



Engineering and Business Solutions

Climate Risk Modelling

Made Practical for Macroeconomic Decision Making



Agenda

Introduction to Opti-Num Solutions

MATLAB uses in Financial Services

Incorporating Climate Risk Modelling

DEMO: Using the IMF DIGNAD Model

How We Can Support You

QnA



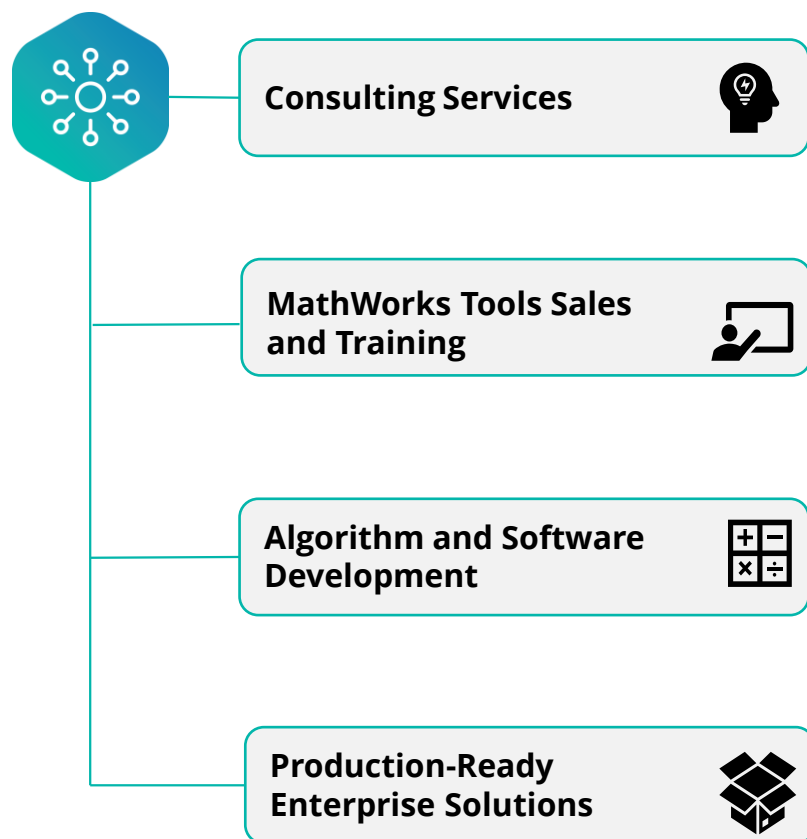
Opti-Num Solutions is a high-tech consulting and engineering firm specialising
Artificial Intelligence, Model Operations, and Simulation Engineering.

- Trusted MathWorks partner since 1992
- Original developers of MathWorks' Industrial Communication Toolbox
- Successfully delivered more than 250 projects locally and internationally
- Skilled consulting team of 30+ engineers and developers

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Offerings & Industries Served

At Opti-Num Solutions, we are passionate about partnering with our clients to tackle complex business challenges and provide data-driven, evidence-based solutions. Our enthusiasm for interesting challenges has given us a broad range of exposure to many different industries and industry leading clients.



Aerospace & Defence



Renewable Energy



Manufacturing



Mining



Automotive



Banking & Financial Services



Healthcare/
Medical Devices



Research & Teaching



Telecommunications



Key Uses of MATLAB in Banking/Finance

Central Banks & Regulators

- Macroeconomic forecasting
- Stress testing & scenario analysis for financial stability
- System risk modeling and contagion analysis

Asset Managers, Hedge Funds & Proprietary Trading

- Portfolio Optimisation and Asset Allocation
- Risk modeling and Monte Carlo simulations
- Algorithmic trading and quantitative strategies

Commercial Banks

- Credit risk modeling and default probability
- Balance sheet stress testing
- Consumer finance models – loan pricing & capital allocation

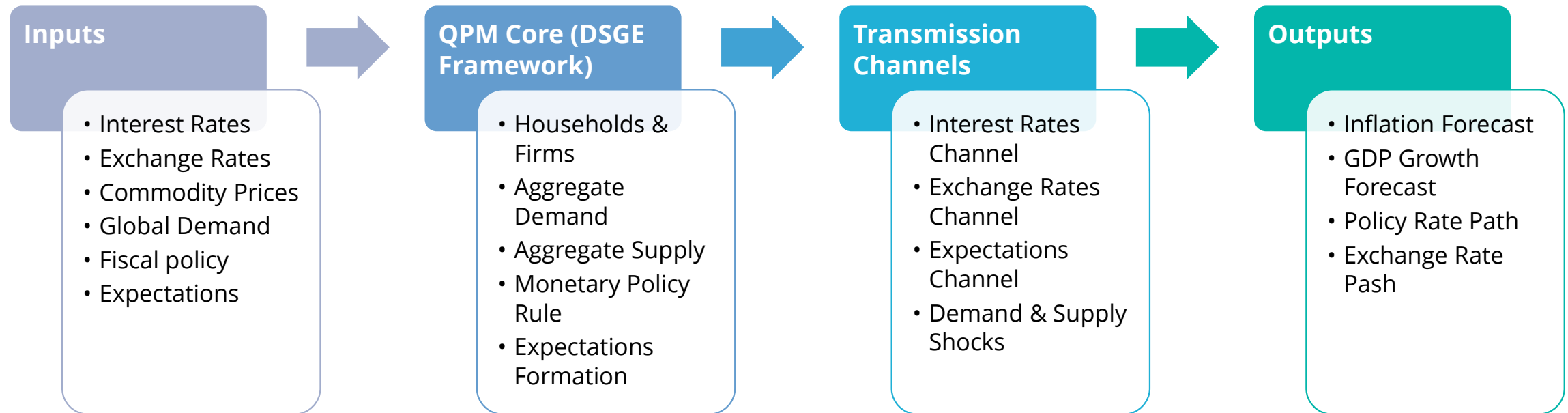
Investment Banks

- Valuation models
- Option pricing and derivative modeling
- Market risk (VaR) and high frequency trading

Insurance & Re-insurers

- Actuarial risk modeling
- Catastrophe modeling for natural disasters
- Solvency capital modeling

Quarterly Projection Model (QPM)



Uses of QPM:

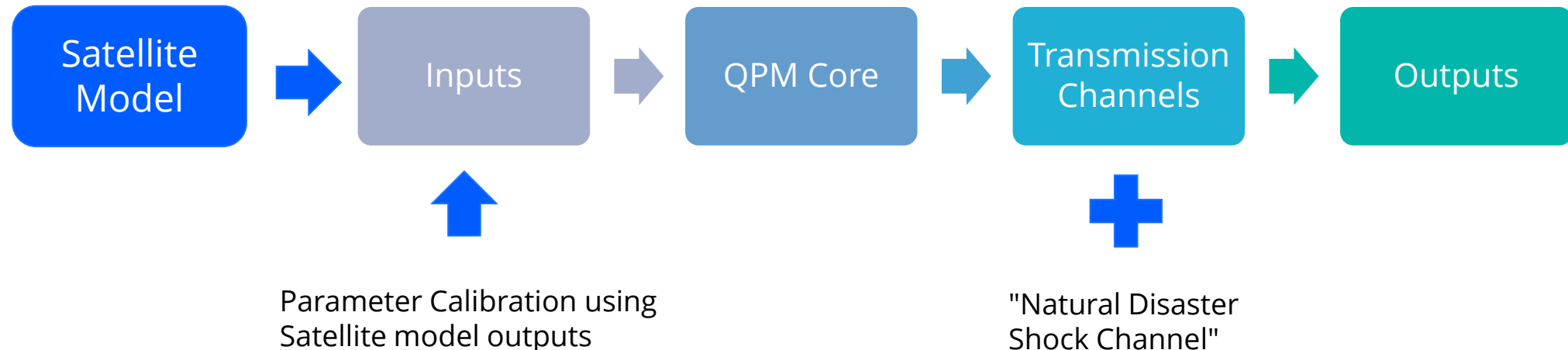
- Produce baseline forecasts (e.g., GDP, Inflation, Interest Rates, Exchange Rates).
- Conduct scenario analysis and policy simulations (e.g., oil price shocks, fiscal stimulus)
- Support Monetary Policy or Inflation Reports



Incorporating Satellite Models - Climate Risk Modelling

Central banks & policy makers, especially in emerging markets, could integrate satellite-style modules or insights into their **core macroeconomic frameworks** to better capture the **macroeconomic and financial implications of specific shocks**.

Feed the resulting macro paths (output, inflation, debt, aid inflows) as scenario inputs into the QPM

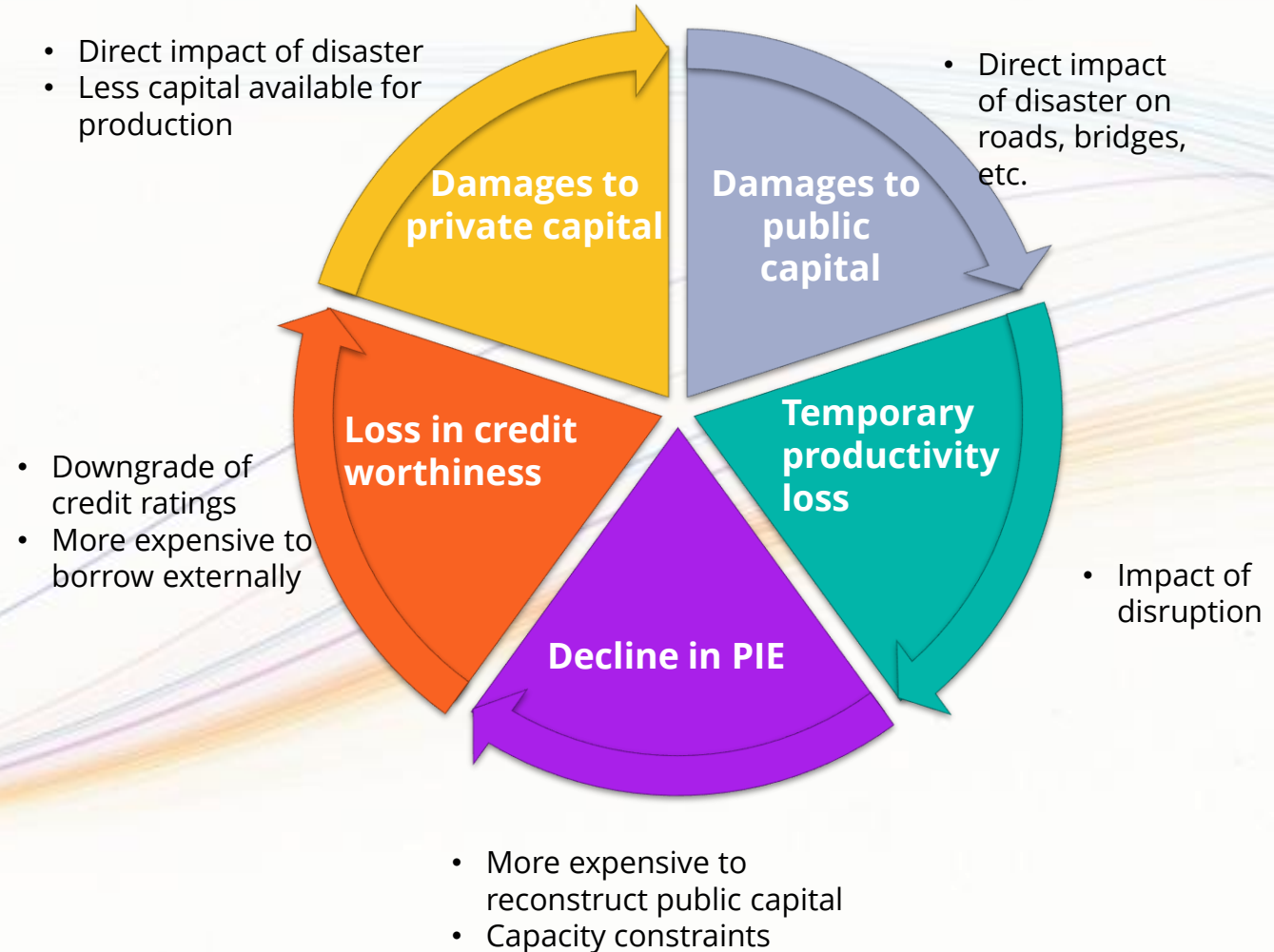


A Brief Overview of DIGNAD



- **Debt-Investment-Growth-Natural-Disasters**
- Extension of the DIG model
- Used to simulate the effect of one-off climate induced disasters
- Evaluates **macroeconomic dynamics** of key variables (GDP, debt, fiscal deficit, public and private investment, etc.) under alternative scenarios
- DIGNAD is a DGE model suitable for EMDEs
- Developed by the IMF

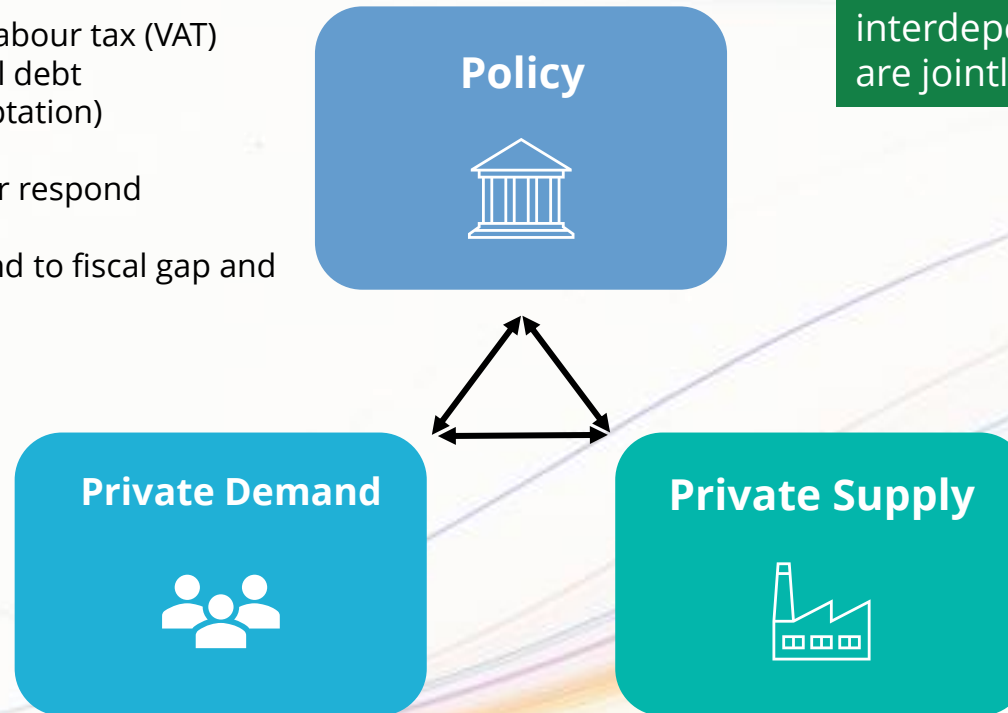
How natural disasters affect the economy



The DIGNAD Model Structure: **General Equilibrium**

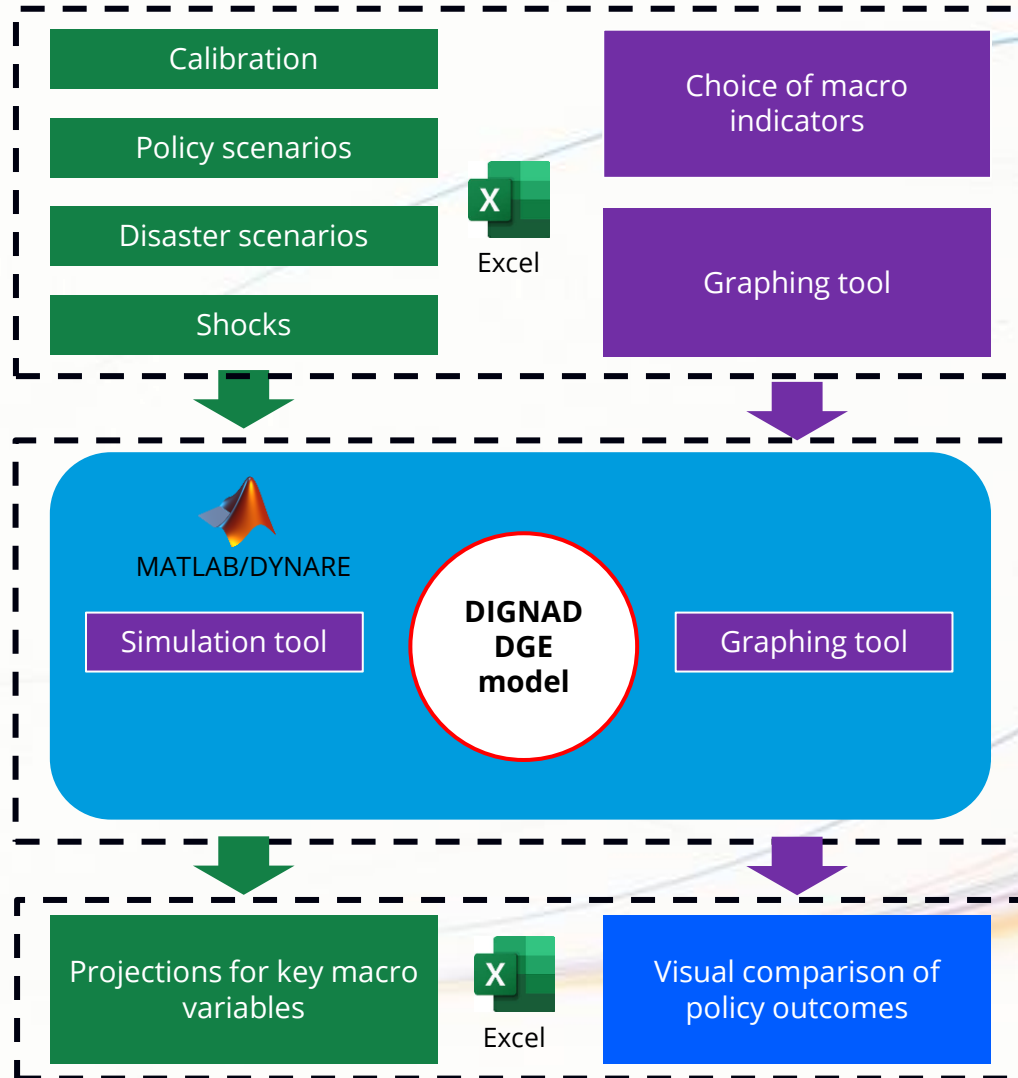
- **Fiscal instruments:** Consumption & labour tax (VAT)
- **Debt instruments:** Domestic/External debt
- **Public Infrastructure** (Standard/Adaptation)
- **Other:** Donor grants
- Policy instruments can be *exogenous* or respond *endogenously* to fiscal gap
- Fiscal rule: taxes endogenously respond to fiscal gap and debt deviations

- **Households:** Savers, Non-savers
- Earn labor income and domestic transfers
- Consume domestic and foreign goods
- Savers choose where to invest



- **Firm Sectors:** Tradable, Non-tradable
- Firm production requires inputs:
 - Labour
 - Private Capital
 - Public Infrastructure (Standard, Adaptation)

The DIGNAD Toolkit



- Consider a hypothetical once-in-a-100 years devastating flood destroying 10% of Rwanda's capital stock.
- What might be the impact of investing in ex-ante adaptation on output growth and public debt?

Scenario 1: Baseline

- No adaptation infrastructure
- A natural disaster hits in 5 years

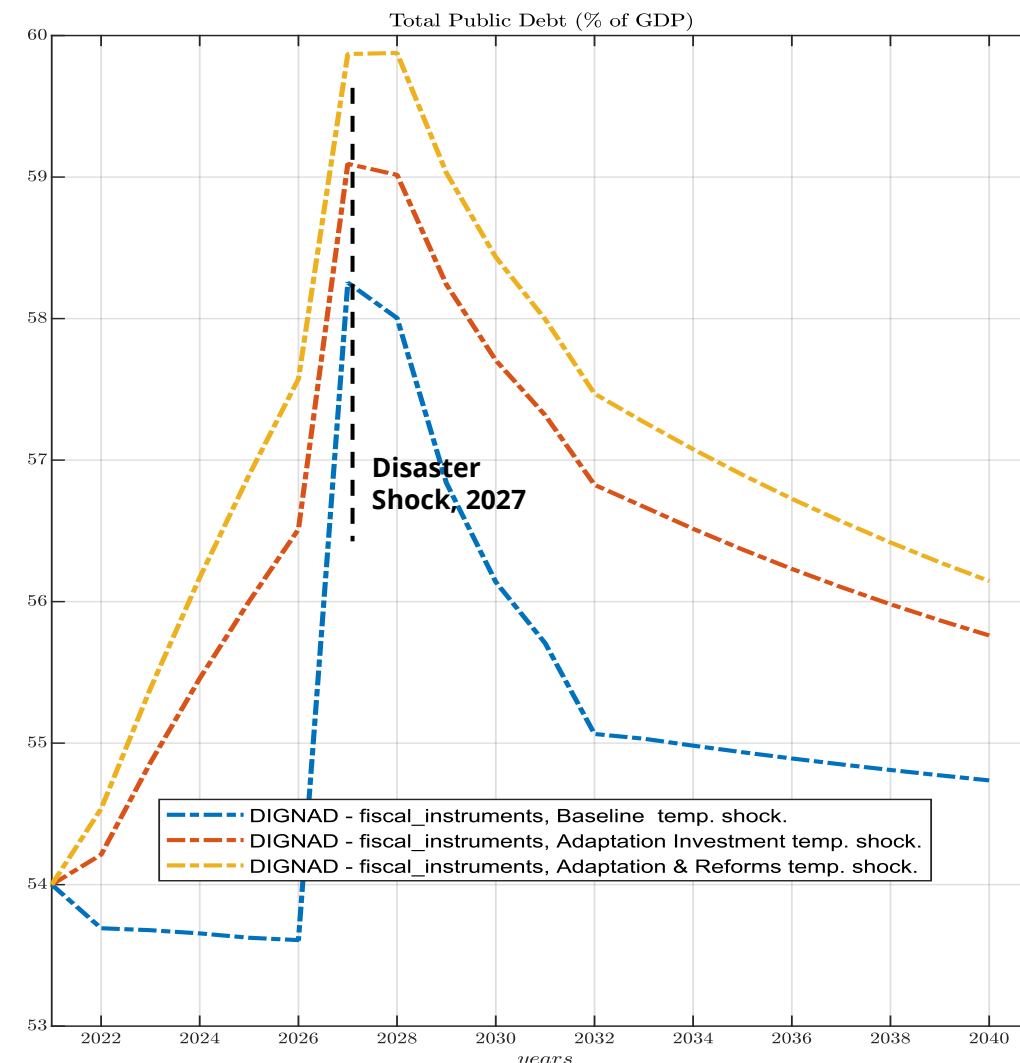
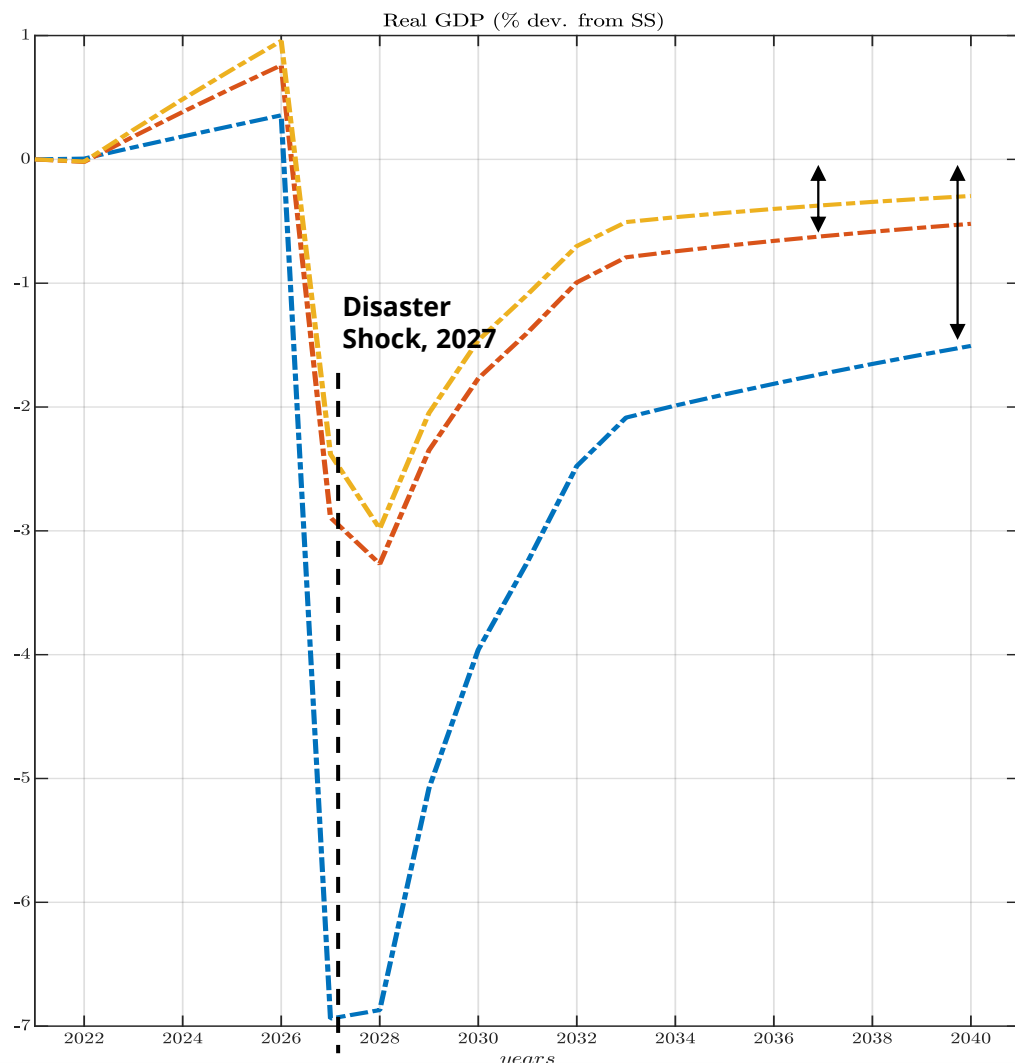
Scenario 2: Adaptation Investment

- Investment in resilient infrastructure
- Budget envelope of 1.5% of GDP/year
- Private financing and concessional borrowing for 5 consecutive years

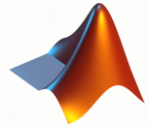
Scenario 3: Adaptation & Reforms

- Investment in resilient infrastructure
- Climate reforms: PIMA, green PFM, 20% increase in PIE
- Catalysed green financing from Private Sector & DPs and further 1.5% of GDP

Policy Lessons from DIGNAD Simulations



How We Can Support You



MATLAB can be used to:

- Build apps/webapps and tools to pre-process and visualise data
- Fit, simulate, and forecast complex macroeconomic scenarios using univariate and multivariate econometric models
- Model and manage stress tests and prudential requirements, and maintain orderly markets using machine learning
- Scale, compute, and store data securely in the cloud and integrate with your organisation's enterprise technology infrastructure

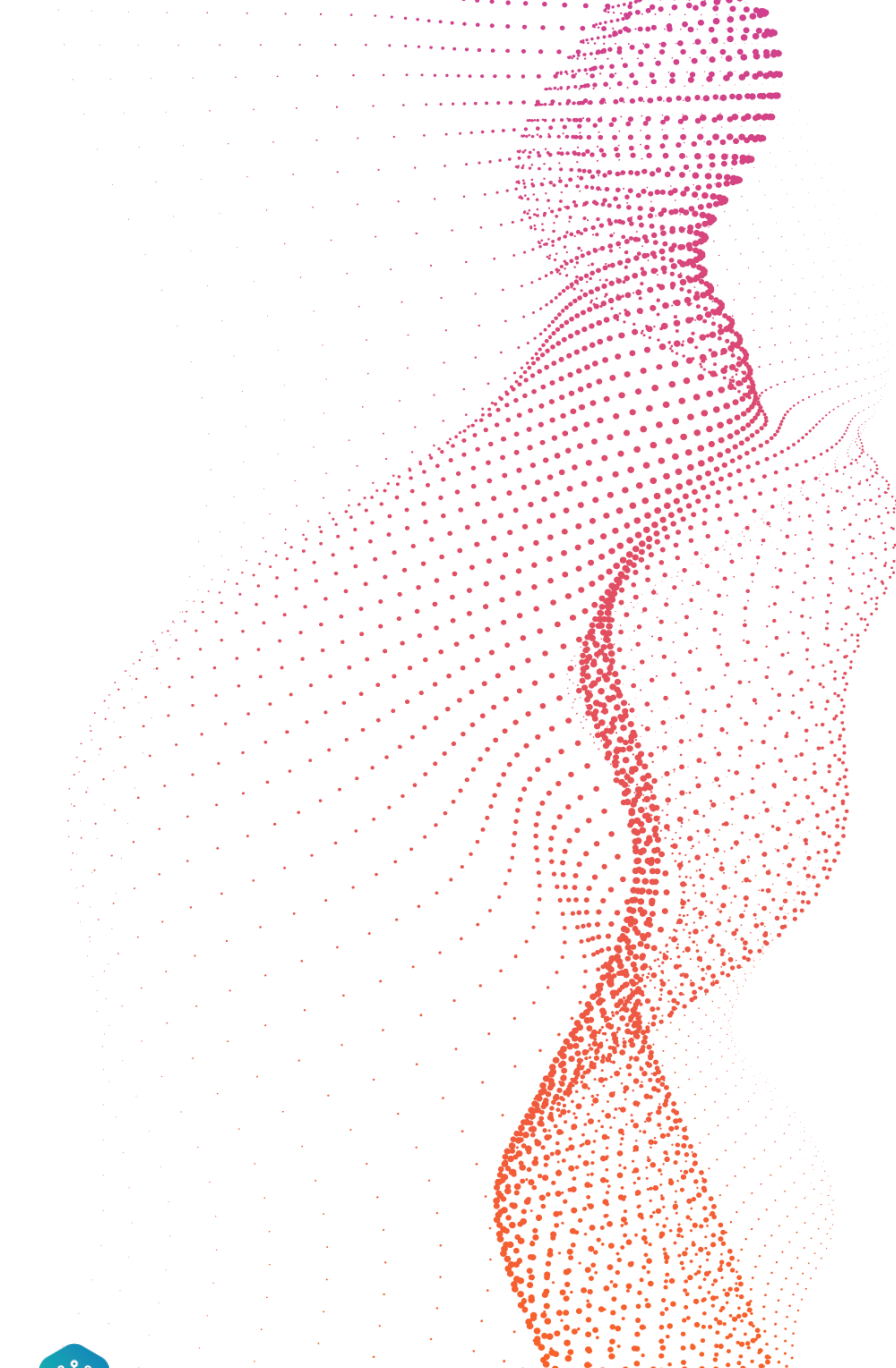


Opti-Num can help you with:

- Technical support, onsite or in-person training, and expert consultant services

Key Products:

- Statistics & Machine Learning Toolbox
- Optimisation Toolbox
- Econometrics Toolbox
- Financial Toolbox
- Parallel Computing Toolbox
- Database Toolbox
- MATLAB Compiler
- Etc.



Let's get started.

► Contact us to start building solutions.

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