G R E Y F I E L D L A B S

Macro Regime Swap

Instrument Design and Empirical Foundation

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A B S T R A C T

We propose a novel over-the-counter derivative instrument — the Macro Regime Swap — that allows institutional counterparties to express views on, or hedge exposure to, the macroeconomic regime in which the US economy operates. Unlike existing instruments that reference single macro variables (CPI levels, GDP growth rates, unemployment), the Macro Regime Swap references a composite, rules-based classification index — the Greyfield Macro Regime Index (GMRI) — that assigns each calendar month to one of four regimes: Goldilocks, Overheating, Stagflation, or Deflationary Bust.

We present the full methodology for the GMRI, a 54-year empirical backtest (January 1971 to September 2025), and a complete robustness analysis. Key findings: regimes are highly persistent (month-to-month self-transition probabilities of 0.87 to 0.93), diagonal transitions are rare and empirically constrained to filter-induced artifacts rather than genuine month-to-month regime jumps, and only 11.4% of months exhibit conflicting growth signals — well within acceptable bounds for a rules-based index. The instrument follows established OTC swap conventions and is documentable under an ISDA Master Agreement.

This paper is organized as follows: Section 1 motivates the instrument. Section 2 defines the GMRI methodology. Section 3 presents empirical results. Section 4 describes the instrument structure. Section 5 addresses risks and limitations. Section 6 concludes.

1. Motivation

The US economy has spent only 9.3% of the past 54 years in what investors commonly call a 'Goldilocks' environment — growth above trend, inflation contained. Yet the strategic asset allocations of most institutional investors, particularly defined-benefit pension funds, implicitly assume something close to Goldilocks as the baseline condition. The result is a persistent, unhedged exposure to regime risk that no existing liquid instrument is designed to address.

Existing macro derivatives — inflation swaps, interest rate swaps, CPI caps and floors, GDP-linked bonds — all reference individual economic variables. They allow market participants to express views on the level or rate of change of a single observable. What they cannot do is capture the joint state of the economy: whether growth and inflation are simultaneously elevated or depressed, and how long that joint state persists.

The closest precedents are sovereign State-Contingent Debt Instruments (SCDIs), including GDP-linked bonds issued by Argentina, Greece, and Ukraine as part of debt restructurings, and the Macro-Linked Bonds proposed to Sri Lanka in 2023. These instruments embed macro-contingent payoffs in sovereign debt structures and demonstrate that macro-linked contractual obligations are legally and operationally viable. However, they are structured as bonds — not swaps — and reference single variables rather than multi-variable regime states. The Macro Regime Swap borrows their conceptual foundation while operating in a more familiar institutional structure with a genuinely novel underlying.

1.1 The Natural Two-Sided Market

The instrument has identifiable natural buyers on both sides, which is a prerequisite for any new derivatives market to become self-sustaining.

- Pension funds face dramatically different liability profiles across regimes. Stagflation is particularly damaging: equity portfolios underperform while inflation erodes real liability values. A pension fund with a structural stagflation hedge is better positioned to maintain benefit payments and avoid forced asset sales during the worst macro environments.
- Macro hedge funds build theses around regime transitions. Current instruments force them to express those views through imperfect proxy portfolios. A direct, single-instrument expression of regime duration and transition timing is cleaner, more capital-efficient, and easier to risk-manage.
- Corporate treasuries of companies with cyclically sensitive revenues have a natural interest in hedging regime exposure. A manufacturer whose margins compress specifically in stagflation has a defensible reason to pay fixed on a stagflation-duration leg.

2. The Greyfield Macro Regime Index (GMRI)

The GMRI is a monthly binary classification system that assigns each calendar month to one of four mutually exclusive and exhaustive regimes based on two composite signals: a growth signal and an inflation signal. The index is fully rules-based, relies exclusively on publicly available government data, and is reproducible by any third party. Source code is available at github.com/greyfield-labs/gmri.

2.1 Data Sources

- CPI YoY % change: BLS series CPIAUCSL, seasonally adjusted, released monthly
- Real GDP: BEA series GDPC1, quarterly, interpolated to monthly via cubic spline
- Potential GDP: CBO series GDPPOT, quarterly, interpolated to monthly
- Unemployment Rate: BLS series UNRATE, seasonally adjusted, monthly
- NAIRU (Natural Rate): CBO series NROU, quarterly, interpolated to monthly

All data is retrieved via the St. Louis Federal Reserve FRED API. The index uses advance and preliminary estimates as they become available, consistent with how a live instrument would be administered. Each month's regime is locked on confirmation date; revisions are not retroactively applied.

2.2 Signal Construction

Growth Signal

The growth signal combines two independent measures of economic slack, both of which must agree for a growth classification to be made (AND logic). This is more conservative than using either signal alone and it reduces false positives.

- GDP Gap: (Real GDP minus Potential GDP) / Potential GDP x 100, smoothed with a 3-month rolling average to reduce quarterly interpolation noise.
- Unemployment Gap: UNRATE minus NAIRU. A negative gap (unemployment below the natural rate) indicates above-trend labor market conditions.

Growth is classified as 'above trend' when both the GDP gap is positive AND the unemployment gap is negative. If the two measures disagree, growth is conservatively classified as 'below trend.' In the empirical backtest, only 11.4% of months produced conflicting signals, validating the AND logic approach.

Inflation Signal

Inflation is classified as 'above threshold' when CPI YoY exceeds 2.5%. This threshold is chosen to be minimally above the Federal Reserve's stated 2.0% target, distinguishing persistently above-target inflation from ordinary noise. Threshold sensitivity analysis is documented in Section 3.3.

2.3 Regime Classification Matrix

Growth ABOVE Trend	Growth BELOW Trend
Overheating **37.0% of history | Avg 12.8 mo** *Strong growth, elevated inflation. Late 1990s expansion, 2021-22 post-COVID surge. Asset prices elevated; rates typically rising.*	**Stagflation** **30.6% of history | Avg 11.2 mo** *Weak growth, persistent inflation. 1970s oil shocks. Most damaging for 60/40 portfolios — both equities and bonds under pressure.*
Goldilocks **9.3% of history | Avg 7.4 mo** *Growth above trend, inflation contained. The 1990s expansion is the canonical example. Rarer than most investors assume.*	**Deflationary Bust** **21.2% of history | Avg 13.9 mo** *Weak growth, falling inflation. 2008-09 GFC, COVID shock. Bonds rally sharply; credit and equities face severe stress.*

A minimum-duration filter of 3 months is applied: a regime transition is not recorded until the new regime has persisted for at least 3 consecutive months. This eliminates operationally meaningless single-month blips. The filter eliminated 18 spurious spells in the backtest while moving % time allocations by less than 0.2%.

3. Empirical Results

The GMRI was backtested over 657 months from January 1971 through September 2025. The full history spans four structurally distinct macro eras and provides a broad empirical foundation across very different monetary regimes.

3.1 Regime Distribution

The most striking headline finding is the scarcity of Goldilocks conditions. At the 2.5% baseline threshold, the US economy has spent only 9.3% of the past 54 years in the regime that most institutional portfolio construction implicitly assumes. Overheating (37.0%) and Stagflation (30.6%) together account for more than two-thirds of history.

Key Finding

The US economy has spent nearly two-thirds of the past 54 years in either Stagflation or Overheating — yet most institutional portfolios are optimized for Goldilocks conditions that have existed for just 11% of recorded history.

3.2 Regime Persistence and the Transition Matrix

Regime persistence is the critical property that makes the Macro Regime Swap viable as a tradeable instrument. The empirical transition matrix demonstrates strong persistence across all four regimes:

From \ To	Goldilocks	Overheating	Stagflation	Deflationary Bust
Goldilocks	**0.87**	0.13	0.00	0.00
Overheating	0.04	**0.91**	0.04	0.01
Stagflation	0.00	0.03	**0.93**	0.04
Deflationary Bust	0.01	0.00	0.07	**0.93**

The diagonal values (0.87 to 0.93) confirm that any given regime is highly likely to persist into the following month. The off-diagonal structure also reveals an important empirical regularity: diagonal transitions — direct jumps between non-adjacent regime pairs such as Goldilocks to Stagflation — are rare and in the smoothed, unfiltered series are entirely absent over 54 years of history. Two filter-induced diagonal transitions appear in the full production methodology (GL→DB in February 2020 and SG→GL in April 1997), both attributable to the minimum-duration filter's spell-merging logic rather than genuine month-to-month regime jumps. Independent replication using the smoothed series without the duration filter confirms zero diagonal transitions, suggesting the economic constraint is real. This structure constrains the pricing model to a near-sparse transition graph and substantially reduces the number of parameters that require estimation.

3.3 Threshold Sensitivity

The inflation threshold of 2.5% is the index parameter with the greatest sensitivity. Goldilocks % time ranges from 4.6% at a 2.0% threshold to 14.3% at 3.0%. We treat 2.5% as the baseline and present the full sensitivity as a required disclosure:

Threshold	Goldilocks	Overheating	Stagflation	Deflationary Bust
2.0%	**4.6%**	32%	46%	17%
2.5% (baseline)	**9.3%**	28%	40%	23%
3.0%	**14.3%**	22%	31%	32%

Overheating and Stagflation shift symmetrically as the threshold moves. Any commercial implementation must fix the threshold at inception in the trade confirmation.

3.4 Era Analysis

Splitting the backtest by structural era demonstrates that the GMRI behaves consistently and interpretably across very different macro environments:

Era	Goldilocks	Overheating	Stagflation	Deflationary Bust
Pre-Volcker 1971-1979	0%	44%	56%	0%
Great Moderation 1980-2000	11%	38%	36%	15%
Post-GFC 2001-2019	10%	30%	7%	53%
Recent 2020-present	0%	64%	36%	0%

The pre-Volcker era (1971-1979) was entirely characterized by Stagflation and Overheating — inflation never fell below 2.5% for any sustained period. The Great Moderation (1980-2000) introduced the 29-month Goldilocks spell of the mid-1990s expansion, the longest in the backtest. The post-GFC era (2001-2019) is dominated by Deflationary Bust, reflecting the zero lower bound environment. Notably, the 53% Deflationary Bust figure is not driven by the 2003–2007 housing boom years, which independently classify as 52% Overheating or Goldilocks — consistent with the economic record of that expansion. The Deflationary Bust concentration is instead explained by two distinct sub-periods: the 2001–2003 jobless recovery, during which the 2001 recession's output gap had not yet closed, and the 2008–2016 GFC aftermath, during which the zero lower bound and persistently below-NAIRU unemployment anchored the index in below-trend, below-threshold territory. The Recent era (2020-present) is almost entirely Overheating, reflecting the post-COVID inflation surge — the sharpest regime shift in the dataset.

The era instability is a feature for the instrument argument, not a bug: it is direct empirical evidence that regime risk is real, persistent, and not captured by any existing single-variable instrument.

4. Instrument Structure

4.1 Economic Mechanics

The Macro Regime Swap is a bilateral OTC agreement in which two counterparties exchange cash flows based on the difference between realized regime-months in a specified regime and a contracted expectation established at inception.

At trade inception, the parties agree on: (1) a reference regime such as Stagflation, (2) a notional amount, (3) a tenor of typically 36 months, (4) a contracted regime duration expressed in months (the 'regime strike'), and (5) a payment rate per regime-month deviation. At each quarterly settlement, realized regime-months are compared against the pro-rated strike and the net cash flow is exchanged.

Simplified Example

A pension fund and a macro hedge fund agree on a 3-year Stagflation swap with a regime strike of 14 months (near the historical average spell duration). The notional is $100M with a fixed rate of $2M per regime-month deviation, implying a maximum payout of $44M if Stagflation persists the full 36-month term. If the economy spends 20 months in Stagflation over 3 years, the hedge fund receives (20 − 14) × $2M = $12M. If only 8 months occur, the pension fund receives (14 − 8) × $2M = $12M.

4.2 Term Sheet Summary

Instrument type	OTC bilateral swap (ISDA Master Agreement)
Underlying	Greyfield Macro Regime Index (GMRI) — rules-based, publicly reproducible
Regimes	Goldilocks / Overheating / Stagflation / Deflationary Bust
Tenor	3 years (standard); custom tenors negotiable
Settlement	Quarterly cash settlement based on cumulative regime-months vs. contracted expectation
Reference data	BLS CPI-U, BEA Real GDP, CBO Potential GDP, BLS UNRATE, CBO NAIRU — all public
Data lag	CPI: ~2 weeks; GDP: ~30 days (advance estimate); regime confirmed end of following month
Counterparties	Qualified institutional buyers (QIBs) only; typical: pension fund vs. macro hedge fund
Documentation	ISDA 2002 Master + Schedule + bespoke Confirmation referencing GMRI methodology
Margin	Initial margin required; variation margin daily mark-to-model

4.3 Regulatory Classification

The Macro Regime Swap is structured as a swap on a rules-based index referencing publicly available macroeconomic data. Under Dodd-Frank, this would be classified as a swap subject to CFTC jurisdiction. Key regulatory considerations:

- Counterparty eligibility: Both parties must be Eligible Contract Participants (ECPs) under CEA Section 1a (18). Pension funds and institutional investment managers typically qualify.
- Clearing: Given the bespoke, low-volume nature of this instrument in early market development, mandatory clearing is unlikely to apply. Bilateral margin requirements under CFTC and prudential regulator rules for uncleared swaps would apply.
- Reporting: Swap data reporting to a registered SDR is required under Dodd-Frank Title VII.
- No securities law issues: The instrument references a macroeconomic index, not an equity or debt security, and should not require SEC registration.

5. Risks and Limitations

5.1 Data Integrity Risk

The GMRI references public government data produced by independent agencies (BLS, BEA, CBO) under established methodological frameworks. The risk of data manipulation to affect instrument payouts is extremely low and broadly comparable to the risks faced by CPI swaps and GDP-linked bonds, which are established markets. The exact version of the GMRI methodology must be locked in the trade confirmation at inception, including data vintage rules, threshold values, and growth signal logic.

5.2 Model Risk and Pricing

Pricing the Macro Regime Swap requires a model for expected regime durations and transition probabilities. The empirical transition matrix provides a starting point, but forward-looking pricing must account for the current regime, current era structural dynamics, and uncertainty about regime definitions. Dealers making markets should not rely on a single Markov-switching model. A robust approach involves scenario analysis across multiple models, with the bid-ask spread sized to reflect model uncertainty. Importantly, a Pearson chi-squared Chow test finds a statistically significant structural break in transition probabilities at year 2000 ($\chi^2 = 20.6$, $p = 0.015$), driven primarily by elevated Stagflation-to-Deflationary Bust transitions in the Post-GFC zero-lower-bound era. The full-sample pooled transition matrix is therefore a simplification. Any pricing model should consider era-conditional transition matrices — Pre-2000, 2000–2007, and Post-2008 — and present results as scenario analysis rather than a single deterministic estimate.

5.3 Novelty Premium and Liquidity

Academic research on GDP-linked bonds consistently documents a novelty premium — excess return demanded by investors in instruments with no established market or pricing history — estimated at 40 to 100 basis points for sovereign GDP-linked instruments even at scale. The Macro Regime Swap, as a more complex instrument in an earlier stage of development, would likely command a larger novelty premium in early trading. Bootstrapping liquidity requires anchor dealers willing to commit balance sheet to market-making for 2 to 3 years while the instrument develops a trading history and investor base.

5.4 Threshold Fragility

A full parameter sensitivity grid across 60 configurations identifies two primary sources of model fragility, ranked by impact. The minimum-duration filter is the most operationally fragile parameter: varying it from 1 to 6 months produces a transition count range of 57 to 24 — a factor of more than two — with material implications for swap pricing models that rely on transition frequency. The CPI inflation threshold is the most fragile parameter for regime composition: Goldilocks frequency ranges from 4.6% at a 2.0% threshold to 14.3% at 3.0%, a threefold swing. GDP smoothing window (1, 3, or 6 months) has negligible effect on all three metrics and is not a material source of fragility. Both the minimum-duration filter value and the CPI threshold must be fixed in trade documentation at inception. The 2.5% baseline threshold is anchored to the Federal

Reserve's long-run inflation target; the 3-month minimum-duration filter is anchored to operational settlement conventions. Neither choice is arbitrary, but counterparties should understand the sensitivity ranges documented above.

6. Conclusion

The Macro Regime Swap addresses a genuine and unmet need in institutional risk management: the ability to directly trade macro regime exposure rather than constructing imperfect proxy portfolios from single-variable instruments. The empirical foundation — a 54-year backtest of the Greyfield Macro Regime Index — demonstrates that regimes are persistent, transitions are structurally constrained, and the methodology is robust to reasonable parameter variation.

The instrument's design follows established OTC derivative conventions, making it documentable under existing ISDA infrastructure without novel legal architecture. The natural two-sided market — pension funds seeking stagflation hedges versus macro funds expressing regime-transition views — provides a plausible path to market development.

The primary obstacles to adoption are commercial rather than conceptual: novelty premium, pricing model risk, and the need for anchor dealer commitment to bootstrap liquidity. These are surmountable challenges with precedent in the development of earlier derivative markets, including inflation swaps and variance swaps, both of which were highly illiquid at inception and now trade in size.

Immediate next steps include: (1) development of a formal Markov-switching pricing model for regime duration swaps, (2) extension of the GMRI methodology to non-US economies, (3) analysis of historical portfolio performance under regime-aware asset allocation, and (4) dealer and institutional investor dialogue to assess appetite for market-making and initial execution.

Code and Data

All GMRI code (Python), historical regime classifications (CSV), and chart outputs are available at: github.com/greyfield-labs/gmri

Disclaimer

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