VERSION 1

BBN BTC / EMERGING MARKETS BENCHMARK

PUBLIC METHODOLOGY

VERSION 1 · INAUGURAL RELEASE

A weekly relative-performance series comparing Bitcoin with broad emerging-market equity risk, measured by the MSCI Emerging Markets Net Total Return Index (USD). The headline is a rebased ratio of a Bitcoin price index over the MSCI EM Net Total Return level, anchored to a fixed base date, designed to show whether Bitcoin is gaining or losing strength against a global higher-beta, dollar-sensitive and liquidity-sensitive equity universe.

< 100	100	> 100
BTC UNDERPERFORMS	BASE ANCHOR	BTC OUTPERFORMS

BENCHMARK FAMILY	BBN Benchmarks · Bitcoin Macro Benchmarks
BENCHMARK NAME	BBN BTC / Emerging Markets Benchmark
PRIMARY OBJECTIVE	Measure Bitcoin's relative performance versus broad emerging-market equity risk
UPDATE FREQUENCY	Weekly — one end-of-week observation
HEADLINE UNIT	Base-100 BTC-to-MSCI EM Net TR rebased ratio
HEADLINE BOUNDS	Unbounded above; bounded below by zero (the index level is structurally positive)
BASE DATE / VALUE	Tuesday, 2 January 2018 · headline = 100.00
EM REFERENCE	MSCI Emerging Markets Net Total Return Index, USD · Bloomberg ticker M1EF
MATERIAL REVISION THRESHOLD	0.5 index points (headline)
METHODOLOGY VERSION	Version 1 — inaugural public release
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HOW TO READ IT — AND WHAT 100 MEANS

A headline above 100 means Bitcoin has outperformed broad EM equities since the base date; below 100 means EM equities have outpaced Bitcoin. Unlike a BBN Index, which is scored around a 50 mid-point, the 100 here is not a neutral or trailing-norm point — it is a fixed anchor. A headline of exactly 100 would mean Bitcoin and the MSCI EM Net Total Return Index have moved by identical proportional amounts since 2 January 2018.

POSITIONING

This is the global higher-beta equity-risk signal in the BBN Bitcoin Macro Benchmarks family — a proprietary, directional benchmark for editorial, research and commercial data use. It is not an IOSCO-aligned regulated financial benchmark, not a tradable instrument, not an investable index, and not an investment recommendation.

01 WHAT THE BENCHMARK MEASURES

The benchmark answers one cross-asset question: is Bitcoin gaining or losing strength versus broad emerging-market equity risk, measured from a fixed historical anchor? Emerging markets are not U.S. large-cap or technology equities — they are more exposed to external financing conditions, dollar strength, commodity cycles, country-level political risk and global liquidity shifts. Comparing Bitcoin with them frames BTC as part of a wider global risk-and-liquidity regime rather than only against U.S. tech or against rates.

ELEMENT	WHAT IS MEASURED
BTC leg	U.S. dollar price of Bitcoin from the CME CF Bitcoin Reference Rate (BRR) — an institutional-quality reference price
EM equity leg	Level of the MSCI Emerging Markets Net Total Return Index (USD), ticker M1EF — broad EM equity return including reinvested dividends net of withholding taxes
Headline benchmark	BTC price index ÷ MSCI EM Net TR level index, both rebased to 100 on 2 January 2018, then multiplied by 100
Weekly change	Week-on-week percentage change in the headline — a momentum and outlier-review diagnostic
EM units per BTC	BTC price ÷ EM index level, published for scale reference only — a constant multiple of the headline that cannot disagree with it directionally

WHY NET TOTAL RETURN, NOT PRICE RETURN

The headline uses the Net Total Return variant rather than the Price index. A price-return EM index excludes dividends; since 2018 that difference accumulates to roughly 14–16 percentage points of total return. Because Bitcoin pays no dividends, comparing it with a price-return EM index would systematically understate EM and bias the headline upward on the BTC side. Net Total Return — dividends reinvested after withholding tax at rates applicable to non-resident institutional investors — is the institutional standard for cross-asset relative-performance comparison and is unbiased against either leg.

02 EMERGING-MARKET LEG SPECIFICATION

The headline uses one named MSCI variant, with no substitution inside the series. Alternative variants and indices are explicitly ineligible.

INDEX NAME	MSCI Emerging Markets Net Total Return Index (USD) · Bloomberg M1EF · Refinitiv .MIEF00000PUS
INDEX TYPE	Net Total Return — reinvested dividends after deduction of withholding taxes at non-resident institutional rates
COVERAGE	Large- and mid-cap representation across the emerging-market countries in the index (24 as of publication), ~85% of free-float-adjusted market capitalisation per country
RECONSTITUTION	Quarterly MSCI index reviews with semi-annual major reviews (May and November); constituent and country changes flow into the level automatically
ROLL REQUIREMENT	None — MSCI EM is a cash equity index, not a futures contract, so no back-adjustment, roll cycle or splicing is required

VARIANTS AND INDICES NOT USED

EXCLUDED REFERENCE	REASON FOR EXCLUSION
MSCI EM Price Index (USD)	Excludes dividends, creating a systematic upward bias on the BTC side of the headline
MSCI EM Gross Total Return (USD)	Includes dividends gross of withholding tax, overstating institutional after-tax return; not the industry standard
MSCI EM Local Currency	Embedded FX exposure would mix equity and currency signals and break comparability across periods of changing dollar strength
FTSE Emerging Index	Classifies South Korea as developed, giving a materially different country mix; not interchangeable with MSCI EM
Single-country / regional sub-indices	The benchmark measures broad EM exposure, not country or regional concentration
EM equity ETF NAV or close (EEM, IEMG, VWO)	Embed tracking error, premium/discount and fund-flow effects; may appear only as a secondary visual cross-check in release notes, never in the headline

03 DATA SOURCES AND SOURCE TIERS

Both legs use named source hierarchies; any substitution is a documented methodology change. Both legs are USD-denominated, so no FX conversion enters the headline.

BITCOIN PRICE LEG

TIER	SOURCE	WHEN USED
Primary	CME CF Bitcoin Reference Rate (BRR), 16:00 London fix	Headline source — identical to the BTC leg of the other BBN Macro Benchmarks
Fallback 1	CME CF BRR — New York variant (BRRNY), 16:00 ET fix	Used if BRR is unavailable for the observation date
Fallback 2	Bloomberg BNY Mellon Bitcoin Index or Bloomberg Galaxy Bitcoin Index, end-of-day NY value	Used only if both BRR and BRRNY are unavailable; the switch is logged in the release note

EMERGING-MARKET LEG

TIER	SOURCE	WHEN USED
Primary	MSCI EM Net TR USD level (M1EF), via Bloomberg or Refinitiv institutional distribution	Headline source
Fallback 1	The same MSCI series via the parallel provider (Bloomberg if Refinitiv was primary, or vice versa)	Used if the primary distribution is delayed for the observation date
Not used	MSCI EM Price, Gross TR, Local Currency, FTSE Emerging, country sub-indices, ETF NAV/close	Never eligible for the headline; ETF closes may appear only as a secondary visual cross-check

04 OBSERVATION RULE AND CALENDAR

Bitcoin trades continuously while the MSCI EM Net TR level is calculated by MSCI after the close of constituent emerging-market exchanges, so the benchmark fixes a common weekly observation with explicit timestamps for each leg.

OBSERVATION DAY	Friday
BTC TIMESTAMP	CME CF BRR fix, 16:00 London time
EM TIMESTAMP	MSCI EM Net TR USD end-of-day close, normally published ~17:00 New York time
ALIGNMENT	Both legs are taken on the same calendar Friday; MSCI handles local holidays internally (using the most recent prior close where Friday is not a local trading day). Both legs are USD-denominated.

If EM is unavailable on Friday (an MSCI publication delay), the nearest prior valid MSCI EM Net TR close is used and the BTC leg is moved back to the same date. If Bitcoin is unavailable, BRRNY is used for the same

Friday; if both BTC sources fail, the observation moves to the nearest prior Friday with a valid BTC value and the EM leg is aligned to it. If both legs are unavailable, the week is deferred and no headline is published; missed weeks are not back-filled, and the next valid Friday resumes the series. A forward-fill of either leg beyond five calendar days is not permitted — past that point the week is treated as missing.

05 CALCULATION METHODOLOGY

The headline is built in deterministic steps from the weekly observation pair. Values are held to four decimals internally and reported to two; BRR(0) and M1EF(0) denote the fixed 2 January 2018 base levels.

STEP 1 — BTC PRICE INDEX

$$\mathrm{BTCIndex}_t = 100 \times \mathrm{BRR}_t \,/\, \mathrm{BRR}_0$$

STEP 2 — EM INDEX LEVEL REBASED

$$\mathrm{EMIndex}_t = 100 \times \mathrm{M1EF}_t \,/\, \mathrm{M1EF}_0$$

STEP 3 — HEADLINE BENCHMARK

$$\mathrm{BBN\ BTC/EM}_t = 100 \times \mathrm{BTCIndex}_t \,/\, \mathrm{EMIndex}_t$$

$$= 100 \times [\ \mathrm{BRR}_t/\mathrm{BRR}_0\ ] \,/\, [\ \mathrm{M1EF}_t/\mathrm{M1EF}_0\ ]$$

Equals 100 on the base date; bounded below by zero (both legs are structurally positive) and unbounded above.

STEP 4 — WEEKLY CHANGE & SCALE DIAGNOSTIC

$$\mathrm{WeeklyChange}_t = [\ \mathrm{BBN\ BTC/EM}_t \,/\, \mathrm{BBN\ BTC/EM}_{t-1\mathrm{wk}} - 1\ ] \times 100\%$$

$$\mathrm{EMUnitsPerBTC}_t = \mathrm{BRR}_t \,/\, \mathrm{M1EF}_t$$

EM-units-per-BTC is a scale reference only — algebraically a constant multiple of the headline that cannot disagree with it directionally.

WORKED EXAMPLE — ILLUSTRATIVE FRIDAY OBSERVATION

INPUT	VALUE	SOURCE
Observation date	**14 June 2024**	Standard weekly Friday (illustrative)

INPUT	VALUE	SOURCE
BRR(t)	$66,250.00	CME CF BRR, 16:00 London
BRR(0) base	$13,412.44	2 January 2018 anchor
M1EF(t)	720.00	MSCI EM Net TR USD, 14 June 2024 close
M1EF(0) base	589.86	2 January 2018 close

Step 1 — BTC index: 100 × 66,250.00 / 13,412.44 = 493.94. Step 2 — EM index rebased: 100 × 720.00 / 589.86 = 122.06. Step 3 — Headline: 100 × 493.94 / 122.06 = 404.66. Diagnostic — EM units per BTC: 66,250.00 / 720.00 = 92.01.

A reading of 404.66 means that since the anchor Bitcoin has appreciated by about 4.94× while the MSCI EM Net TR index has appreciated by about 1.22× (roughly a 22% total return over six and a half years, dividends reinvested), so Bitcoin has outperformed broad EM equities by about 4.05× over the period. This places the benchmark in the "Strong BTC outperformance versus emerging markets" band, and the diagnostic shows that one Bitcoin currently represents about 92 index units of the MSCI EM Net TR benchmark.

PUBLICATION LAYERS

Every weekly release falls into exactly one layer. Full publication requires the BTC leg from tier-1 BRR and the EM leg from tier-1 MSCI distribution, with no fallback and a forward-fill of at most one day; it carries the headline, weekly change, the EM-units-per-BTC diagnostic and a release note. Provisional applies when either leg uses a tier-2 fallback or is forward-filled by two to five days; the same outputs are published with a "Provisional" label and a deviation note, and may be revised when the primary source returns. No publication applies when either leg is unavailable beyond the five-day limit or a verified source error is unreconciled; a short coverage note is issued and the next valid Friday resumes the series, with no back-fill.

06 INTERPRETATION FRAMEWORK

The benchmark does not claim Bitcoin is outperforming the real EM economy; it says Bitcoin is gaining or losing strength relative to broad EM equity total return since the base date. A rising headline means BTC is gaining against global higher-beta equity risk; a falling headline means that exposure is leading BTC. The four price combinations distinguish broad risk-on (BTC and EM both rising), capital rotating from BTC into wider EM risk or BTC-specific weakness against a benign backdrop (BTC down, EM up), digital-asset strength against a softening global complex or BTC-specific bid (BTC up, EM down), and broad cross-asset risk-off in which BTC draws no defensive flow (both falling).

> **BTC-DOMINANT VOLATILITY**
>
> Bitcoin runs at roughly 60–80% annualised volatility against MSCI EM's 15–20%, so almost all weekly headline variance is driven by the BTC leg. A 5% weekly headline move is far more likely to be a Bitcoin move than an EM move; the underlying BTC and EM levels published with each release show which leg drove a given week.

07 HEADLINE INTERPRETATION BANDS

The bands partition the full positive range of possible readings with no gaps or overlaps; each boundary is a threshold, so a band runs from its lower figure up to (but not including) the next. They are deliberately asymmetric around 100 because BTC volatility is roughly three to four times MSCI EM's, so over multi-year horizons the headline drifts upward whenever BTC appreciates and the upper bands widen geometrically.

HEADLINE	BAND	MEANING
≥ 500	**Severe BTC outperformance**	BTC has appreciated dramatically more than MSCI EM Net TR since the base
250 – <500	**Strong BTC outperformance**	Pronounced BTC strength relative to MSCI EM Net TR
150 – <250	**Moderate BTC outperformance**	BTC has clearly outpaced MSCI EM Net TR
>100 – <150	**Slight BTC outperformance**	BTC has marginally outperformed MSCI EM Net TR
100	**On the base-date anchor**	Identical proportional moves since the base
75 – <100	**Slight BTC underperformance**	MSCI EM Net TR has compounded slightly faster than BTC has risen
40 – <75	**Moderate BTC underperformance**	MSCI EM Net TR has materially outpaced BTC
20 – <40	**Strong BTC underperformance**	Pronounced relative weakness of BTC versus MSCI EM Net TR
< 20	**Severe BTC underperformance**	BTC has lost dramatically relative to MSCI EM Net TR

08 STRUCTURAL FEATURES THE HEADLINE REFLECTS

MSCI Emerging Markets carries structural features that the headline mechanically reflects but that readers should not read as a Bitcoin signal; the benchmark discloses rather than adjusts for them. China is roughly 25–30% of index weight, so moves driven by Chinese regulation, property-market dynamics or capital-control changes are China-specific rather than EM-wide. Korea and Taiwan together are around 30% of weight and are dominated by semiconductor and technology-hardware constituents, so part of the "EM" signal is global tech beta rather than pure emerging-economy exposure. Reconstitution events flow straight into the level — the phased addition of China A-shares (2018–2023), Saudi Arabia inclusion (2019), Argentina removal (2021), Pakistan reclassification (2021) and Russia removal (2022, a one-time mechanical drop of about 3%). In strong-dollar periods MSCI EM USD typically underperforms while BTC's dollar relationship is less consistent, so the headline can rise even when both legs fall in absolute USD terms. Both assets are sensitive to global USD liquidity and are not independent, and their empirical correlation has shifted across regimes — near zero in 2017–2021, strongly positive in 2022–2023 as BTC traded as a long-duration risk asset, and mixed since. The benchmark measures the rebased ratio at every point without assuming the underlying relationship is constant.

09 QUALITY CONTROL AND GOVERNANCE

On every publication the MSCI EM Net TR USD level is cross-checked between Bloomberg (M1EF) and Refinitiv (.MIEF00000PUS), with any discrepancy beyond 0.10% triggering manual review; the series is validated as Net Total Return USD (not Price, Gross or Local Currency); the single Friday alignment and USD denomination of both legs are confirmed; major MSCI reviews are logged with their announced changes and any mechanical level effects; and the series is checked for missing weeks, duplicates and consistent base-date application, with each release appended to an immutable archive carrying source values, computed values and layer.

A weekly headline change of 12% or more forces re-verification of both legs against tier-2 sources before publication, and a single-leg daily change of 8% or more cross-checks that leg against its tier-2 source. For stale prices, two consecutive unchanged MSCI EM closes are flagged, three trigger manual review against MSCI's direct publication, and five exclude the EM leg for that week, after which the substitution chain applies. Large mechanical reconstitution moves (such as Russia's 2022 removal) are noted with the MSCI reference but are not treated as outliers or suppressed.

Revisions and versioning. A material revision is a change of 0.5 index points or more to a published headline, or any methodology change that would have produced such a difference; smaller corrections are archived without public notice. Revisions are triggered by republished MSCI or BRR data, a variant error, a calendar-alignment error, a stale-data violation or an undisclosed source-tier fallback. This is the inaugural publication, Version 1. Any change to the base date, the primary BTC source, the EM index variant or the headline formula is a material methodology change, carrying at least 30 calendar days' public notice, a parallel-published transition of at least four weeks, a versioned changelog entry and a new version number. Non-substantive editorial edits are made without notice but recorded in the archive.

Source and construction conventions follow MSCI's published index methodology and the CF Benchmarks BRR methodology; IOSCO's benchmark principles are treated as a transparency reference, not a compliance claim.

SCOPE, LIMITATIONS AND FAMILY POSITION

This is a single-index macro pair, so it has no internal diversification and relies on one equity reference — there is no equivalent broad EM index with an identical country mix (FTSE Emerging excludes Korea), so single-source resilience risk applies. It is a directional indicator, not a tradable spread: the MSCI EM index is not directly investable, and the headline reflects MSCI's float-adjustment, reconstitution and withholding-tax assumptions, which pass through automatically. Most weekly variance reflects Bitcoin rather than EM; the reference embeds the China concentration and Korea/Taiwan tech tilt described above; the level is mechanically dependent on the fixed, disclosed base date; and the weekly cadence captures intraweek events (FOMC, Chinese macro releases, MSCI announcements) only at the next Friday. Within the BBN macro-pair family this is the global higher-beta equity-risk signal: where BTC/Gold frames Bitcoin against hard money, BTC/Copper against a single cyclical commodity and BTC/10-Year Yield against the U.S. rate environment, BTC/EM frames it against non-U.S., dollar- and liquidity-sensitive equity risk, with a planned BTC/S&P 500 benchmark providing the U.S. large-cap counterpart.