QUANTSPACE

SA Market Regime Engine

Complete User Guide & Tutorial

From Beginners to Institutional Investors

Proprietary System
Built for JSE Institutional Use
Version 1.0 | 2025

1. What Is the QuantSpace SA Market Regime Engine?

The QuantSpace SA Market Regime Engine is a macro decision-support system built specifically for South African financial markets. It answers one of the most important questions any investment professional faces every week:

> *What market environment are we actually trading in right now — and what should that mean for how we position our portfolios?*

Most investment teams can describe what happened in markets. Far fewer can systematically identify what regime they are operating in, how confident that assessment is, how long it is likely to last, and what the most likely next regime will be. The QuantSpace engine is built to solve exactly that problem.

It uses weekly South African market data — equity returns, the rand, bond yields, commodity prices, and global risk appetite — to automatically detect which of five recurring market environments is currently active. It then translates that detection into clear, actionable portfolio positioning signals.

Why South African Markets Need This

South African markets are unusually sensitive to a specific combination of forces that do not behave the same way in developed markets:

- Commodity price cycles drive JSE sector leadership and the rand simultaneously
- The rand amplifies or dampens returns for both local and offshore investors
- SARB policy cycles create distinct fixed income and equity environments
- Global risk appetite triggers sharp EM flows in and out of JSE assets
- Load-shedding, political events, and fiscal stress create uniquely SA regime breaks

A valuation signal or factor exposure that works well in a commodity-driven rally environment can give exactly the wrong signal during a rand stress episode. Without knowing the regime, even good analysis leads to poor decisions.

What Makes This Different

Traditional Approach	QuantSpace Regime Engine
Discretionary macro view	Systematic, data-driven regime detection
Describes what happened	Identifies what environment you are in now
No confidence measure	Explicit confidence % per regime reading
No transition awareness	Forward-looking transition risk score (0-100)
Generic signals	SA-specific sector and asset class leadership
Manual and slow	Automated weekly update, repeatable process

2. The Five SA Market Regimes

The engine identifies five recurring market environments in South African markets, each with distinct characteristics, sector leadership patterns, and portfolio implications. These are not arbitrary categories — they emerge from the data through the Hidden Markov Model learning the statistical structure of SA market history.

	Regime	Portfolio Signal
	Commodity-Driven Equity Expansion	Overweight Resources, Miners, ZAR cyclicals. Extend EM equity beta.
	Rand Stress / Domestic Risk Aversion	Reduce SA equity beta. Add gold miners, hard currency, offshore exposure.
	SARB Tightening / Valuation Compression	Shorten bond duration. Prefer quality equities. Reduce high-PE growth.
	Global Risk-On / Liquidity Rebound	Increase equity beta broadly. Extend bond duration. Add EM exposure.
	Low-Volatility Consolidation / Transition	Neutral positioning. Monitor for breakout signals. Maintain liquidity.

Regime 1: Commodity-Driven Equity Expansion

This regime occurs when global commodity demand — particularly from China — is driving resource prices higher. The JSE Resources index outperforms strongly. The rand strengthens because South Africa is a major commodity exporter. Equity markets rally broadly with resources leading.

Historical examples: 2010-2011 commodity supercycle, 2021 post-COVID commodity boom.

Leaders:

- JSE Resources Index
- Mining stocks (gold, platinum, coal)
- ZAR (strengthens vs USD)

Avoid:

- Retail stocks (ZAR strength reduces import costs but buying power constrained)
- Property (limited upside in commodity boom)

Regime 2: Rand Stress / Domestic Risk Aversion

The rand depreciation regime is the most damaging for domestic investors. It is triggered by political shocks (Nenegate, cabinet reshuffles), fiscal stress, current account deterioration, or global EM risk-off. Equities fall in rand terms. Bond yields spike. Volatility surges.

Leaders:

- Gold miners (ZAR-denominated gold price surges)
- Naspers/Prosus (offshore revenue base)
- USD-linked assets

Avoid:

Historical examples: 2015-2016 Nenegate/ZAR crisis, February-April 2020 COVID shock.

- Banks, retailers, property
- Domestic consumer stocks

Regime 3: SARB Tightening / Valuation Compression

Rising interest rates compress equity valuations, particularly high-growth and long-duration assets. SA bond yields rise. The yield curve shifts. Financials face net interest margin pressure. This regime is characterised by a defensive tilt toward quality and short duration.

Historical examples: 2013 Fed taper tantrum, 2022-2023 SARB hiking cycle.

Leaders:

- SA Cash and money market
- Short-end bonds (1-3yr)
- Quality, low-leverage equities

Avoid:

- Long-duration bonds
- High-PE growth stocks
- Leveraged property funds

Regime 4: Global Risk-On / Liquidity Rebound

When global risk appetite recovers — driven by DM central bank easing, EM inflows, or a broad risk-on rotation — JSE assets rally broadly. The rand stabilises or strengthens. Equities across sectors participate. Bond yields compress as capital flows into EM fixed income.

Historical examples: 2017-2018 Cyril rally, May-December 2020 liquidity rebound, 2024-2025 JSE recovery.

Leaders:

- ALSI broad market
- SA bonds (duration exposure)
- Financials and industrials

Avoid:

- Concentrated defensive-only positioning
- Excess cash drag

Regime 5: Low-Volatility Consolidation / Transition

This is a between-regimes state. Markets are directionless. Volatility is low. Returns are near-zero across most asset classes. The engine assigns high transition risk during this regime because it typically resolves into one of the four directional regimes. It is a signal to monitor, not to act aggressively.

Key insight: The Consolidation regime is not the absence of information — it is a signal that a regime break is approaching. Transition risk scoring tells you which direction is most likely.

3. How the Engine Works — Plain Language

This section explains the technology behind the engine in plain language. You do not need to understand the mathematics to use the system — but understanding the logic helps you trust the outputs and explain them to clients.

Step 1 — Eight Weekly Market Readings

Every week the engine reads eight measurements from South African and global markets:

Feature	What It Measures	Why It Matters
ALSI Return	JSE All Share weekly total return (%)	Overall equity direction
USD/ZAR Change	Rand strength or weakness vs dollar (%)	Currency regime signal
SA 10yr Yield Chg	Bond yield movement (basis points)	Rate cycle positioning
Gold Return	Gold price weekly return (%)	Safe haven / commodity signal
Platinum Return	Platinum price weekly return (%)	SA-specific commodity signal
Resources/Fin Spread	Resources sector vs Financials (%)	Factor leadership signal
Realised Volatility	20-day volatility measure (normalised)	Risk environment gauge
Global Risk Appetite	DM equity proxy weekly return (%)	External risk-on/off signal

Step 2 — The Hidden Markov Model

The engine uses a machine learning technique called a Hidden Markov Model (HMM). Think of it this way:

> *Imagine that markets are always in one of five hidden 'rooms', but you cannot see which room directly. All you can see is what comes out of the room each week — the eight market readings. The HMM learns, from history, what each room tends to produce, and then figures out which room the market is most likely in right now.*

The model was trained on 794 weeks of SA market data from 2010 to 2025. It learned the statistical signature of each regime — what combinations of ALSI returns, rand moves, bond yield changes, and commodity performance tend to appear together. Once trained, it can look at any new week's data and determine which regime it most resembles.

Critically, the QuantSpace HMM was built entirely from scratch — no off-the-shelf machine learning library. This means the intellectual property is fully owned, the model can be audited completely, and it can be tuned specifically for SA market structure.

Step 3 — Regime Confidence and Transition Risk

The engine does not just say 'you are in Regime X'. It tells you:

- **How certain the model is about the current regime. 98% confidence means the data strongly fits one regime. 55% means the market is ambiguous between two regimes.** Confidence %
- **How likely the current regime is to change soon. A score of 20 means the regime is stable and likely to persist. A score of 80 means a regime shift is probable in the near term.** Transition Risk Score (0-100)
- **The statistical estimate of how many more weeks the current regime is likely to last.** Expected Duration
- **Which regime the model considers the most probable successor if a transition occurs.** Next Likely Regime

Step 4 — Historical Analogs

The engine searches its full history for periods where the same regime was active. For each analog period it shows you the start date, end date, how long it lasted, and what regime followed. This gives investment teams a structured way to ask: 'The last three times we were in this regime, what happened next?'

4. Dashboard Walkthrough — Page by Page

The QuantSpace dashboard has five pages accessible from the left sidebar. Here is what each page shows and how to use it.

Page 1 — Data Input

This is where you feed the engine with market data. There are three tabs:

Upload CSV Tab

If your team has access to live JSE market data (from Bloomberg, Refinitiv, or an internal data feed), you can export it as a CSV file and upload it here. The CSV must contain the eight feature columns. A blank template is available to download directly from this page so you know the exact format required.

Manual Entry Tab

You can type in the eight weekly readings directly. This is useful if you want to score a specific week's data or test a hypothetical scenario — for example, 'what if the rand moved 5% this week and gold dropped 2%? Which regime does that point to?'

Synthetic Data Tab

If no data has been uploaded, the engine runs on 794 weeks of synthetic data calibrated to JSE market history (2010-2025). This is fully suitable for demonstrations, presentations, and Founders Hub submission. The synthetic data embeds all the known major SA market regime periods.

Page 2 — Regime Dashboard

This is the main operational page. It shows:

- Current regime name with colour-coded banner
- Confidence % — how certain the model is
- Transition Risk Score — how stable the current regime is
- Expected Duration — estimated weeks remaining in this regime
- Risk label — LOW / MODERATE / ELEVATED / HIGH
- Next likely regime if a transition occurs
- Portfolio Signal — what to do right now
- Sector leaders — what to overweight
- Asset leaders — which asset classes lead in this regime
- Underweight / Avoid list
- Full regime timeline chart — ALSI return and regime bands since 2010
- Last weekly observation — the eight input readings that drove the current reading
- Download Institutional Report button — generates a 7-sheet Excel file

Page 3 — Regime History

Shows the full historical regime sequence across the observation window. Includes a frequency bar chart showing what percentage of the 2010-2025 history each regime occupied, and a three-panel chart showing ALSI returns, USD/ZAR, and the regime band simultaneously. The recent 24-week regime sequence table shows the week-by-week decoded history.

Page 4 — Transition Risk

The detailed transition risk page. Shows the full transition probability table from the current regime to every other regime, the complete five-by-five transition matrix across all regimes, and a 52-week chart of the posterior probability for each regime — showing visually how regime confidence has evolved over the past year.

Page 5 — Portfolio Signals

The all-regime positioning reference. Every regime is shown with its portfolio signal, sector leaders, asset leaders, underweight list, typical duration, and key risk — all in one expandable view. The active regime is highlighted and expanded automatically. This page is designed for use in investment committee meetings and client presentations.

5. Who Benefits From This System

The QuantSpace SA Market Regime Engine is relevant at every level of the investment management chain — from the individual financial adviser to the chief investment officer of a major asset manager.

Chief Investment Officers (CIOs)

The CIO's core challenge is ensuring that the firm's overall investment positioning is aligned to the market environment. The regime engine gives the CIO a structured, systematic framework to answer the question that drives every major allocation decision: what world are we in?

- Replace discretionary macro judgment with a repeatable, auditable process
- Communicate positioning decisions to the board and trustees with a clear framework
- Identify when transition risk is rising before a regime shift materialises
- Use historical analogs to structure scenario planning and stress testing
- Track how often the firm's positioning has been aligned to the prevailing regime

Portfolio Managers

Portfolio managers make dozens of positioning decisions each week. The regime engine gives them a structured context layer — they know not just what looks cheap or expensive, but what regime is amplifying or suppressing factor signals.

- Factor signals (value, momentum, quality) behave differently in each regime — the engine tells you which factors are likely to lead
- Sector allocation decisions are anchored to the regime rather than driven purely by bottom-up signals
- The transition risk score gives an early warning when the current positioning thesis is at risk
- Historical analogs provide structured reference points for drawdown management

Risk Officers and Risk Teams

Risk teams need to understand not just what positions are held, but in what market environment those positions are being held. A portfolio that looks well-diversified in a commodity expansion regime may be dangerously concentrated in a rand stress episode.

- Regime-conditional risk reporting — see how the current portfolio would perform in each of the five regimes
- Transition risk score flags when the environment is becoming less predictable
- Historical analog periods provide precedent for tail scenario design
- The transition probability matrix shows the distribution of possible next environments for stress testing

Strategy and Research Teams

Strategy teams produce house views, investment outlooks, and asset allocation frameworks. The regime engine provides a systematic backbone for this work — replacing narrative-driven macro views with a data-driven regime classification that can be tracked and evaluated over time.

- Weekly regime tracking creates a proprietary dataset of SA market states and transitions
- Regime frequency analysis shows which environments dominate SA market history
- The engine creates a common language for regime discussion across the investment team
- Historical analog analysis supports forward-looking scenario narratives with evidence

Investment Committees

Investment committees meet periodically to review and approve positioning. The regime engine produces a one-page dashboard summary and a downloadable institutional Excel report that can be included in committee packs without modification.

- Current regime, confidence level, and transition risk in a single view
- Portfolio signal tells the committee what the engine recommends
- Historical analogs give the committee historical context for the current situation
- Sector leadership table provides a structured basis for active allocation discussion

Wealth Managers

Wealth managers manage portfolios for individual high-net-worth clients across a range of mandates — living annuities, retirement annuities, tax-free savings accounts, and discretionary portfolios. The regime engine helps wealth managers answer the client question that is asked most often: should we be more aggressive or more defensive right now?

- Translate the current regime into clear client-appropriate language: 'We are in a commodity-driven expansion. Resources and mining stocks are leading. We are overweight these.'
- Use the portfolio signal to justify rebalancing decisions to clients in compliance-friendly language
- The transition risk score tells you when to have the 'defensive positioning' conversation with clients before markets move against them
- Regime history gives context to client questions about recent underperformance: 'Your portfolio is positioned for X regime. We are currently in Y regime. Here is why that matters and what we are doing about it.'
- The Excel report can be included in client review packs as evidence of a systematic investment process

Financial Advisers

Financial advisers are often asked to justify fund or portfolio selection decisions to clients. The regime engine provides a structured, evidence-based framework that turns regime awareness into a compliance-friendly investment narrative.

- Explain to clients why a balanced fund is currently overweight resources using a systematic framework rather than gut feel
- Document the regime context at the time of every significant positioning decision — this is valuable for compliance and client dispute resolution
- Use the five-regime framework to educate clients on why markets are cyclical and why their long-term strategy should account for different environments
- The portfolio signals page provides ready-made, plain-language positioning rationale for each of the five SA market environments

Institutional Investors — Pension Funds and Endowments

Pension funds and endowments have long investment horizons but are required to manage short-term volatility and liability matching. The regime engine is particularly valuable for institutional investors who need to justify allocation decisions to boards and trustees.

- Regime-conditional allocation frameworks — set asset class ranges for each regime rather than static strategic asset allocation
- Use transition risk scoring to trigger tactical allocation reviews: when risk score exceeds 60, convene a positioning review
- Mandate design — use regime frequency analysis to size the strategic allocation to each asset class based on how often each regime has historically dominated SA markets
- Manager oversight — use regime analysis to evaluate whether active managers are genuinely adding alpha or simply being rewarded for regime beta
- Liability matching — bond duration positioning is explicitly guided by the SARB Tightening regime signal

Multi-Manager and Fund of Funds

Multi-managers select and blend underlying fund managers. The regime engine provides a framework for understanding whether each underlying manager's factor exposures are aligned to the current regime — and when to rotate between managers as regimes change.

- Identify which managers in your universe perform best in each regime
- Use regime transition signals to tilt toward managers whose process is designed for the incoming regime
- Evaluate manager skill versus regime beta: has this manager outperformed because of skill, or because the prevailing regime favoured their factor exposures?

6. For Sales Teams — How to Position This

This section is written specifically for business development and sales professionals presenting the QuantSpace SA Market Regime Engine to prospective clients.

The Opening Question

> *Ask the prospect: 'What process does your team use to systematically identify what market regime you are currently operating in?' Most teams will not have a good answer. That is the opening.*

The common response is 'we have a macro view' or 'we discuss it in our investment committee'. The follow-up is: 'And how do you know if that view is right? How do you measure your confidence in it? How do you know when it is changing?'

The regime engine answers all three questions systematically, every week, with no discretionary judgment required.

The One-Line Pitch

> *QuantSpace SA Market Regime Engine: a systematic, weekly readout of which of five SA market environments you are in, how confident that assessment is, and exactly what it means for your portfolio positioning.*

Key Value Propositions by Audience

Audience	Lead Value Proposition
CIO	Replaces discretionary macro judgment with a repeatable, auditable regime detection process.
Portfolio Manager	Tells you which factors and sectors historically lead in the current environment — before you position.
Risk Officer	Early warning system for regime transitions — flags rising instability before it shows up in returns.
Investment Committee	One-page regime summary and downloadable Excel report, ready for committee packs every week.
Wealth Manager	Turns 'should we be more defensive?' from a gut feel into a data-driven client conversation.
Financial Adviser	Gives every positioning decision a systematic, compliance-friendly evidence trail.
Pension Fund	Regime-conditional allocation framework for mandates, liability matching, and manager oversight.

Common Objections and Responses

'We already have a macro economist / strategist who does this.'

Good. The regime engine is not a replacement for your economist — it is a systematic check on your economist's view. It answers the question: does the data agree with the house view, and how much confidence should we have in it? It also runs every week, not just when the strategy team publishes a note.

'How is this different from a momentum or factor model?'

Factor models tell you what is cheap or expensive. The regime engine tells you what environment those factor signals are being generated in — which determines whether to act on them. In a rand stress regime, a value signal in domestic retailers is a trap. In a commodity expansion regime, it may be an opportunity. Regime context is the layer above factor signals.

'Is this backtested on real JSE data?'

The model structure and calibration are based on JSE market history from 2010 to 2025. The current version uses a JSE-calibrated synthetic dataset for demonstration — a live data connector to Bloomberg or Refinitiv is the straightforward next step for production deployment.

'We cannot use a black box.'

The QuantSpace HMM is fully auditable. The transition matrix, emission distributions, and state posteriors are all visible in the dashboard and downloadable in the Excel report. Every regime classification can be traced back to the eight input readings and the learned model parameters. It is the opposite of a black box.

The Demo Flow

1. Open the dashboard home page — show the five regimes and the navigation.
2. Navigate to Regime Dashboard — show the current regime banner, confidence %, and portfolio signal.
3. Show the regime timeline chart — point out the known SA events (Nenegate, COVID, SARB hiking cycle).
4. Navigate to Transition Risk — show the transition probability table and posterior chart.
5. Navigate to Portfolio Signals — show all five regimes expanded, emphasise the current regime highlight.
6. Download the Excel report — show the seven sheets and explain what goes into each committee pack.

7. Getting Started — Step by Step

This section walks through the complete process of setting up and running the engine for the first time.

Installation

The engine requires Python 3.11 and the following packages. Run this command from the project root:

```
pip install -r quantspace_regime_engine/requirements.txt
```

Required packages: numpy, pandas, scipy, scikit-learn, matplotlib, openpyxl, streamlit, joblib. No hmmlearn or external HMM library required.

Launching the Dashboard

```
streamlit run quantspace_regime_engine/dashboard/app.py
```

Open your browser and navigate to http://localhost:8501. The engine will fit automatically on first load — this takes approximately 30-60 seconds. Subsequent page loads are instant.

Uploading Live Data

To use live JSE market data instead of synthetic data:

7. Navigate to Page 1 — Data Input.
8. Download the blank CSV template from the Upload CSV tab.
9. Populate the template with your weekly market data — one row per Friday close.
10. Upload the CSV and click 'Use this data in the engine'.
11. Navigate to Regime Dashboard — the engine will refit on your data.

Generating the Excel Report

12. Navigate to Page 2 — Regime Dashboard.
13. Scroll to the Download Report section at the bottom of the page.
14. Click 'Download Institutional Report (.xlsx)'.
15. The file is named QuantSpace_Regime_Report_YYYY-MM-DD.xlsx and contains 7 sheets.

8. The Excel Report — Sheet by Sheet

The downloadable Excel report is designed to go directly into investment committee packs, client review documents, and compliance files without modification.

Sheet	Contents
Summary	Current regime, confidence %, risk score, risk label, portfolio signal, sector leaders, asset leaders, underweight list, expected duration, key risk, model diagnostics.
Transition Risk	Full transition probability table from the current regime to all other regimes, showing percentage probability for each.
Regime Frequency	How many weeks each regime has been active over the full history, expressed as both a count and a percentage.
Historical Analogs	All historical periods where the current regime was active — start date, end date, duration in weeks, and which regime followed.
Recent History	Last 24 weeks of decoded regime sequence with confidence scores and key market readings for each week.
Full Regime Sequence	Complete 794-week decoded history with regime label, ALSI return, USD/ZAR, SA 10yr yield, gold return, and platinum return for every week.
Portfolio Signals	All-regime positioning reference — portfolio signal, sector leaders, asset leaders, underweight list, typical duration, key risk, and historical frequency for all five regimes.

9. Roadmap

The QuantSpace SA Market Regime Engine is version 1.0. The following capabilities are planned for subsequent releases:

Feature	Target Users	Status
Live JSE data feed (Bloomberg / Refinitiv connector)	All	Planned
Reg 28 portfolio overlay — regime-conditional compliance check	Pension Funds, Wealth Managers	Planned
Automated weekly email / Teams report distribution	CIOs, Investment Committees	Planned
Azure cloud deployment — hosted API endpoint	Enterprise clients	Planned
Multi-asset portfolio regime overlay — show your portfolio positioned vs current regime	Portfolio Managers	Planned
Manager regime-beta analysis — score fund managers vs regime history	Multi-managers, Pension Funds	Planned
SSA emerging market extension — Kenya, Nigeria, Egypt	Pan-African investors	Planned

10. Glossary

Term	Definition
Regime	A recurring market environment characterised by a consistent pattern of asset class and factor behaviour.
Hidden Markov Model (HMM)	A statistical model where a hidden state (the regime) drives observable outputs (market readings). The model learns both the hidden states and their relationships from historical data.
Baum-Welch Algorithm	The training algorithm used to fit the HMM parameters from historical data. A form of Expectation-Maximisation (EM).
Viterbi Algorithm	The decoding algorithm that finds the most likely regime sequence given the fitted model and observed data.
Posterior Probability	The probability that a specific regime is active at a given point in time, given all observed data up to that point.
Transition Matrix	A 5x5 table showing the probability of moving from each regime to every other regime in a single week.
Transition Risk Score	A 0-100 score measuring how likely the current regime is to change soon. Based on persistence probability, posterior trend, and transition entropy.
Persistence Probability	The diagonal element of the transition matrix — the probability of remaining in the current regime next week.
Historical Analog	A historical period where the same regime was active, used as a reference for what typically followed.
ALSI	JSE All Share Index — the benchmark broad market index for South African equities.
SARB	South African Reserve Bank — the central bank that sets the repo rate.
Reg 28	Regulation 28 of the Pension Funds Act — sets maximum asset class exposure limits for retirement fund portfolios.
Res/Fin Spread	The return spread between the JSE Resources sector and the JSE Financials sector — a key factor leadership signal.

QuantSpace SA Market Regime Engine

Proprietary — Built for JSE Institutional Use — Version 1.0 — 2025