FOR MODEL-VALIDATION TEAMS

# Numerical validation.

*This note summarises the automated numerical-validation evidence behind the Bellman DSGE solver stack. It is written for the reader who would otherwise interrogate the test suite directly. Full methodology is in the Engine SOP.*

## Solver core — validated against closed-form solutions

The platform implements two canonical linear rational-expectations solvers, each tested against analytic solutions with closed-form answers:

| COMPONENT | METHOD | VALIDATION |
|---|---|---|
| QZ solver | Klein (2000) generalized Schur | Matches closed-form NK stable manifold to **1e-8**; recovers the correct generalized eigenvalues ($\rho$, $1/\beta$). |
| Gensys solver | Sims (2002) with $\eta$ expectational errors | Phillips + AR(1) IRF matches closed form to **1e-6**; impact and trajectory verified. |
| Module pipeline | Declarative composition → canonical form → gensys | Closed-economy NK monetary & demand shocks reproduce textbook signs and AR(1) decay (Galí, 2008, ch. 3). |

## Fails loudly, never silently

The solvers are engineered to **report** ill-posed configurations rather than return plausible-looking but wrong numbers. The test suite explicitly verifies that:

- a system with more unstable roots than jump variables returns `noStableSolution` (with the eigenvalue counts);
- a passive Taylor rule ($\phi_\pi < 1$) is reported as **indeterminate**, not solved;
- too few expectational errors to absorb the unstable subspace is reported, not silenced.

## What v1's live dashboard computes today — and the honest caveat

The validated QZ/gensys engine above is the platform's solver foundation. The v1 production dashboard additionally uses a reduced-form recursive simulator for the shipping small-open-economy model, with calibrated proxies for theoretical moments, variance decomposition, and fan-chart band widths. The **Engine SOP** documents exactly which figures are analytically exact and which are approximations, in full, with source references.

> **Disclosure is the feature.** Bellman DSGE ships its limitations in writing. If a precise quantity is load-bearing for a published conclusion, re-derive it in a full state-space solver and cite both — the platform's v1 strength is speed of exploration with honest provenance.

*Test files:* `QZSolverTests`, `SimsSolverTests`, `LinearDsgeSystemTests`, `ModulePipelineTests`, `ParameterValidatorTests`. *Methodology: Engine SOP chapters 02–05.*