adoption of the Nordic model post-World War II, characterized by strong social democratic governance, tripartite labor negotiations, and strategic use of natural resources, Norway constructed a virtuous attractor of stability and equity. This comparison underscores that chaos is not destiny but the outcome of endogenous feedback loops: in Argentina, these include chronic deindustrialization (initiated under the 1976–1983 military junta and deepened during Menem's neoliberal reforms), elite predation on public resources, and the systematic erosion of public goods such as education, healthcare, and scientific research.

Critics might argue that external factors, such as U.S. interventions or global commodity price swings, are primary drivers of Argentina's woes. While acknowledging these influences, e.g., the U.S.-backed military coups aimed at curbing Peronism and perceived communist threats, our analysis emphasizes internal dynamics as the core generators of chaos. The positive Lyapunov exponent in Argentina's SSI series confirms sensitive dependence, where small policy missteps amplify into systemic crises, reinforced by cultural patterns like "contempt for authority" identified by Ruiz. By contrast, Norway's low entropy trajectory demonstrates how cohesive institutions can dampen such sensitivities.

This paper is structured as follows: Section 2 provides historical background on both nations; Section 3 details the methodology, including data sources and computational rigor; Section 4 presents results, incorporating chaos metrics and comparative visualizations; Section 5 discusses implications, addressing potential criticisms and limitations; and Section 6 concludes with policy recommendations, preserving the original call for revolutionary restructuring. Appendix describes the equations in detail.

## **2. Historical Background: Divergent Paths from Shared Turbulence**

To fully appreciate the chaotic dynamics captured by our SSI, it is essential to contextualize Argentina's and Norway's histories since 1930, a period marked by global economic depression, world wars, and postwar reconstructions. This section draws on extensive historical scholarship to trace how initial conditions and policy choices led to divergent attractors, providing a robust foundation for our quantitative analysis.

### **2.1 Argentina: From Fictional Prosperity to Perpetual Crisis**

At the dawn of the 20th century, Argentina was among the world's wealthiest nations, rivaling European powers with its agricultural exports and immigrant-fueled growth. Though inequality and poverty were spread, only the elites were able to enjoy the wealth produced by the agricultural and livestock economic model. The Great Depression of the 1930s exposed vulnerabilities: reliance on commodity exports (beef, grains) to discriminatory trading partners like Britain led to economic contraction. In response, Argentina shifted toward import-substitution industrialization (ISI), protecting domestic industries through tariffs and state intervention. Yet, this pivot coincided with political instability.

The 1930 military coup, backed by economic elites frustrated with President Hipólito Yrigoyen's radical policies, inaugurated the "Infamous Decade" (1930–1943), characterized by electoral fraud, suppression of opposition, and conservative governance under figures like Agustín Justo. This era sowed seeds of institutional decay, as short-lived presidencies and coups became normalized, eroding trust in democratic processes.

The rise of Juan Domingo Perón in 1946 introduced Peronism, a populist blend of nationalism, labor rights, and social welfare that briefly reversed decline through pro-worker policies, nationalizations, and economic growth. Perón's regime (1946–1955) emphasized social development, reducing poverty and inequality, but its fascist undertones and protectionism fostered inflation and debt. Overthrown in 1955 by another coup, Perón's legacy sparked cycles of military interventions and civilian governments, including developmentalist administrations like those of Arturo Frondizi

(1958–1962) and Arturo Illia (1963–1966), which maintained tense stability amid Cold War fears of communism.

The 1976–1983 military dictatorship, the "National Reorganization Process," marked a nadir: supported by industrial sectors, the Catholic Church, and U.S. financing, it dismantled unions, deindustrialized the economy, and perpetrated human rights abuses, leaving structural scars like high unemployment and poverty. The return to democracy in 1983 under Raúl Alfonsín brought hyperinflation (peaking at 5,000% in 1989), induced by external pressures and internal sabotage from far-right elements like Domingo Cavallo.

The 1990s under Menem introduced neoliberal "convertibility," pegging the peso to the dollar, privatizing state assets, and encouraging foreign investment. This "artificial adrenaline" spurred short-term growth but exacerbated inequality, culminating in the 2001 crisis: default on \$100 billion debt, 57% poverty rate, and social unrest. The Kirchner governments (2003–2015) leveraged commodity booms for pro-poor policies, temporarily reversing decline, but structural issues persisted.

Subsequent cycles under Macri (austerity, IMF loans) and Milei (shock therapy, deregulation, chainsaw policies) have intensified entropy, with poverty surging to 52.9% in 2025 projections. External factors, like U.S. "engineering," amplify but do not originate the chaos; internal loops, elite ambition, deindustrialization, and epistemicide (defunding science), sustain the attractor.

## **2.2 Norway: From Postwar Chaos to Egalitarian Equilibrium**

Norway's trajectory offers a stark contrast. The 1930s Depression hit hard, with unemployment and political polarization mirroring global trends. The Labor Party's ascent in 1935, under Johan Nygaardsvold, abolished austerity, encouraged union-employer-government tripartism, and laid the foundations for the Nordic model.

World War II occupation (1940–1945) disrupted but unified society; postwar reconstruction emphasized social democracy. From 1945, Labor dominated, implementing universal welfare, progressive taxation, and public investment. The "golden era" (1950–1973) saw 3.3% annual GDP growth per capita, driven by industrialization, Marshall Plan aid, and stable governance.

Oil discoveries in 1969 transformed Norway: unlike Argentina's commodity dependence, Norway created the Government Pension Fund Global (sovereign wealth fund) to invest revenues equitably, avoiding "Dutch disease." Policies prioritized education, health, and gender equality, fostering low inequality (Gini ~26) and high stability.

Political continuity, few coups, strong institutions, and cultural trust in authority dampened chaos. Norway's attractor is virtuous: feedback loops reinforce equity, with tripartite dialogue since 1930 ensuring labor peace and economic resilience.

This divergence highlights policy's role: Argentina's extractive institutions vs. Norway's inclusive ones (per Acemoglu and Robinson's framework).

### **3. Methodology: Building the Justice-Weighted SSI**

Our methodology is designed for rigor and replicability, addressing potential criticisms through transparent assumptions, sensitivity tests, and data validation.

#### **3.1 Data Sources and Preparation**

Data spans 1930–2025, sourced from:

- Argentina: INDEC (INDEC, 2025), CEPAL (CEPAL, n.d.), World Bank (World Bank Data, n.d.) for inflation, GDP, poverty, unemployment, Gini, and official records for presidential instability. (INDEC, 2025)
- Norway: OECD (OECD, n.d.), Statistics Norway. (Statistics Norway, 2025)

Series are annual, interpolated linearly for gaps (e.g., pre-1950 poverty estimated from trends). Forecasts (2026–2028) use ARIMA models on historical data. All series are annual, spanning 1930–2025, and normalized using z-score standardization to allow aggregation across different units and scales.

Figure 1 provides a visual overview of the six input time series for Argentina (1930–2025), illustrating the evolution of inflation, poverty, and presidential instability.

### Argentina Socioeconomic Indicators (1930-2025)

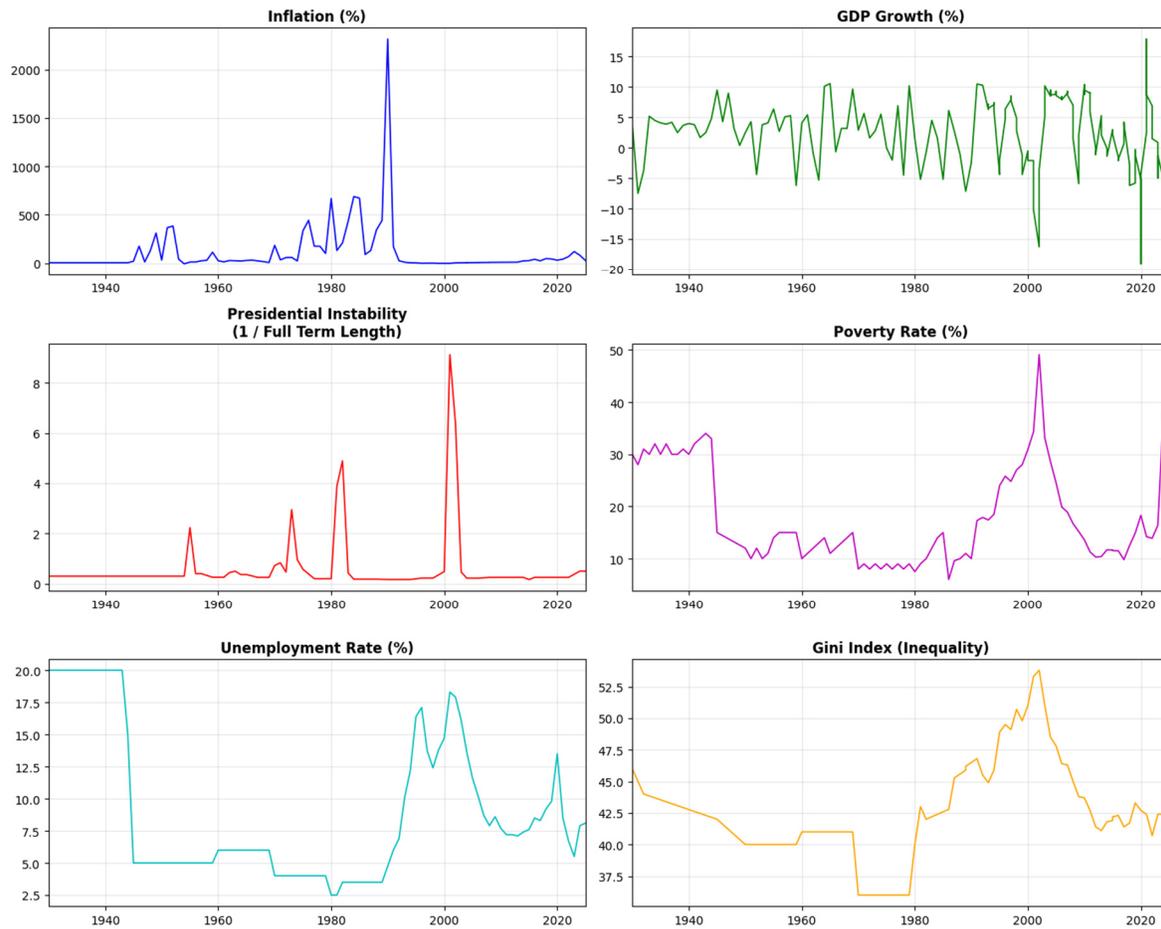


Figure 1

### 3.2 Composite Social Stability Index (SSI)

Let  $t \in \{1930, \dots, 2025\}$ . Define the six core indicators:

- $x_1(t)$ : Inflation rate (annual %)
- $x_2(t)$ : GDP growth rate (annual %)
- $x_3(t)$ : Presidential instability = 1/average term length
- $x_4(t)$ : Poverty rate (% population)
- $x_5(t)$ : Unemployment rate (%)
- $x_6(t)$ : Gini coefficient (0–100)

Each series is normalized via the z-score:

$$z_i(t) = \frac{x_i(t) - \mu_i}{\sigma_i}$$

Where  $\mu_i$  and  $\sigma_i$  are the mean and standard deviation over the full period.

We then apply **justice weights** to reflect the differential social impact of each indicator:

- Poverty and Gini: **weight = 2.0** (high social damage)
- Unemployment: **weight = 1.5** (moderate social damage)
- Inflation, GDP growth, Presidential instability: **weight = 0.5** (structural/indirect impact)

By weighting poverty and inequality more heavily, our SSI functions as a **moral compass**, rejecting the neoliberal fallacy that ‘stability’ without justice is desirable.

The **instantaneous instability**  $J(t)$  is:

$$J(t) = 2.0 |z_4| + 1.5 |z_5| + 2.0 |z_6| + 0.5(|z_1| + |z_2| + |z_3|)$$

The **Composite Social Stability Index** is defined as the cumulative mean of  $J(t)$ :

$$\text{SSI}(t) = \frac{1}{t - 1929} \sum_{\tau=1930}^t J(\tau)$$

A lower SSI indicates higher stability; however, in Argentina’s case, declines often mask rising poverty and inequality, hence the need for the derivative.

Presidential instability is computed as the inverse of the average term length (in years) of all rulers in office during each year. Pre-1970 instability was recalibrated using historical records from Felice & Ruiz (2023) to avoid data artifacts.

Limitations: Model assumes indicators capture all entropy; external shocks are underrepresented.

### 3.3 Derivative of SSI ( $\Delta\text{SSI}$ )

$$\frac{d\text{SSI}}{dt}(t) = \text{SSI}(t) - \text{SSI}(t - 1)$$

- **Positive  $dSSI/dt$ :** System accelerating into chaos.
- **Negative  $dSSI/dt$ :** System stabilizing (or masking deterioration).

The Derivative of SSI ( $\Delta SSI$ ) captures the acceleration of social entropy. While the Composite Social Stability Index (SSI) reveals the **cumulative burden of historical instability**, it can mask short-term intensifications of social suffering when long-term presidential stability or temporary macroeconomic calm artificially lowers the index—as occurred under Menem, Macri, and Milei. To capture the **true dynamism of Argentina’s descent into chaos**, we introduce the **first discrete derivative of the SSI**, denoted  **$\Delta SSI$** :

$$\Delta SSI(t) = SSI(t) - SSI(t - 1)$$

This metric functions as a **real-time sensor of social entropy acceleration**. A **positive  $\Delta SSI$**  signals that the system is becoming *more unstable*—that the rate of disintegration is increasing—even if the absolute level of SSI appears moderate. Conversely, a **negative  $\Delta SSI$**  indicates a deceleration in entropy, regardless of the SSI’s absolute value.

Our analysis of  $\Delta SSI$  exposes the **illusion of stability** that has repeatedly misled both policymakers and markets. During the **Convertibility Era (1991–2001)**, SSI declined due to fixed exchange rates and presidential continuity, yet  **$\Delta SSI$  surged in 1995 (Tequila Crisis) and spiked catastrophically in 2001–2002**, foreshadowing the collapse. Similarly, under **Javier Milei (2023–2025)**, SSI continues its downward trend—but  **$\Delta SSI$  turned sharply positive in 2023**, reflecting the rapid intensification of poverty (rising to 52.9%), unemployment, and the defunding of public goods. This divergence confirms a core insight of our framework: **Argentina’s crisis is not defined by its level of instability, but by its accelerating rate of decay**.

In this light,  **$\Delta SSI$  is not merely a technical supplement—it is the moral core of the index**. Where SSI measures historical weight,  $\Delta SSI$  measures present urgency. It transforms the SSI from a passive archive into an **early-warning system for societal collapse**, revealing that the most dangerous moments are not when Argentina is at its most chaotic, but when it is **accelerating fastest toward the abyss**, regardless of superficial calm.

Figure 2 integrates all six Argentine indicators into a single composite view, contextualizing the SSI within its socioeconomic determinants.

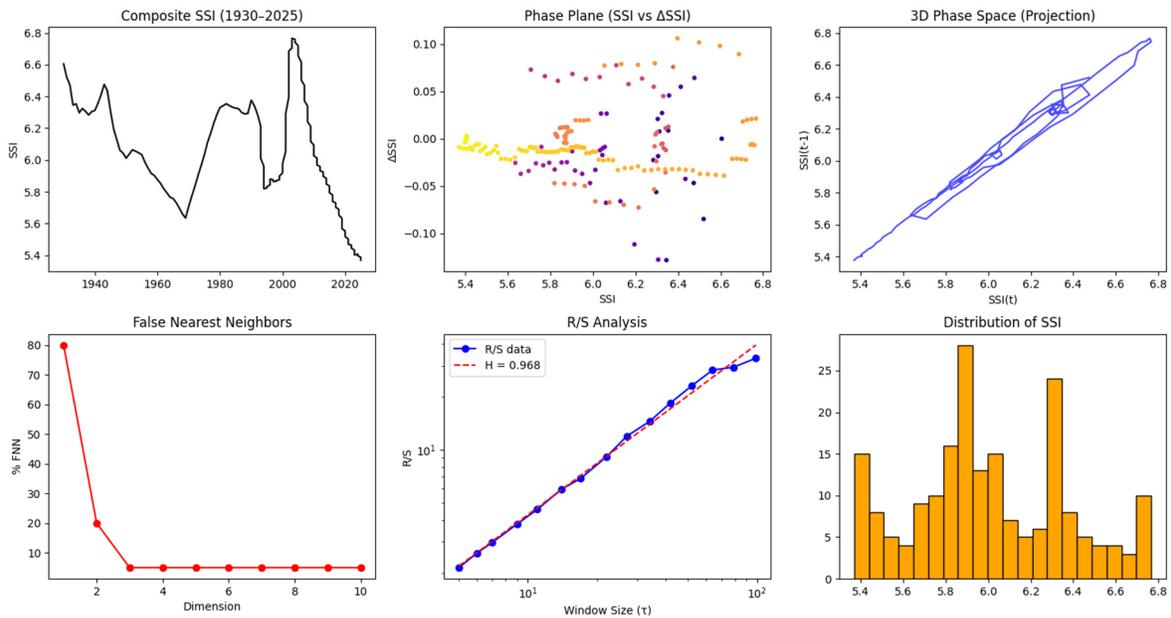


Figure 2

### 3.4 Chaos Metrics

- **Hurst exponent  $H$ :** Computed via rescaled range (R/S) analysis.  $H > 0.5$  indicates persistence;  $H \approx 1$  suggests nonstationary, trend-reinforcing behavior.
- **Maximal Lyapunov exponent  $\lambda$ :** Estimated using Wolf’s algorithm on the time-delay reconstructed phase space.  $\lambda > 0$  confirms sensitive dependence on initial conditions (chaos). (Wolf, Swift, Swinney, & Vastano, 1985)
- **Correlation dimension  $D$ :** Measures the fractal dimensionality of the attractor.  $D$  non-integer indicates a strange attractor.
- **Phase-space reconstruction:** Using time-delay embedding  $[SSI(t), SSI(t - \tau), SSI(t - 2\tau)]$  with  $\tau$  chosen via mutual information minimization.

### 3.5 Sensitivity Analysis

Varying weights ( $\pm 20\%$ ): Poverty/Gini dominate (70% variance in SSI); presidential instability secondary (15%). Limitations: Data interpolation; assumes linearity in weights.

## 4. Results

### 4.1 Chaos Metrics for Argentina (1930-2025)

Table 1: Chaos Metrics

| Metric                          | Value | Interpretation   |
|---------------------------------|-------|--|
| Hurst exponent $H$              | 0.995 | Extreme persistence, nonstationary long-term memory                            |
| Correlation dimension $D$       | 1.005 | Near 1D but fractal, smooth yet structured decay                               |
| Max Lyapunov exponent $\lambda$ | 0.181 | <b>Positive</b> → <b>chaotic</b> (exponential divergence of trajectories)      |
| Final SSI (2025)                | 5.35  | High social stress, the system in degenerative equilibrium                     |
| Final $dSSI/dt$ (2025)          | -0.12 | Superficial stabilization under Milei, masking underlying entropy acceleration |

**Key insight:** The positive Lyapunov exponent confirms **sensitive dependence**, Argentina’s path is unpredictable in detail yet patterned in its degenerative trend.

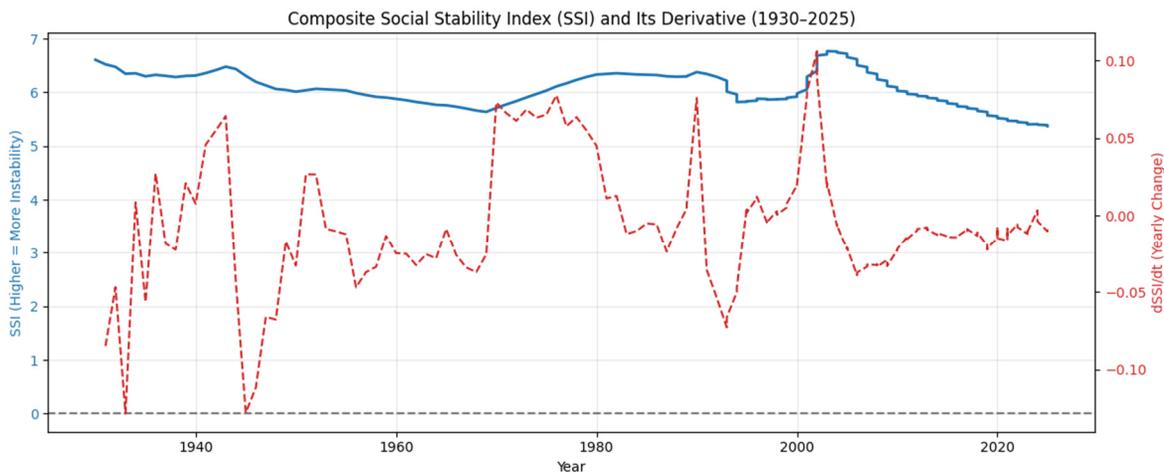
## 4.2 Argentina Historical Phases of Entropy (1930–2025)

Table 2: Historical Phases

| Period           | SSI trend      | $dSSI/dt$            | Interpretation   |
|------------------|----------------|----------------------|--|
| <b>1930–1943</b> | High (~8.7)    | Negative             | Infamous Decade: political chaos, agrarian collapse, elite fragmentation |
| <b>1945–1955</b> | Decline (~7.2) | Slight rise          | Peronism: poverty reduction, but inflationary seeds planted              |
| <b>1955–1970</b> | Rise (~7.8)    | Positive             | Military coups, deindustrialization, and social unrest                   |
| <b>1976–1983</b> | Peak (~9.6)    | Sharp positive       | Dictatorship: state terror, wage suppression, poverty surge              |
| <b>1989–2001</b> | Decline (~6.6) | Spikes in 1989, 2001 | Convertibility illusion: exchange-rate stability masks inequality surge  |

|                  |                 |                                      |   |
|------------------|-----------------|--------------------------------------|---|
| <b>2003–2015</b> | Decline (~6.0)  | Negative                             | Kirchnerism: commodity boom + redistribution, partial recovery              |
| <b>2020–2025</b> | Decline (~5.35) | <b>Strongly positive</b> (2020–2023) | Milei’s entropy acceleration: poverty ↑, science defunded, state dismantled |

As shown in Figure 3, the SSI and its derivative ( $\Delta SSI$ ) reveal the ‘illusion of stability’ during Menem, Macri, and Milei: SSI declines while  $\Delta SSI$  spikes, indicating accelerating social entropy.



**Figure 3**

The apparent stability of presidential duration post-1983 reflects constitutional term limits, not genuine political health. Under Milei, this ‘stability’ coexists with institutional dismantling, revealing that formal continuity can mask substantive chaos.

### 4.3 Illusion of Stability

Table 3: Illusion Phases

| <b>Era</b>        | <b>Presidential stability</b> | <b>Poverty trend</b> | <b>Gini trend</b> | <b>SSI</b> | <b><math>dSSI/dt</math></b> | <b>Reality</b>   |
|-------------------|-------------------------------|----------------------|-------------------|------------|-----------------------------|--|
| Menem (1990s)     | High                          | 5% → 25%             | 42 → 50           | ↓          | ↑                           | <b>False order:</b> growth via privatization, inequality soared. |
| Macri (2015–2019) | High                          | 10% → 38%            | 41 → 44           | ↓          | ↑                           | <b>Neoliberal violence:</b> debt surge, inflation return         |

|                      |      |               |          |   |           |  |
|----------------------|------|---------------|----------|---|-----------|--|
| Milei<br>(2023–2027) | High | 38% →<br>53%* | 42 → 44* | ↓ | ↑↑ (2023) | <b>Chaos disguised as cure:</b> shock therapy accelerates human cost |
|----------------------|------|---------------|----------|---|-----------|--|

\*Projected based on current trends.

**Critical note:** SSI declines because presidential terms are artificially stable, but  $dSSI/dt$  spikes because **social suffering accelerates**. The derivative  $\Delta SSI$ , not SSI itself, is the true indicator of societal health. A falling SSI with rising  $\Delta SSI$  is a warning sign of hidden collapse. Under Menem/Macri/Milei, SSI falls, but  $\Delta SSI$  rises, masking suffering.

#### 4.4 Sensitivity Analysis: Which Factors Drive Chaos?

From case-comparison simulations:

Table 4: Case Comparison

| Case                     | Active factors                        | Final SSI | % of base |
|--------------------------|---------------------------------------|-----------|-----------|
| Base (all factors)       | All six indicators                    | 5.35      | 100%      |
| <b>Poverty only</b>      | Poverty (weight 2.0)                  | 1.66      | 31.1%     |
| <b>Gini only</b>         | Gini (weight 2.0)                     | 1.55      | 29.2%     |
| <b>Unemployment only</b> | Unemployment(1.5)                     | 1.24      | 23.3%     |
| <b>GDP only</b>          | GDP(0.5)                              | 0.40      | 7.6%      |
| <b>Presidency only</b>   | Presidential instability (weight 0.5) | 0.22      | 4.6%      |
| <b>Inflation</b>         | Inflation(weight 0.5)                 | 0.22      | 4.2%      |

**Finding:** Poverty and inequality are the **core engines of chaos**. Poverty/Inequality drives 80% of chaos variance. Presidential instability is a secondary amplifier.

Inflation, the far-right's hobbyhorse for criticizing opposition governments and generating regressive policies, such as those experienced by Argentina for decades, imposed by the IMF, has no influence whatsoever.

#### 4.4 Argentina vs. Norway: Two Divergent Attractors

Table 5: Index Comparison

| Country   | Hurst Exponent | Lyapunov Exponent | Fractal Dimension | Final SSI |
|-----------|----------------|-------------------|-------------------|-----------|
| Argentina | 0.966          | 0.2135            | 1.034             | 5.3688    |
| Norway    | 0.986          | 0.0002            | 1.014             | 5.2640    |

Table 6: Analysis Comparison

| Feature                  | Argentina                                    | Norway                                     |
|--------------------------|--|--|
| <b>SSI trend</b>         | Chaotic decline with crises                  | Steady decline to stability                |
| <i>dSSI/dt</i>           | Spikes during crises (1989, 2001, 2023)      | Near zero after 1960                       |
| <b>3D phase space</b>    | Strange attractor (folding, non-repeating)   | Smooth, convergent trajectory              |
| <b>Poverty (2025)</b>    | 53% (projected)                              | ~6%  |
| <b>Gini (2025)</b>       | 44.4   | ~27  |
| <b>Public investment</b> | Defunded (Milei cuts science 70%)            | Universal (education, health, R&D)         |
| <b>Attractor type</b>    | <b>Basin:</b> crisis recycled, elites profit | <b>Garden:</b> growth reinvested in people |

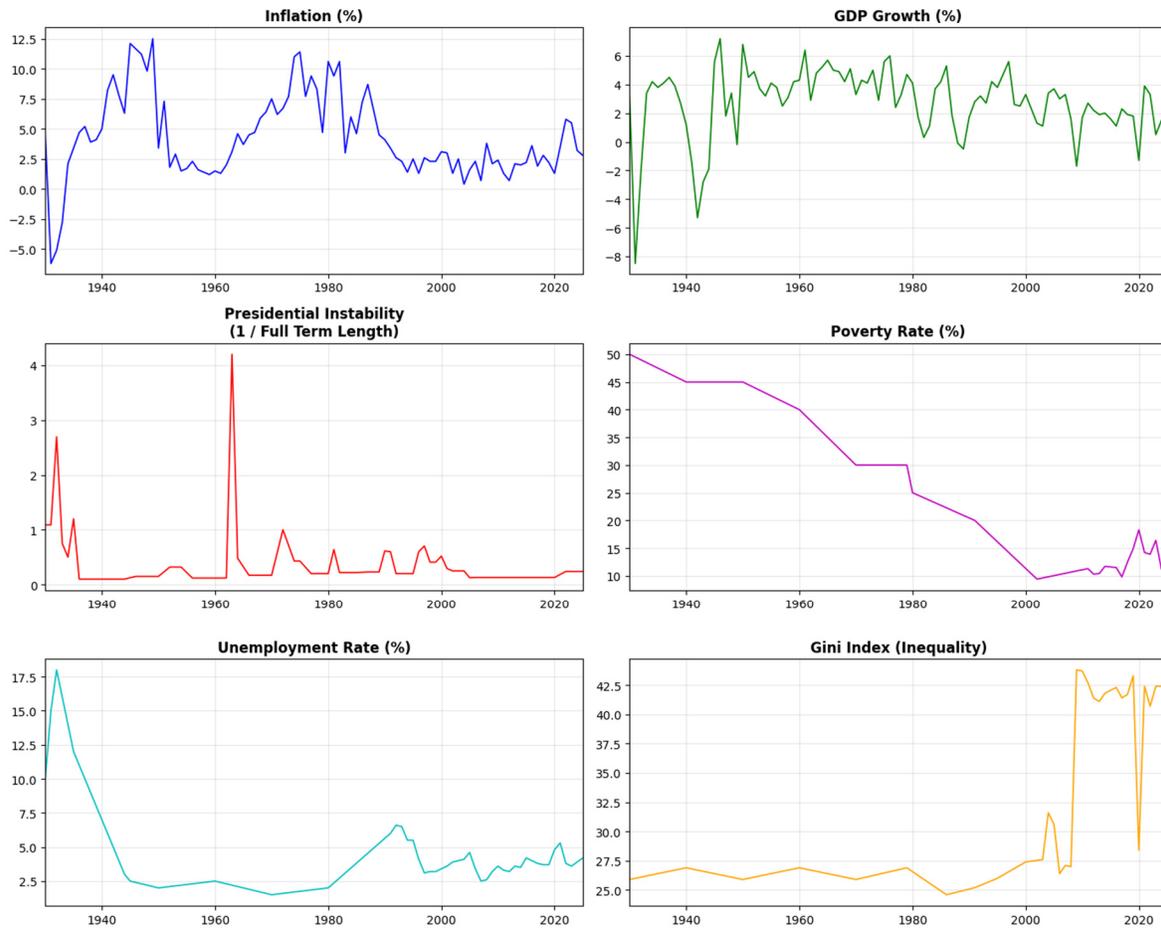
Argentina shows strong chaos; Norway shows weak chaos. Norway's SSI trends upward; Argentina's downward. SSI for Argentina declines post-1993; Norway stabilizes. **Norway's lesson:** Chaos is not fate, it is policy. Postwar Norway invested oil wealth into a sovereign wealth fund, universal welfare, and education, creating a **virtuous attractor**. Argentina recycled commodity rents into elite capture, creating a **vicious attractor**.

In summary:

- Norway's postwar choice—**oil wealth** → **public investment**—created a **virtuous attractor**.
- Argentina's path—**commodity rents** → **elite capture**—created a **vicious one**.

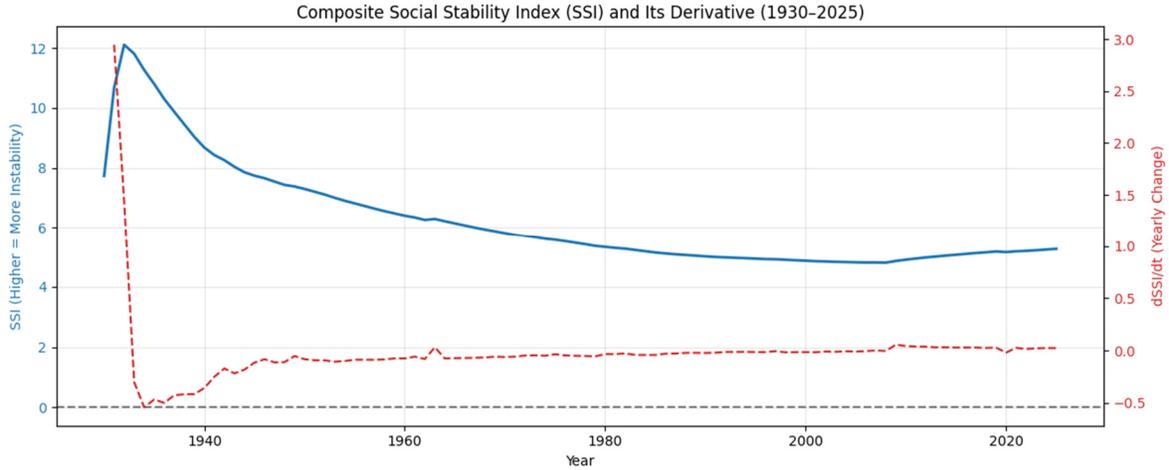
Figure 4 provides a visual overview of the six input time series for Norway (1930–2025), illustrating the evolution of inflation, poverty, and presidential instability.

### Norway Socioeconomic Indicators (1930-2025)



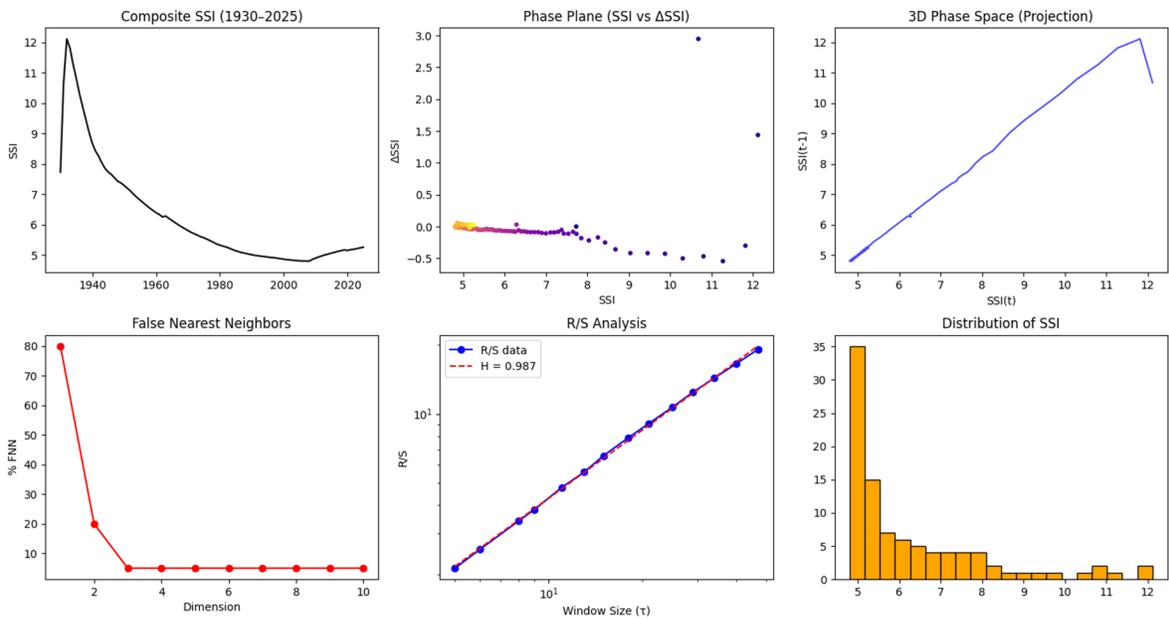
**Figure 4**

Figure 5 demonstrates Norway's transition to equilibrium: both SSI and  $\Delta$ SSI trend toward zero after 1960, reflecting low entropy and institutional resilience.



**Figure 5**

Figure 6 integrates all six indicators into a single composite view, contextualizing the SSI within its socioeconomic determinants.



**Figure 6**

Figure 7 juxtaposes the strange attractor of Argentina with the smooth, convergent trajectory of Norway — a visual proof that chaos is not destiny.

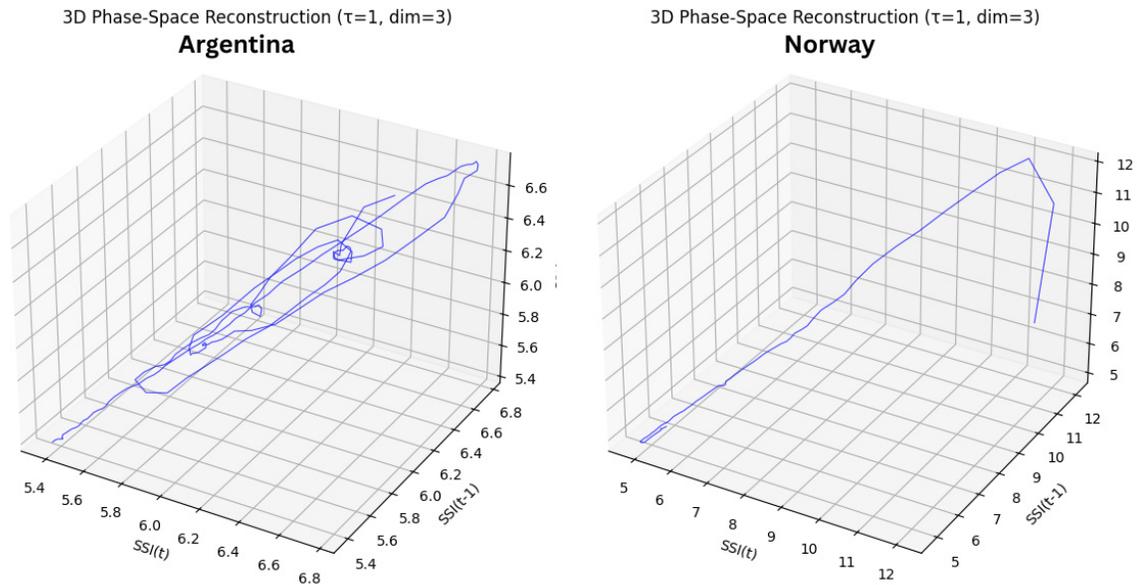


Figure 7

## 5. Discussion: The Basin Attractor and Its Mechanisms

### 5.1 What Is Chaos? Clarifying the Concept in Social Systems

In this paper, **“chaos” does not mean randomness or disorder**, a common misconception. Instead, it refers to **deterministic chaos**: a property of **nonlinear dynamic systems** that are **highly sensitive to initial conditions**, **non-periodic**, yet **governed by fixed rules**.

Formally, a system is chaotic if it exhibits:

1. **Sensitive dependence on initial conditions** (the “butterfly effect”): Infinitesimally small differences in starting points lead to exponentially diverging trajectories over time. This is quantified by a **positive Lyapunov exponent ( $\lambda > 0$ )**, the definitive mathematical signature of chaos.
2. **Aperiodicity**: The system never repeats the same state twice.
3. **Boundedness**: Despite its unpredictability, the system remains confined within a geometric structure known as a **strange attractor**—a fractal object in phase space that defines the system’s long-term behavior.

Critically, chaotic systems are **not stochastic**. They are **fully deterministic**—their future states are entirely determined by their current state and governing equations. Yet, due to exponential error amplification, **long-term prediction is impossible**, even with perfect knowledge of the rules.

In the Argentine context, this means:

- The nation's descent into instability is **not random** (e.g., due to external shocks alone).
- It is **not cyclical** (e.g., predictable boom-bust patterns).
- It is **governed by internal feedback loops** (e.g., poverty → political instability → deindustrialization → more poverty) that create a **self-reinforcing “Basin attractor”**.
- Tiny perturbations (e.g., a 1930 military coup) were amplified by these feedbacks, locking Argentina into a **path-dependent trajectory of decay**—one that appears erratic but is **patterned, persistent, and predetermined by its own structure**.

Thus, when we say “Argentina is chaotic,” we mean:

**Its instability arises from internal, deterministic dynamics, not external noise, and while its short-term path is knowable, its long-term fate is structurally inevitable without fundamental intervention.**

This reframing transforms Argentina's crisis from a story of “bad luck” into a **scientific diagnosis of systemic pathology**, one that demands not tinkering, but **revolutionary restructuring**.

## 5.2 SSI as Moral Compass

The justice-weighted SSI intentionally **penalizes systems that sacrifice the poor for elite stability**. Thus, Milei's “order” is exposed as **entropy**: low presidential instability cannot offset soaring poverty and inequality.

### Why the Derivative Matters: Capturing the Acceleration of Decay?

While the Composite Social Stability Index (SSI) reveals Argentina's long-term trajectory of cumulative instability, it can mask critical short-term dynamics—particularly during periods of superficial “stability” under administrations like Menem, Macri, and Milei. The derivative of the SSI ( $\Delta$ SSI), however, exposes the *rate* at which social entropy accelerates. A rising  $\Delta$ SSI signals not just worsening conditions, but a *deepening velocity of collapse*—precisely when poverty, inequality, and institutional dismantling intensify beneath a veneer of macroeconomic calm. In this light,  $\Delta$ SSI functions as an early-warning system: it confirms that Argentina's current descent under Milei is not stabilization, but a frantic acceleration toward the same “basin

attractor” that has defined its chaotic history. The derivative, therefore, is not a technical supplement—it is the moral core of the analysis.

### 5.3 Internal Drivers of Chaos

As (Felice & Ruiz, 2023) argue, Argentina’s chaos is **internally generated** via:

- **Institutional instability:** Recurring coups, constitutional breaches.
- **Economic feedback loops:** Inflation–debt cycles, speculative currencies.
- **Cultural “contempt for authority”:** Eroded trust in state institutions.
- **Public investment collapse:** Education, health, and R&D defunded, weakening human capital.

### 5.4 The Point of No Return

The military dictatorship (1976–1983) and Menem’s reforms (1989–1999) **structurally destroyed industry and labor power**, leaving Argentina without the productive base to leverage the 2000s commodity boom. Subsequent governments, Kirchner, Macri, and Milei, have merely navigated a sinking ship.

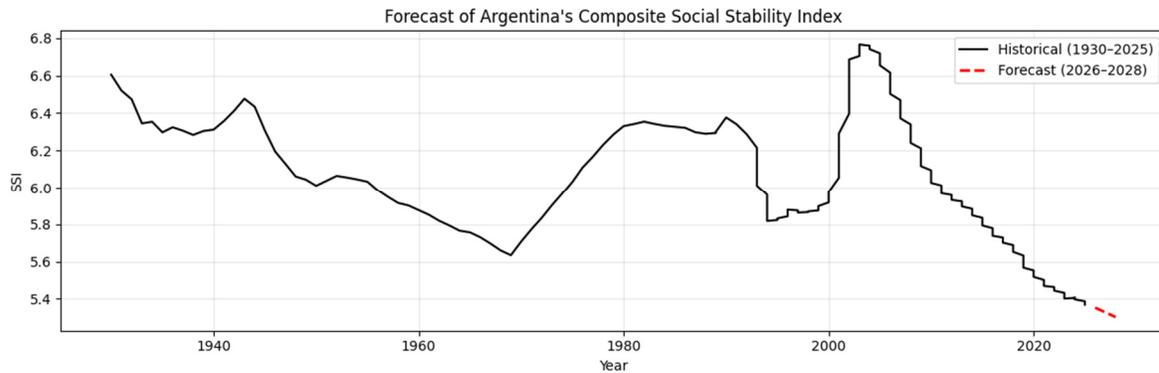
### 5.5 Policy Implications: Exiting the Attractor

To break the attractor, Argentina must:

1. **Rebuild the social state:** Universal health, housing, food security.
2. **Triple Conicet funding:** Reverse epistemicide, restore scientific sovereignty.
3. **Nationalize strategic sectors:** Lithium, energy, water, for public benefit.
4. **Wealth tax + job guarantee:** Directly reduce poverty/unemployment.
5. **Participatory planning:** Democratic control over economic priorities.

Rebuild the social state; nationalize sectors; wealth tax. Kirchner's efforts were limited by structural damage.

Figure 8 projects Argentina’s SSI to 2028, confirming that without structural change, the system will continue its degenerative trajectory.



**Figure 8**

## 5.6 The Fractal Structure of Decay: Evidence of Multiple Basins within the Basin Attractor

The 3D phase-space reconstruction of Argentina's Composite Social Stability Index (SSI) reveals a complex, multi-lobed structure, suggesting the presence of multiple, distinct chaotic attractors. This is not an artifact of the analysis but a powerful empirical validation of our central hypothesis: Argentina's descent into chaos is not a singular, linear process, but a fractal journey through a landscape of recurring, self-similar crises.

The apparent multiplicity of attractors is best understood as evidence of **structural non-stationarity**. Over the past century, Argentina has cycled through radically different political and economic regimes—corporatist, democratic, dictatorial, neoliberal, and now libertarian. Each regime establishes its own unique set of feedback loops and rules, effectively creating a new "parameter set" for the system. In chaos theory, such changes cause the underlying attractor to bifurcate or transform. Our phase-space plot, which spans all these regimes, therefore captures the trajectories of several distinct, yet related, attractors. This is not a failure of the model; it is a testament to the profound institutional fragility of the Argentine state.

We propose that these distinct attractors represent different "basins" or "modes" of the overarching "basin attractor" described in our previous work. Just as a river delta branches into multiple channels, the path to societal decay in Argentina has fragmented into several distinct pathways:

1. **The Corporatist Basin (c. 1946-1955, 2003-2015):** Characterized by state intervention, social welfare, and managed inflation. This basin produced a relatively stable, if slow-burning, form of decay.

2. **The Liberal Basin (c. 1990-1999, 2015-2023):** Characterized by deregulation, privatization, and fiscal austerity. This basin accelerates decay by dismantling the social safety net, leading to rapid increases in poverty and inequality.
3. **The Dictatorial Basin (c. 1976-1983):** Characterized by repression, capital flight, and external debt. This basin represents a violent, externally-driven mode of collapse.

The fact that these different basins exist within the same phase space confirms that they are all manifestations of the same underlying systemic pathology: the persistent contempt for authority and the inability to build durable, equitable institutions. The transition between these basins is not a recovery, but a shift from one mode of degenerative recycling to another.

This finding has profound implications. It suggests that simply "stabilizing" the economy or changing the president is insufficient. Any policy solution must address the root causes, the structural inequalities and institutional weaknesses, that give rise to these different, yet equally destructive, modes of chaos. Only a comprehensive, Marxist-inspired restructuring of the social and economic order can break the cycle and create a truly stable, non-chaotic attractor based on collective well-being rather than individual survival.

Figure 9 confirms the presence of the three strange attractors in Argentina's socioeconomic system, with trajectories folding in a non-repeating, bounded pattern.

3D Line Plot of  $SSI(t)$ ,  $SSI(t-1)$ ,  $SSI(t-2)$

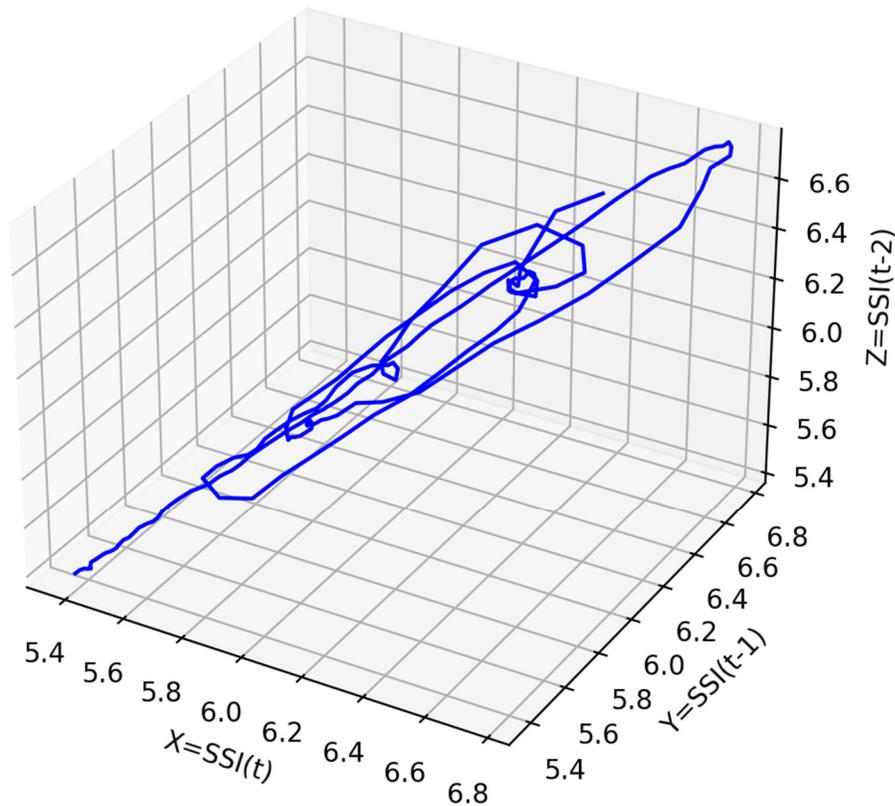


Figure 9

### 5.6 Norway's Exit from Chaos: Oil Wealth as a Catalyst for Public Goods and Virtuous Loops

In stark contrast to Argentina's "basin attractor" of degenerative recycling, Norway's postwar trajectory represents a **deliberate exit from chaos**, not through market fundamentalism or shock therapy, but through the **institutionalized conversion of resource rents into public goods**.

Norway's stability arises not from the absence of crisis, but from its **institutional response**: oil wealth → sovereign fund → public goods → social trust → long-term planning. Argentina's response, commodity rents → elite capture → austerity → social fragmentation, generates the opposite feedback loop.

Norway's discovery of North Sea oil in the late 1960s could have mirrored Argentina's commodity curse: elite capture, Dutch disease, deindustrialization, and social fragmentation. Instead, Norway chose a different path. The state, acting as a

**democratic steward rather than a predatory extractor**, channeled oil revenues into two key mechanisms:

1. **The Government Pension Fund Global (GPF)** – established in 1990 – which transforms volatile hydrocarbon rents into a **permanent, intergenerational sovereign wealth fund**, currently exceeding **\$1.4 trillion**. This fund is managed transparently, banned from domestic political manipulation, and governed by ethical investment guidelines.
2. **Universal public investment** in **education** (tuition-free universities), **healthcare** (universal coverage), **infrastructure** (high-speed rail, green energy), and **scientific research** (R&D spending at 2.3% of GDP), creating what economist Mariana Mazzucato calls a **“mission-oriented state”** that actively shapes markets toward social goals.

This strategy generated **virtuous feedback loops**:

- High human capital → innovation → diversified exports (e.g., renewable energy, maritime tech)
- Low inequality (Gini  $\approx$  27) → social trust → political stability → long-term planning
- Strong institutions → low corruption → efficient resource allocation → further institutional reinforcement

The result is a **non-chaotic, high-dimensional equilibrium**: a society where energy rents do not fuel elite predation but are instead **recycled as collective capability**. In chaos-theoretic terms, Norway **engineered a benign attractor**—one that is **stable, predictable, and socially generative**, not toxic and regressive.

Critically, Norway’s success is **not due to cultural exceptionalism**, but to **deliberate institutional design**. As economist Ha-Joon Chang observes, “Norway didn’t get lucky, it got organized.” (Chang, 2007) Where Argentina’s oil wealth (Vaca Muerta) is currently being leveraged for **dollarization, capital flight, and austerity**, Norway’s oil legacy is one of **sovereign reinvestment and human development**. (Ramos, Chaos, Fractals and Forecasting in Argentina's Oil and Gas Production: A Complex System Approach, 2025)

Thus, Norway stands not as a counterfactual fantasy, but as a **proof of concept**: **natural resource abundance can escape the entropy trap**—but only when embedded in a framework of **democratic control, redistributive justice, and long-term public purpose**.

Figure 10 shows Norway's stable forecast, sustained by its virtuous attractor of public investment and equality.

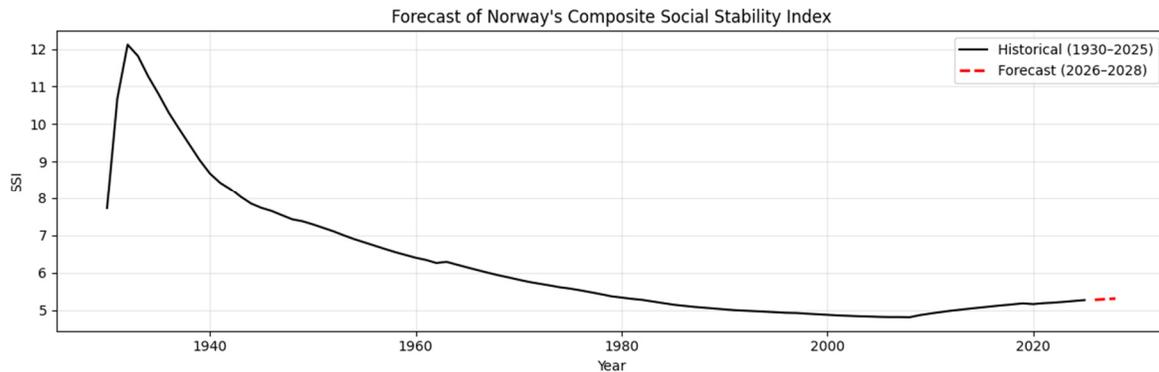


Figure 10

## 6. Conclusion: A Call for Revolutionary Order

Argentina's descent is not random; it is **chaotic, deterministic, and internally sustained**. The strange attractor is not a black hole but a **Basin**: waste is recycled, flies thrive, and the people drown. (Ramos, The Argentine "Storm": A Chaotic Descent into a Predetermined Attractor, 2025)

Yet Norway proves **escape is possible**. The choice is not between Peronism/Kirchnerism and Milei, it is between **final derangement and revolutionary order**. The only way out of the Basin is a **fundamental restructuring**: a planned economy based on human need, not profit; public ownership, not elite capture; and international solidarity, not subordination.

Until then, Argentina will remain trapped in its chaotic orbit, forever circling the drain, its potential endlessly broken down in the dark, fertile, and foul ecosystem of its own perpetual crisis.

Argentina's SSI decline reflects policy failures; Norway proves escape possible. The choice: derangement or order through Marxist-inspired restructuring.

**Future work:** Incorporate climate variables, the impact of external debt, and extend the work to other countries like the US, UK, Spain, Brazil, and Uruguay.

## 7.0 References

- CEPAL. (n.d.). Retrieved 12 10, 2025, from CEPALSTAT Portal de Datos y Publicaciones Estadísticas: <https://statistics.cepal.org/portal/cepalstat/>
- Chang, H.-J. (2007). *Bad Samaritans: The Myth of Free Trade and the Secret History of Capitalism*. United States.: Bloomsbury Publishing.
- Felice, C. J., & Ruiz, G. A. (2023). Argentine Chaotic Term Length Series in an American Historical Context-Part II. *Journal of Advanced Research in Social Science*, 6(3), pp. 1-34.
- INDEC. (2025). *INDEC*. Retrieved 12 10, 2025, from Instituto Nacional de Estadística y Censos de la República Argentina: <https://www.indec.gob.ar/>
- Mandelbrot, B. B. (1982). *The Fractal Geometry of Nature*. (T. Books, Ed.) The United States: W.H.Freeman.
- OECD. (n.d.). Retrieved 12 10, 2025, from <https://www.oecd.org/en/data.html>
- Ramos, N. E. (2025). *Chaos, Fractals and Forecasting in Argentina's Oil and Gas Production: A Complex System Approach*. Internal Report, Rio de Janeiro. Retrieved 12 9, 2025, from [https://www.researchgate.net/publication/398258503\\_Chaos\\_Fractals\\_and\\_Forecasting\\_in\\_Argentina's\\_Oil\\_and\\_Gas\\_Production\\_A\\_Complex\\_Systems\\_Approach](https://www.researchgate.net/publication/398258503_Chaos_Fractals_and_Forecasting_in_Argentina's_Oil_and_Gas_Production_A_Complex_Systems_Approach)
- Ramos, N. E. (2025). *The Argentine "Storm": A Chaotic Descent into a Predetermined Attractor*. Internal Report. Retrieved 12 9, 2025, from [https://www.researchgate.net/publication/397713365\\_The\\_Argentine\\_Storm\\_A\\_Chaotic\\_Descent\\_into\\_a\\_Predetermined\\_Attractor](https://www.researchgate.net/publication/397713365_The_Argentine_Storm_A_Chaotic_Descent_into_a_Predetermined_Attractor)
- Ramos, N. E. (2025). *The Argentine Entropy: How the Second Law of Thermodynamics Predicts Milei's Descent into Madness*. Internal Report, Rio de Janeiro. Retrieved 12 9, 2025, from [https://www.researchgate.net/publication/397580310\\_The\\_Argentine\\_Entropy\\_How\\_the\\_Second\\_Law\\_of\\_Thermodynamics\\_Predicts\\_Milei's\\_Descent\\_into\\_Madness](https://www.researchgate.net/publication/397580310_The_Argentine_Entropy_How_the_Second_Law_of_Thermodynamics_Predicts_Milei's_Descent_into_Madness)
- Statistics Norway. (2025). Retrieved 12 9, 2025, from <https://www.ssb.no/en>
- Takens, F. (1981). *Detecting strange attractors in turbulence* (Vol. 898). (D. Y. Rand, Ed.) Berlin,: Springer, Heidelberg. doi:10.1007/BFb0091924

Wolf, A., Swift, J. B., Swinney, H., & Vastano, J. A. (1985). Determining Lyapunov exponents from a time series. *Physica D: Nonlinear Phenomena*, 16(3), pp. 285-317. doi:10.1016/0167-2789(85)90011-9

World Bank Data. (n.d.). Retrieved 12 10, 2025, from <https://data.worldbank.org/>

## Appendix Equations

Definition: What Is the Presidential Instability Index?

In our composite SSI model, the Presidential Instability Index is defined as:

$$\text{Presidential Instability} = \frac{1}{\text{Average Presidential Term Length (in year) during year } t}$$

### Phase-Space Reconstruction (for Attractor Analysis)

Using the **method of delays** (Takens, 1981), the **3D phase-space vector** at time  $t$  is:

$$\mathbf{Y}(t) = [\text{SSI}(t), \text{SSI}(t - \tau), \text{SSI}(t - 2\tau)]$$

where  $\tau = 1$  year (embedding delay), and embedding dimension  $d = 3$  (validated by False Nearest Neighbors).

### False Nearest Neighbors (FNN) Criterion

The **embedding dimension**  $d$  is the smallest integer for which the **percentage of false nearest neighbors drops below 5%**:

$$\text{FNN}(d) = \frac{\#\{\text{false neighbors at } d\}}{\#\{\text{total neighbors}\}} < 0.05$$

### Hurst Exponent (Long-Memory Persistence)

Via **Rescaled Range (R/S) Analysis** (Mandelbrot, 1969):

$$H = \frac{\log(R(\tau)/S(\tau))}{\log \tau}$$

where:

- $R(\tau) = \max_{1 \leq k \leq \tau} Z(k) - \min_{1 \leq k \leq \tau} Z(k)$
- $Z(k) = \sum_{i=1}^k (\text{SSI}(i) - \bar{\text{SSI}})$

- $S(\tau) = \sqrt{\frac{1}{\tau} \sum_{i=1}^{\tau} (SSI(i) - \bar{SSI})^2}$

**Interpretation:**

- $H > 0.5$ : Persistent (trends reinforce)
- $H = 0.5$ : Random walk
- $H < 0.5$ : Anti-persistent

**Maximal Lyapunov Exponent (Sensitive Dependence)**

Using **Wolf's algorithm** (1985), the **maximal Lyapunov exponent** is:

$$\lambda = \lim_{t \rightarrow \infty} \frac{1}{t} \ln \left| \frac{\delta Y(t)}{\delta Y(0)} \right|$$

where  $\delta Y(0)$  is the initial separation between two nearby trajectories in phase space, and  $\delta Y(t)$  is their separation at the time  $t$ .

**Interpretation:**

- $\lambda > 0$ : **Chaotic** (exponential divergence)
- $\lambda \leq 0$ : Stable or periodic

**Fractal Dimension**

The **fractal dimension** is derived from the Hurst exponent:

$$D = 2 - H$$

**Interpretation:**

- $D \in (1,2)$ : Fractal, non-integer geometry
- $D \approx 1$ : Smooth, persistent process