Monetary-fiscal coordination in South Africa: Aligning the stars

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Monetary-fiscal policy tensions build-up when debt is rising and inflation is falling. The consequence is that either fiscal policy must achieve fiscal consolidation with monetary policy maintaining price stability (passive FP−active MP) or monetary policy must accommodate fiscal policy in debt stabilisation leaving fiscal policy free to achieve its spending and redistribution objectives (passive MP−active FP). We introduce the concept of a fiscal neutral rate (*fiscal r-star*) into a two-agent new Keynesian dynamic stochastic general equilibrium model estimated with South African data. We show two persistent gaps: (i) monetary r-star exceeds fiscal r-star, indicating a misalignment between monetary and fiscal policy; and (ii) market interest rates exceed fiscal r-star, implying that, without policy action, the risk premium on borrowing will continue to be a drag on growth and debt service costs are likely to crowd out other spending. Our model simulations show that the optimal welfare outcomes are achieved by taking steps to align fiscal r-star with monetary r-star, through introducing a credible fiscal anchor.

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1 Introduction

In South Africa, the recent reduction of the inflation target has focused attention on the fiscal implications of monetary policy. The local literature on fiscal-monetary policy is, however, relatively sparse, particularly in the context of rising debt and falling inflation.[1] To address this gap, we introduce a new analytical concept, the fiscal-neutral interest rate—dubbed "fiscal r-star" by Bolhuis et al. (2024)—into an estimated DSGE model for South Africa. This approach allows us to establish how monetary-fiscal tensions arise and potentially lead to fiscal dominance regimes; we then investigate both desirable and undesirable equilibrium outcomes to better understand optimal coordination strategies. In doing so, we provide guidance on how each authority should adjust its strategy to 'align the stars' of debt sustainability and price stability.

Specifically, our analysis aims to quantify how fiscal pressures interact with the monetary transmission mechanism in South Africa and to assess whether explicit monetary–fiscal coordination improves macroeconomic outcomes through three related questions. First, we ask how the *fiscal-neutral interest rate* (fiscal r-star) relates to the *natural interest rate* (monetary r-star).[2] Second, we trace how the resulting *monetary–fiscal gap* evolves over time and assess whether periods of fiscal stress coincide with weaker monetary transmission or signs of fiscal dominance. Third, we evaluate whether monetary policy should respond directly to fiscal pressures—through an augmented policy rule—or whether coordination through fiscal adjustment alone yields more stable macroeconomic outcomes.

The estimated model reproduces key macro–fiscal dynamics observed in South Africa since the mid-1990s, with parameter values broadly consistent with the literature. Monetary policy is characterised by a strong and persistent reaction to inflation and a high degree of interest-rate smoothing, while the fiscal rule exhibits only a modest debt feedback, signalling fiscal policy that is slow to respond to rising debt. Extending the Taylor rule for interest rate policy to include the monetary-fiscal gap yields a statistically significant negative coefficient, suggesting that policy rates have historically adjusted downward in response to widening monetary–fiscal

[1] With the tax base all but saturated (albeit some discussion around a possible wealth tax), a lower inflation target implies that fiscal policy must cut nominal spending to maintain debt sustainability (Havemann and Hollander, 2024). Without a coordinated approach to macroeconomic policy, fiscal dominance (and/or financial repression) is highly likely (Leeper, 1991; Jeanne, 2025).

[2] Taking the primary balance as given, the fiscal-neutral rate is the interest rate that is consistent with a stable debt-to-GDP ratio over time. We contrast it with the standard monetary-neutral rate (the usual "r-star" used in monetary policy for price stability), which equilibrates output at potential and inflation at target.

tensions.[3]

The augmented specification also provides a better statistical fit, indicating that incorporating fiscal conditions into monetary policy decisions improves explanatory power and suggests the monetary authority indeed responds to fiscal conditions. Historical decompositions show that risk-premium and monetary shocks explain most of the variation in the monetary–fiscal gap, while fiscal shocks play a smaller but persistent role. These findings imply that debt sustainability pressures have at times constrained the monetary transmission mechanism, supporting the interpretation of a weak form of fiscal dominance in certain episodes.

We contribute to the debate on a fiscal anchor by showing that the optimal macroeconomic policy from a welfare perspective is achieved by each authority having a clear and credible anchor. This 'aligns the stars'.

2 Methodology

We build on the two-agent New Keynesian (TANK) dynamic stochastic general equilibrium (DSGE) model from Havemann and Hollander (2024) that explicitly links fiscal and monetary policy interactions in an open-economy setting. A flexible-price equilibrium version of the model is introduced to construct model-implied "natural" variables, including the monetary-neutral interest rate (monetary r-star) and the natural fiscal-neutral interest rate (*natural* fiscal r-star). Analogous to the derivation of a debt-stabilising primary balance, the fiscal-neutral rate is derived from the intertemporal government budget constraint.

The model distinguishes between Ricardian households, who have access to financial markets and are able to smooth consumption across time, and non-Ricardian (rule-of-thumb) households, who can only consume their current disposable income. Nominal rigidities are introduced through price and wage stickiness across all goods and labour markets, while real rigidi-

[3] It is important to note that we are not assuming the monetary authority directly responds to fiscal conditions; rather, in general equilibrium the stability of the system requires either fiscal policy or monetary policy or both to respond. This requirement for macroeconomic policy holds implicitly and is most clearly presented in the fiscal theory of the price level (Leeper, 1991; Cochrane, 2001, 2014; Leeper, 2016, 2023). Cochrane (2014, p. 78) emphasises the fiscal theory of the price level as follows: "In this way, the Treasury and the Fed acting together do, in fact, institute a system in which the government as a whole sets the interest rate i_{t-1} and then sells whatever face value of the debt B_{t-1} that [is demanded] . . . even though the Fed does not directly change the overall quantity of debt, and even though the Treasury seems to sell a fixed quantity, not at a fixed price." Simply put, "[m]onetary policy control of inflation requires appropriate fiscal backing" (Leeper, 2016, p. 2) and if this is not the case, the build-up of fiscal pressures will spillover to monetary policy.

ties are captured through habit formation in consumption and investment adjustment costs.

Monetary policy is characterised by a Taylor-type interest rate rule that responds to inflation and output, while fiscal policy follows six independent reaction functions—for government spending, public investment, and tax instruments—each adjusting to deviations in debt and output. The government sector encompasses redistribution effects, crowding-in and crowding-out dynamics, and a risk premium that links sovereign risk from debt accumulation to higher public and private sector borrowing costs. The model is open-economy in nature, with both consumption and investment goods, a balance-of-payments constraint, and access to foreign bonds, whereby the uncovered interest parity (UIP) condition need not hold due to risk premium effects.

The model is estimated using Bayesian techniques on South African quarterly data covering the period 1994Q1–2023Q2. The empirical setup includes 18 observable variables and 21 exogenous shocks. Deriving the flexible-price (natural) equilibrium leads to the exclusion of nine nominal and external shocks—those associated with monetary policy, price and wage markups, and foreign variables—allowing identification of the model-implied natural rates and output.[4]

2.1 Defining the monetary- and fiscal-neutral rates

The first extension of the model is to incorporate two key interest rates: (i) the monetary-neutral rate (r_n, or 'monetary r-star'), the real interest rate consistent with inflation at its target and output at its potential; and (ii) the fiscal-neutral rate (r_f, or 'fiscal r-star'), the real interest rate consistent with debt stabilisation given the current fiscal balance. While the short-term market rate r is observable (which links monetary policy setting to long-term borrowing and the effective interest rate on government bonds), the two neutral rates, r^n and r^f, are unobserved constructs that we estimate or derive from theory.

The market rates in the model, r and r^{RP}, are the short- and long-term real interest rates relevant for interest rate policy, consumption-savings decisions by households, and government

[4]Bayesian estimation allows for more structural shocks than observables since the Kalman filter integrates out unobserved states. Identification therefore depends on the model's theoretical structure and priors. All parameters are identified according to the Dynare Identification Toolbox. Estimation uses the Metropolis–Hastings MCMC algorithm with three chains of 200,000 draws, a 50% burn-in, and an average acceptance rate of 25%. Tables A.4 to A.6 present the prior and posterior statistics for the estimated parameters along with information about the observable variables.

debt servicing costs. Eq. 1 below follows the standard Taylor rule specification and Eq. 2 captures how government debt-to-GDP dynamics and identified risk premium shocks (both expressed in log-linearised terms):

$$i_t = \phi_i i_{t-1} + (1-\phi_i)(\phi_\pi \tilde{\pi}_t + \phi_y \tilde{y}_t) + \varepsilon_t^i, \quad \text{where } i_{t-1} = \pi_t + r_{t-1}. \tag{1}$$

$$i_t^{RP} = i_t + \underbrace{\gamma_B(\tilde{b}_t) + \varepsilon_t^{RP}}_{\text{risk premium } (RP_t)}, \tag{2}$$

where i_t the nominal policy interest rate, $\tilde{\pi}_t = \pi_t - \bar{\pi}_t$ represents inflation deviations from target, $\tilde{y}_t$ is the output gap, ε_t^i is the monetary policy shock, i_{t-1}^{RP} the nominal interest rate on government debt (which includes the risk premium on borrowing), $\tilde{b}_t = b_t - y_t$ is the debt-to-GDP ratio and ε_t^{RP} is the domestic bonds risk premium shock, which follows a first-order auto-regressive process.

Monetary r-star (r^n) is derived from the flexible-price (i.e., 'natural') equilibrium of the model such that when inflation and output deviations are minimised, the real rate equates with the natural real rate: $\tilde{\pi}_t = \tilde{y}_t = 0 \rightarrow r_t = r_t^n$.[5]

Fiscal r-star (r^f) is derived from the government's intertemporal budget constraint (expressed in nominal GDP terms below):

$$\tilde{b}_t = \frac{(1 + i_{t-1}^{RP})}{(1+\pi_t)(1+g_t)} \tilde{b}_{t-1} - \tilde{pb}_t,$$

where $\tilde{pb}_t$ the primary balance-to-GDP ratio and $g_t = \Delta y_t$ is the real GDP growth rate. Debt sustainability depends on the interaction between the real interest rate, growth, and the primary balance. The fiscal-neutral rate is then defined as the *real* interest rate that stabilises the debt ratio ($\tilde{b}_t = \tilde{b}_{t-1}$) for a given primary balance. In log-linearised terms, simply written as:

$$r_t^f \approx g_t + \tilde{pb}_t - \tilde{b}_{t-1}$$

Our fiscal-neutral interest rate ensures the debt-to-GDP ratio remains stable period-by-period. This representation provides an intuitive fiscal analogue to the natural (monetary) rate of interest, linking debt stabilisation dynamics directly to macroeconomic fundamentals. In the following section, we show why this contemporaneous market-based measure, as opposed to the

[5]The natural rate is different to the efficient rate, which is the perfectly competitive frictionless benchmark that equates with the social planner outcome.

natural fiscal-neutral rate, or a fiscal-neutral rate that ignores sovereign risk, presents a stronger measure for identifying monetary-fiscal tensions.[6]

Bolhuis et al. (2024) define their *fiscal r-star* measure as the debt-stabilising real interest rate that maintains a stable debt-to-GDP ratio for a given debt stock, inflation target, trend growth, and constant primary balance. They show that this measure of debt sustainability is preferable under an *active* fiscal regime−where the primary balance is exogenously set and does not adjust to debt levels.[7]

In contrast, our approach relaxes these assumptions by allowing risk premia and contemporaneous market rates determined in a general equilibrium setting into the fiscal-neutral definition. This allows us to identify a *market-based fiscal-neutral rate* that varies with observed fiscal conditions and financing costs. Importantly, we show that the *natural-equilibrium analogue* of the fiscal-neutral rate, obtained under flexible prices, masks evident tensions that arise in South Africa's data, where sovereign-risk dynamics and policy credibility are key determinants of macroeconomic dynamics. Our market-based measure, by contrast, captures these tensions in real time and thus provides a more realistic indicator of monetary–fiscal interactions in an emerging-market context

We therefore define the *monetary–fiscal gap* as the difference between the long term market-based rate and the fiscal-neutral rate ($r_t^{RP} - r_t^f$). Monetary–fiscal tensions therefore arise when $r_t^{RP} \neq r_t^f$ and persistent deviations create a conflict between inflation control and debt sustainability. As we will see in the following section, this definition does not negate the information value of capturing natural rate dynamics, such as r_t^n, since we can more clearly decompose the misalignment between monetary-fiscal tensions and its main contributors. For example, while the stance of monetary policy may be at its appropriate level given its objectives ($\tilde{\pi}_t = \tilde{y}_t = 0 \rightarrow r_t = r_t^n$), a large and positive gap ($r_t^{RP} \gg r_t^f$) implies that for debt stability, either the risk premium needs to be reduced (through lower debt or improved policy credibility) or monetary policy needs to accommodate the fiscal stance, lowering the real rate below

[6]Another way to interpret fiscal r-star is through a debt valuation perspective (Bolhuis et al., 2024). Government debt can be seen as the present value of expected future primary balances. In a stable scenario (debt not exploding and no Ponzi schemes), the discount rate that equates the debt stock to future surpluses is linked to the interest rate and growth. If the discount rate is too high (actual $r \gg r_f$), the equation does not hold without ever-rising surpluses or eventual default/inflation. Thus, fiscal r-star provides a summary indicator of the required affordability of debt: it tells policymakers the real interest ceiling they must aim for (through credibility and growth) to keep debt sustainable.

[7]The traditional *debt-stabilising primary balance* is appropriate under the assumption of *passive* fiscal regimes−where the primary balance adjusts endogenously to debt levels to ensure debt sustainability (on South Africa, see Havemann and Hollander, 2024).

the natural rate (reducing effective debt service costs and raising inflation to reduce the real debt burden). In other words, monetary policy consistent with inflation stabilisation requires an interest rate above the debt-stabilising rate, tightening financing conditions and potentially undermining fiscal sustainability. In South Africa, this situation has often prevailed: monetary r^n has exceeded fiscal r^f, signalling that debt sustainability and price stability objectives have been in conflict. This tension motivates our subsequent analysis of how the central bank might respond to fiscal developments and how fiscal policy could adjust to ease these constraints.

2.2 Monetary and fiscal policy reaction functions

The second extension is that we augment the model's Taylor rule to include the feedback from the fiscal stance, represented by the gap between market interest rates and fiscal r-star. In other words, we consider that the SARB's policy rate i_t may respond not only to inflation and output, but also to the deviation of fiscal conditions from sustainable levels. We therefore extend the standard Taylor rule (with interest-rate smoothing) to include the fiscal-neutral rate gap, yielding:

$$i_t = \phi_i \, i_{t-1} + (1-\phi_i)\big(\phi_\pi \tilde{\pi}_t + \phi_y \tilde{y}_t - \phi_f r_t^{m-f}\big) + \varepsilon_t^i,$$

in which a coefficient ϕ_f on the monetary-fiscal gap captures monetary policy's responsiveness to the fiscal stance—here expressed as the gap between monetary r-star (including the risk premium) and the fiscal neutral rate: $r_t^{m-f} = r_t^{RP} - r_t^f$. We estimate this augmented rule to determine the extent to which fiscal conditions influence the SARB's reaction function.

To complement the monetary policy rule, we specify and estimate simple fiscal policy reaction functions for government revenue and expenditure to assess fiscal behaviour.[8] For example, a fiscal rule relates changes in government consumption to real debt and output deviations from steady state:

$$g_t^c = \theta_g \, g_{t-1}^c - \theta_{g,b} b_{t-1} - \theta_{g,y} y_t + \varepsilon_t^g,$$

where $\theta_{g,b}$ and $\theta_{g,y}$ reflect how aggressively fiscal policy tightens (e.g., reduces the primary deficit) in response to rising debt and output, and θ_g captures the degree of persistence in spending. Estimating such a rule indicates whether South African fiscal policy has been "pas-

[8] For further details on the fiscal rules in our model, see Havemann and Hollander (2024). The "rule" relates to maintaining a sustainable primary balance, whereby the fiscal authority achieves this by adjusting government consumption spending; tax instruments, government investment expenditure, and government transfers are not conducive to actively managing fiscal sustainability.

sive" (adjusting to stabilise debt) or "active" (ignoring debt levels) in the past.

3 Results

Using the DSGE model, we first investigate whether the SARB has implicitly responded to fiscal pressures in its interest rate setting, captured through misalignments in the monetary-fiscal gap. Second, we conduct policy simulations to explore optimal coordination strategies. This involves finding policy parameter combinations (for the monetary rule and the fiscal rule) that minimise a loss function (which may or may not improve welfare against our benchmark), subject to the model's dynamics. In particular, we search for whether including a response to the fiscal gap in the monetary rule improves outcomes (e.g., inflation or debt stability), and what kind of monetary-fiscal coordination delivers the best results in terms of debt sustainability and economic stability.

3.1 Fiscal pressures and the monetary transmission mechanism

The interaction between fiscal conditions and monetary transmission has become increasingly important as fiscal sustainability pressures intensify. When the real interest rate exceeds the real growth rate, debt dynamics tend to be unsustainable unless the government runs primary balance surpluses, placing a greater burden on monetary–fiscal coordination. Recent evidence for South Africa shows that the differential between risk-adjusted and real interest rates has persisted for much of the post-crisis period (Havemann and Hollander, 2024). A persistently high risk premium raises government borrowing costs and constrains fiscal space, amplifying the challenge of stabilising both inflation and debt. Figure 1 illustrates the evolution of the real interest rate relative to real growth since the mid-1990s based on the estimated model and we observe a clear divergence between r and g since 2010.

A persistent gap between the risk-adjusted rate r^{RP} and the observed real rate r signals that investors demand a substantial premium to hold domestic assets, reflecting perceived fiscal or macroeconomic risks. As shown in Figure 2, this spread has remained elevated for extended periods, especially from 2010Q1, implying that fiscal credibility and monetary effectiveness are intertwined and potentially at odds in recent times.

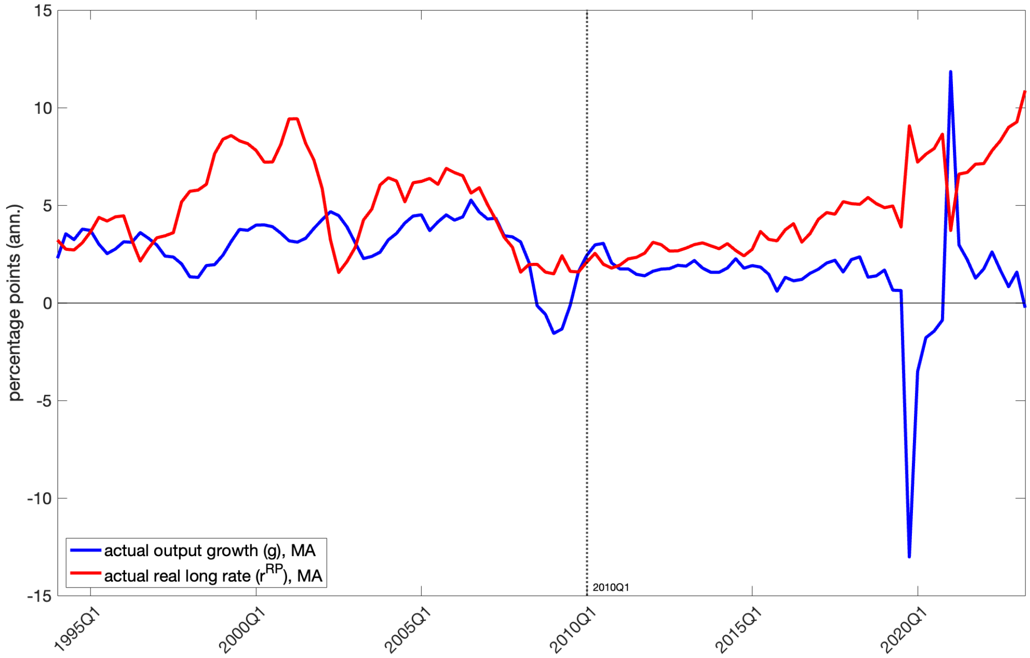

Figure 1: Real interest rate versus real growth rate ($r > g$).
Note: MA=5-quarter moving average.

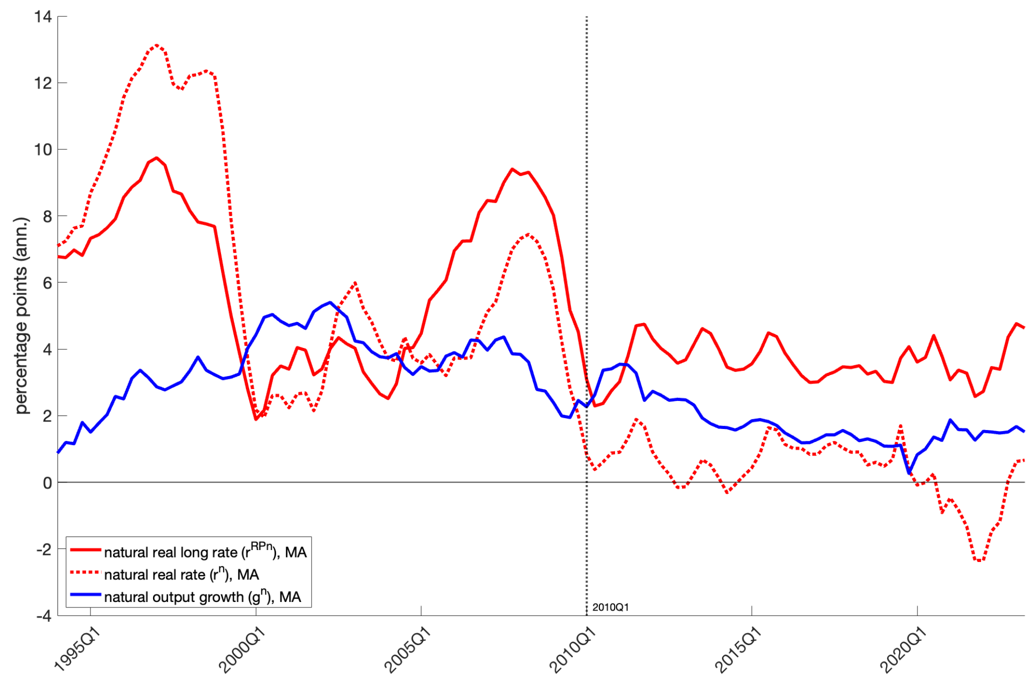

Figure 2: Risk-adjusted versus observed real interest rates ($r^{RP} > r > g$).
Note: MA=5-quarter moving average.

Indeed, monetary policy appears increasingly constrained in its ability to anchor inflation. The empirical correlation between the monetary policy gap $(r - r^n)$ and deviations of inflation from target $(\pi - \bar{\pi})$ has weakened over time—from approximately -0.78 in the pre-2010 period to about -0.33 since 2010—suggesting a reduced sensitivity of inflation to policy rate adjustments. Figure 3 illustrates this relationship, showing that monetary transmission weakens when fiscal imbalances and risk premia are high.

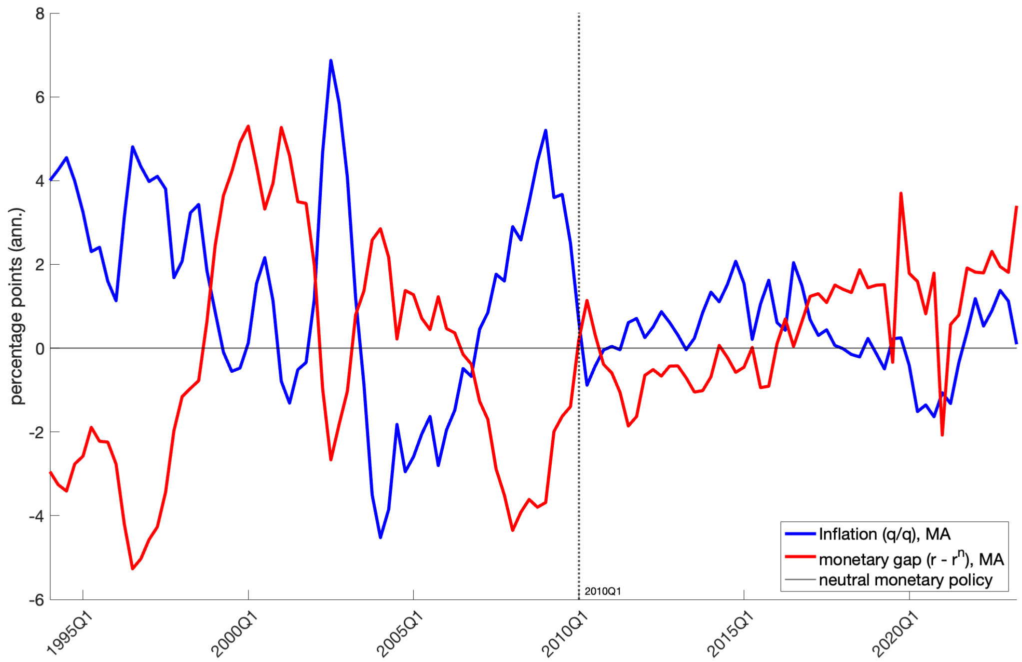

Figure 3: Monetary policy gap versus inflation deviation: evidence of constrained transmission. *Note:* MA=5-quarter moving average.

3.2 Which monetary-fiscal gap measures matter?

The estimated model provides a dynamic representation of both monetary and fiscal equilibrium relationships, allowing us to extract the model-implied *fiscal-neutral rate* (r^f). Figure 4 plots the estimated fiscal-neutral rate against its flexible-price equilibrium (natural) counterpart (r^{fn}). The two rates comove closely over most of the sample, though fiscal r-star tends to exceed its natural rate counterpart. in the aftermath of COVID-19, however, heightened fiscal pressures has lead to r^f falling significantly below r^{fn}. These divergences suggest episodes in which fiscal sustainability considerations required a significantly lower implicit interest rate path than warranted by output and inflation dynamics alone .

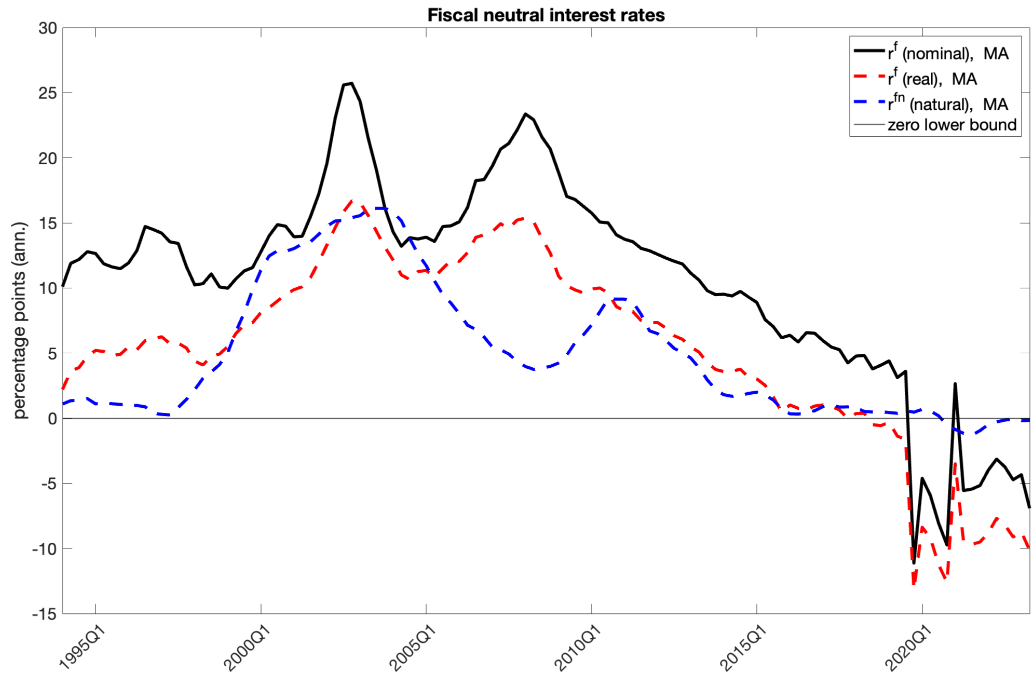

Figure 4: Model-implied fiscal-neutral versus natural (monetary) real interest rates.
Note: MA=5-quarter moving average.

The difference between the monetary and fiscal-neutral rates defines the *monetary–fiscal gap*, a key measure of the consistency (or tension) between policy stances. Figure 5 shows that the estimated gap captures major macroeconomic stress episodes, widening sharply during the late-1990s emerging market crises, the 2008–09 global financial crisis, and the pandemic shock. Periods of a positive gap ($r > r^{f*}$) correspond to fiscal tightening pressures, whereas a negative gap ($r < r^{f*}$) signals periods when monetary policy effectively accommodates fiscal conditions.

The evolution of the gap aligns closely with the trajectory of government debt. When debt rises relative to GDP, the fiscal-neutral rate typically increases, reflecting the higher real return required to stabilise debt. Conversely, during episodes of consolidation or strong growth, the gap narrows or turns negative, indicating that monetary policy can operate closer to its natural equilibrium without endangering fiscal sustainability.

Finally, comparing the flexible-price (natural) versions of both rates highlights the structural component of the monetary–fiscal gap. As shown in Figure 6, the natural monetary–fiscal gap (excluding the risk premium) remains close to zero over most of the post-2015Q1 sample, implying that persistent tensions arise primarily from cyclical and policy-driven shocks interacting with nominal rigidities. We also clearly see how the risk premium is driving a long-run struc-

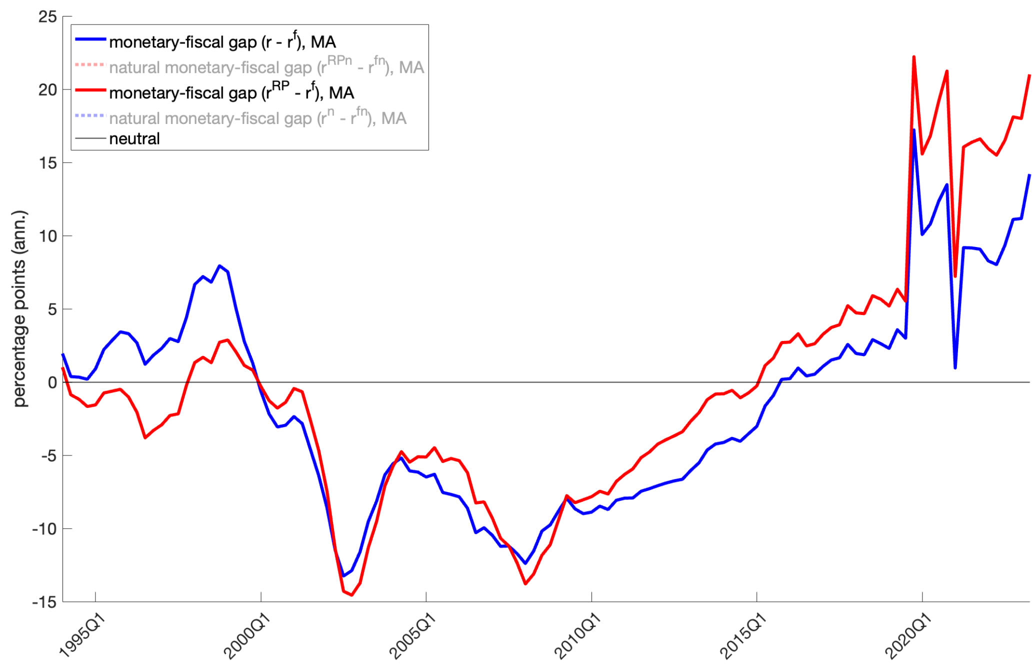

Figure 5: Estimated monetary–fiscal gap: $r_t - r_t^{f*}$.
Note: MA=5-quarter moving average.

tural misalignment between monetary and fiscal policy; absent this cost, we would conclude no misalignment between monetary and fiscal policy rules.

3.3 What drives the monetary-fiscal gap?

The historical decomposition of the monetary–fiscal gap provides insight into the sources of joint policy fluctuations. Figures 7 and 8 present the historical decompositions obtained from each estimated DSGE model. Broadly, since the global financial crisis of 2008, we observe that monetary policy alleviated fiscal pressures by having low short-term rates for an extended period of time, whilst shocks to the risk premium put upward pressure on fiscal tensions. The most noticeable difference between the baseline and augmented model, is in the post-Covid period, where we observe, once account for potential fiscal effects on monetary policy setting, that monetary policy in fact was not counteracting the deteriorating fiscal position.

For the baseline model, risk-premium shocks account for roughly 44% of the forecast error variance in the monetary–fiscal gap, underscoring the dominant role of sovereign and financial risk in shaping the interaction between policies. Monetary policy shocks contribute around

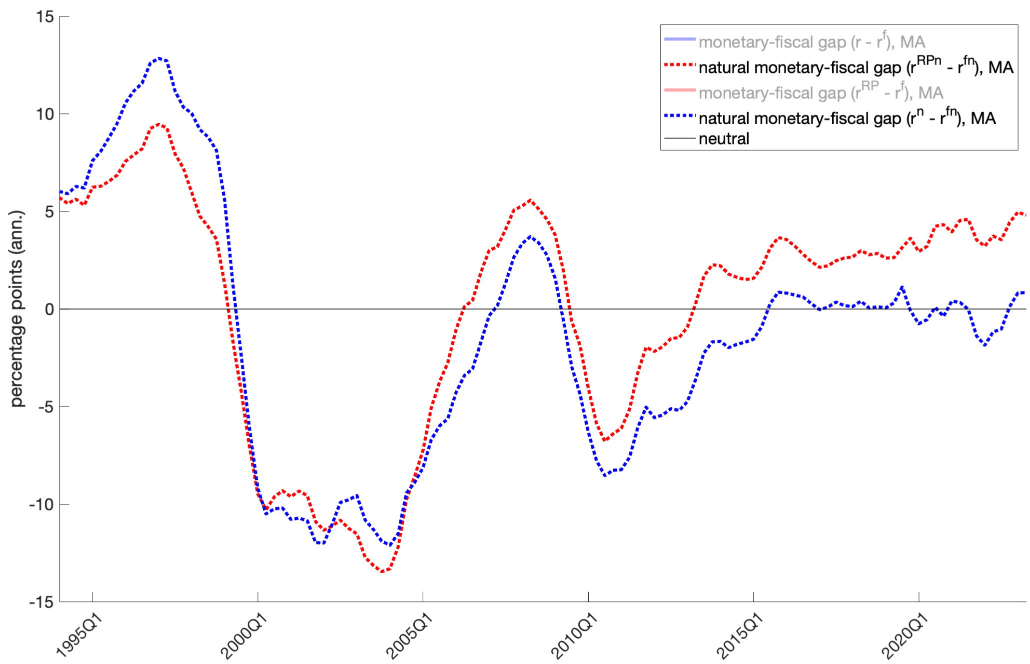

Figure 6: Natural (flexible-price) monetary–fiscal gap.
Note: MA=5-quarter moving average.

19%, reflecting discretionary tightening or easing episodes that alter the short-term alignment of monetary and fiscal stances. These results suggest that much of the observed co-movement between interest rates and debt stems from shifts in perceived risk rather than direct fiscal feedbacks in the monetary rule. For the augment model (including $r^{RP} - r^f$ in the Taylor rule), risk premium shocks account for approximately 41% and monetary policy shocks approximately 22% of the monetary-fiscal gap.

3.4 Does monetary policy respond to fiscal conditions?

Across the two estimated specifications, the main structural parameters and policy-rule coefficients are broadly similar, with posterior means falling well within overlapping 90 percent HPD intervals. The key difference lies in the inclusion of the fiscal-gap response term, ϕ_f, in the augmented Taylor rule. The extended specification delivers a higher log data density (–3796.9 versus –3807.5), indicating a statistically better fit to the data. Apart from this, only a few parameters exhibit meaningful deviations.[9]

[9]Habit formation (κ) is somewhat higher in the restricted model, and the interest-rate smoothing parameter (ϕ_R) slightly lower, while the inflation response (ϕ_π) is marginally stronger. These differences are modest and fall

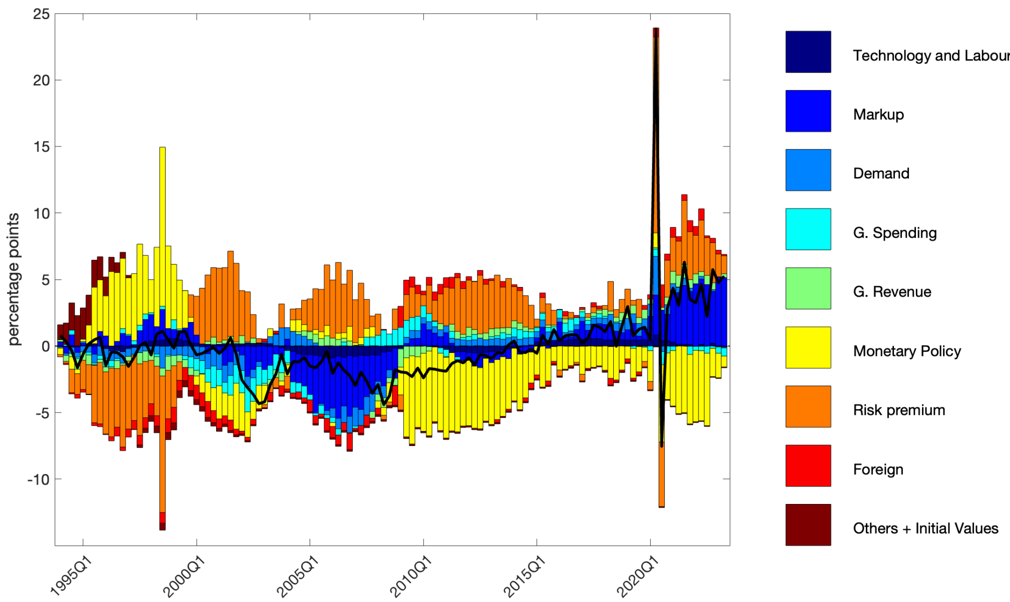

Figure 7: Historical decomposition of the monetary–fiscal gap (excluding $r^{RP} - r^f$ in the Taylor rule).

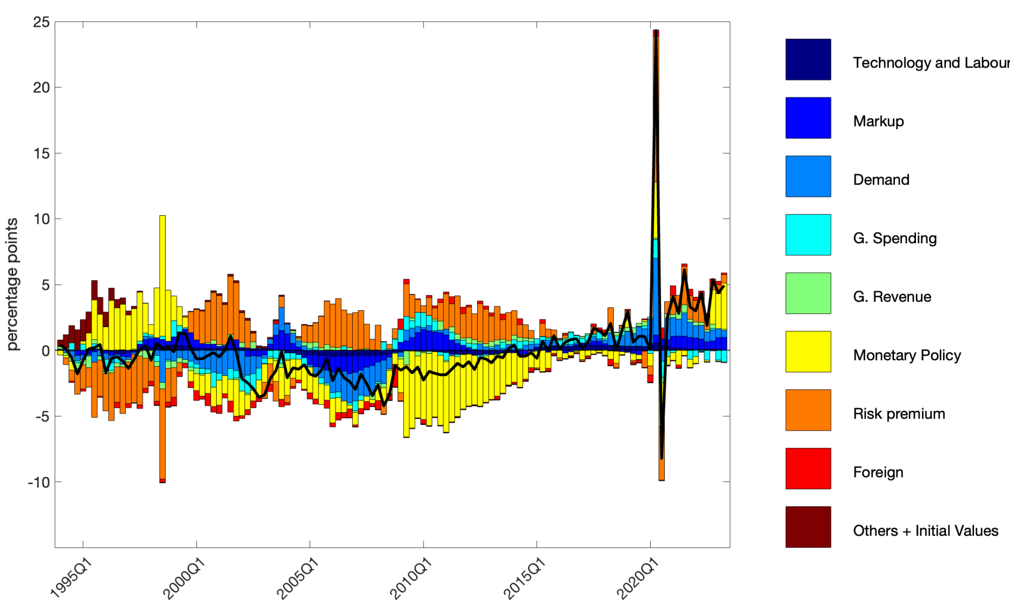

Figure 8: Historical decomposition of the monetary–fiscal gap (including $r^{RP} - r^f$ in the Taylor rule).

Using our estimated policy rules, we find evidence that fiscal conditions have indeed influenced monetary policy at the margin. the inclusion of ϕ_f captures a significant and empirically relevant monetary response to fiscal conditions without materially altering other parameter estimates, suggesting that the data favour the specification in which monetary policy internalises fiscal tensions. In other words, the SARB reacts (consciously or not) to fiscal factors.

In the baseline Taylor rule estimation (no fiscal term), the SARB's reaction to inflation and output appears strong and in line with expectations:

$$i_t = \underset{[0.88,0.92]}{0.9} i_{t-1} + (1-0.9)(\underset{[1.43,1.71]}{1.57} \tilde{\pi}_t + \underset{[0.32,0.47]}{0.40} \tilde{y}_t) ,$$

with priors $\phi_i \sim \beta(0.75, 0.1)$; $\phi_\pi \sim \mathcal{N}(1.5, 0.1)$; $\phi_y \sim \mathcal{N}(0.35, 0.05)$; $\phi_f = 0$, the coefficient on inflation, ϕ_π, is 1.57 and the coefficent on the output gap is 0.4, with a high degree of interest rate smoothing ($\phi_i = 0.9$)

For the extended rule which includes the monetary-fiscal gap, we adopt an agnostic prior for the feedback parameter, specified as $\phi_f \sim \mathcal{N}(0,1)$, which implies no strong prior belief regarding its sign or magnitude. This weakly informative prior centres the distribution at zero while allowing for substantial variation in both directions (roughly 95% of the prior probability lies between -2 and +2), thereby letting the data primarily determine the posterior inference. Our estimated results are:

$$i_t = \underset{[0.91,0.95]}{0.93} i_{t-1} + (1-0.93)(\underset{[1.32,1.65]}{1.48} \tilde{\pi}_t + \underset{[0.28,0.44]}{0.36} \tilde{y}_t - \underset{[0.23,0.66]}{0.43} r_t^{m-f})$$

The estimated coefficients are largely unchanged on inflation and the output gap, and the negative coefficient on the monetary-fiscal gap is statistically different from zero. In the absence of policy rate smoothing ($\phi_i = 0$), a 1 pp increase in the monetary-fiscal gap leads to a 0.43 pp reduction in the policy rate. But given the high degree of smoothing ($\phi_i = 0.93$), the cumulative effect of persistent monetary-fiscal tensions matters for the extent to which fiscal dynamics influence monetary policy.

For example, when fiscal r-star is persistently below monetary r-star debt stabilisation requires lower interest rates for a given primary balance; if fiscal tensions build, there can be a significant cumulative downward pressure on the policy rate (directly through, e.g., financial repression or indirectly through general equilibrium forces).

within plausible posterior uncertainty bands.

Finally, for the fiscal policy rule we use priors $\phi_g \sim \beta(0.75, 0.1)$; $\theta_{g,y} \sim \mathcal{G}(0.2, 0.1)$; $\theta_{g,b} \sim \mathcal{G}(0.4, 0.2)$ and obtain the following estimated values at the posterior mean:

$$g_t^c = \underset{[0.72,0.92]}{0.82} g_{t-1}^c - \underset{[0.01,0.07]}{0.05} y_t - \underset{[0.06,0.17]}{0.12} b_t + \varepsilon_t^g$$

This simple fiscal reaction function suggests that fiscal policy in South Africa has been only mildly responsive to debt. Specifically, our estimates suggest that the primary balance improves by only about 0.1% of GDP for each 1% increase in the debt-to-GDP ratio, i.e. a debt coefficient around -0.1 in the fiscal rule. This is a relatively weak response, indicating a weakly "passive" fiscal regime where debt was largely allowed to rise without prompt countermeasures. In practical terms, South Africa's fiscal authorities have often delayed or avoided the adjustments needed to stabilise debt, reflecting political and social constraints. We will return to this in our model simulations.

3.5 Monetary-fiscal regimes and (optimal) policy coordination

The estimated models allows us to explore the implications for policy coordination and evaluate optimal simple rules (OSR) under alternative policy objectives. The optimisation identifies the policy-rule coefficients that minimise the weighted quadratic loss, subject to the estimated structural parameters. The success of macroeconomic policy can be evaluated by its ability to minimise instability in the key target variables, which is formalised by a quadratic loss function of the form

$$\min \mathcal{L}_t = \Theta_{\mathbb{X}} \mathbb{X}_t^2,$$

where the welfare loss, $\mathcal{L}_t$, is an increasing function of the deviations of one or more policy targets contained in the vector $\mathbb{X}_t$. Each specification assigns weights to policy targets in the loss function (e.g., output, inflation, the monetary–fiscal gap, and the policy instrument). The vector of weights, $\Theta_{\mathbb{X}}$, captures the relative importance assigned to each target variable in the authority's objective function.

For monetary policy, the loss function typically penalises deviations of output and inflation from their steady-state or target values, while for fiscal policy, the relevant targets are output and the monetary–fiscal gap. In both cases, the policymaker may also place weight on the volatility of the policy instrument itself, reflecting the institutional preference for smooth (i.e., more predictable) adjustments in policy settings. This general framework provides a tractable basis for deriving optimal simple rules under alternative policy mandates and coordination regimes.

We define four types of regimes linked to the objective function and for simplicity we weight each variable equally: (1) active monetary policy entails minimising output and inflation while taking into account variation in the policy rate; (2) quasi-active monetary policy, which captures a type of mandate change where the monetary-fiscal gap replaces inflation in the previous objective function; (3) a financial repression / fiscal dominance regime whereby the only policy objective to stabilise is the monetary-fiscal gap; and (4) a joint coordination regime which groups all target variables and policy instruments together.[10]

Policy coordination under monetary dominance

The results in Table 1 show that the optimal response to inflation (ϕ_π) and output (ϕ_y) is notably higher under active monetary policy (**MD1)**. When the assumption of interest rate smoothing is relaxed (**MD2**) the coefficients are closely aligned with the estimated Taylor rule response, which suggests that the monetary authority responds optimally to inflation and output but prefers to do so gradually. For the Taylor rule specification with the monetary–fiscal gap (**MD3**), the fiscal response coefficient (ϕ_f) is approximately seven times larger than the estimated model, indicating a stronger stabilising role for monetary policy when fiscal tensions are internalised. Moving from optimised rules **MD1** to **MD3** we see improvements in the loss function which coincides with higher welfare gains compared to the estimated baseline, ranging from 0.53% to 0.84% in consumption-equivalent units.

Under quasi-active monetary policy, we notice a very similar pattern for the optimised coefficients for **MD4** and **MD5**, corresponding to **MD1** and **MD2**. For **MD6**, the fiscal response coefficient is significantly larger than observed in **MD3**. Dropping the inflation objective can achieve similar welfare gains at the expense, however, of completely overhauling the monetary authority's mandate. The results suggest that the monetary authority likely does internalise fiscal conditions, but the gains from more aggressively responding to fiscal conditions are limited.

[10]Tables A.7 and A.8 in the Appendix present combined results including distributional effects on Ricardian and non-Ricardian household welfare.

Table 1: Optimal monetary policy under alternative objective functions, with loss and welfare measures

Policy weights: $\{y, \pi, r\} = 1$ (active MP)				
Parameters	*Optimal values*			*Estimated*
	MD1	**MD2**	**MD3**	
ϕ_π	4.79	1.67	2.11	1.57 / 1.48
ϕ_y	1.10	0.42	0.52	0.40 / 0.36
ϕ_i	–	0.19	–	0.90 / 0.93
ϕ_f	–	–	2.83	– / 0.43
$\mathscr{L} \to 0\%$	46	43	18	–
ΔW (%)	0.438	0.543	0.697	– / 0.538
$\Delta W/\sigma(W_{\text{base}})$	1.884	2.333	2.994	– / 2.311
CE (%)	0.530	0.657	0.844	– / 0.651
Policy weights: $\{y, r^{m-f}, r\} = 1$ (quasi-active MP)				
Parameters	*Optimal values*			*Estimated*
	MD4	**MD5**	**MD6**	
ϕ_π	4.70	1.65	3.17	1.57 / 1.48
ϕ_y	1.27	0.42	0.84	0.40 / 0.36
ϕ_i	–	0.29	–	0.90 / 0.93
ϕ_f	–	–	8.26	– / 0.43
$\mathscr{L} \to 0\%$	43	36	11	–
ΔW (%)	0.313	0.541	0.704	– / 0.538
$\Delta W/\sigma(W_{\text{base}})$	1.346	2.323	3.024	– / 2.311
CE (%)	0.379	0.654	0.852	– / 0.651

Notes: "Estimated" columns report posterior Taylor-rule coefficients from the baseline estimation without / with the monetary–fiscal gap. $\mathscr{L} \to 0\%$ is the percentage reduction in the loss function under each OSR rule relative to the baseline (no gap). ΔW reports theoretical welfare gains (%) relative to the *Estimated (baseline, no-gap)* rule. CE is the consumption-equivalent gain (%). $\Delta W/\sigma(W_{\text{base}})$ scales the W-gain by the baseline standard deviation of W.

Fiscal dominance

A contrasting scenario arises when the monetary–fiscal gap itself is the central policy target, reflecting fiscal dominance or a quasi-fiscal financial repression regime (Jeanne, 2025).[11] Under this regime, fiscal rules become active while monetary policy turns passive, accommodating fiscal conditions to maintain government debt sustainability. Table 2 summarise these results.

Table 2: Optimal coordination policy under fiscal dominance regime, with loss and welfare measures

Policy weights: $y = 0, r^{m-f} = 1$			
Parameters	*Optimal values*		*Estimated*
	FD1	**FD2**	
ϕ_π	1.79	0.95	1.57 / 1.48
ϕ_y	2.47	0.52	0.40 / 0.36
ϕ_i	-0.34	0.30	0.90 / 0.93
ϕ_f	250.10	37.32	– / 0.43
$\theta_{g,y}$	0.26	-0.16	0.05 / 0.05
$\theta_{g,b}$	4.76	0.49	0.12 / 0.12
ϕ_g	–	0.88	0.82 / 0.82
$\theta_{g,f}$	–	0.16	– / –
$\mathscr{L} \to 0\%$	0	0	–
ΔW (%)	*Unst.*	0.643	– / 0.538
$\Delta W/\sigma(W_{\text{base}})$	*Unst.*	2.763	– / 2.311
CE (%)	*Unst.*	0.778	– / 0.651

Notes: Definitions of $\mathscr{L}$, ΔW, CE, and scaling as in Table 2. "Unst." indicates no stable equilibrium (BK violation).

Under quasi-fiscal financial repression (**FD1**), we observe extraordinarily high feedback from fiscal conditions to the interest rate (ϕ_f), consistent with the central bank adjusting policy primarily to stabilise debt service costs. Simulation results indicate that there is no stable equilibrium, indicative of the challenges of ensuring stability in policy regimes where fiscal policy

[11] Fiscal dominance occurs predominately through an excess supply of government debt and the risk premium and can lead to quasi-fiscal financial repression. Jeanne (2025) defines financial repression as any policy through which the government uses the banking sector to avoid default, i.e., hold government debt by moral suasion or regulation and to accept a return that is lower than the market rate. His theory shows how optimal financial repression progresses through successive stages with increasing levels of distortion, and it can yield substantial welfare gains but is a policy of last resort. Jeanne (2025) distinguishes between *balance-sheet* and *quasi-fiscal* financial repression. The former captures the extent to which the banking sector absorbs the supply of government debt, which typically receives special regulatory status, and the latter involves lowering the interest rate on bank reserves or requiring banks to accept below-market interest rates. We focus on the latter, later stage.

dominates. The fiscal-dominant equilibrium also features a very strong monetary response to fiscal conditions. Monetary policy volatility rises and the Taylor principle is violated ($\phi_\pi < 1$). Fiscal instruments remain largely unresponsive, with mild procyclicality and a slightly stronger debt stabilising reaction. The consumption-equivalent gains under the fiscal dominant regime do not exceed that of active or quasi-active monetary policy, indicating, again, limited gains to adopting stronger emphasis on fiscal conditions in monetary policy setting.

Policy coordination with joint objectives

The results in Table 3 summarise outcomes **JO1** to **JO4** when both authorities assign equal weight to their joint macroeconomic objectives—output, inflation, policy rate, monetary–fiscal gap, and government consumption spending.

Taken together, the optimal simple rules analysis highlights how the equilibrium mix of active and passive policies depends on the structure of the policy objective function. When monetary policy dominates, inflation stabilisation is achieved at the cost of fiscal stress; when fiscal policy becomes active, debt sustainability drives monetary accommodation. But overall, we see that there is little evidence that fiscal instruments benefit from active stabilisation of inflation or output when monetary policy remains active. Government spending rules are better served at maintaining debt sustainability rather than pursuing countercyclical objectives. Consistent with Havemann and Hollander (2024), the analysis suggests that, given a credible monetary policy rule that ensures nominal stability, fiscal policy should remain passive–anchored on debt and output feedbacks that ensure intertemporal solvency. In such settings, explicit coordination delivers negligible welfare gains.

It should also be pointed out that the optimised rules only improve welfare relative to the estimated model (with the monetary-fiscal gap) when interest rate smoothing is relaxed or monetary policy adjusts aggressively to the monetary-fiscal gap (see Table A.7). Interest rate volatility would affect the communication of monetary policy in its current form and also have unintended consequences (e.g., financial instability) not captured in our framework. Furthermore, we show that each optimised rule has distributional effects on welfare across household types that do not correspond to the ranking of optimised rules based on aggregate welfare, suggesting that the distributional consequences of policy rules and coordination warrants further exploration (see Table A.8).

Table 3: Optimal coordination policy under joint policy objectives, with loss and welfare measures

Policy weights: $y, \pi, r, r^{m-f}, g = 1$					
Parameters	*Optimal values*				*Estimated*
	JO1	**JO2**	**JO3**	**JO4**	
ϕ_π	3.01	1.72	3.20	2.07	1.57 / 1.48
ϕ_y	0.76	0.45	0.89	0.59	0.40 / 0.36
ϕ_i	–	0.16	–	-2.42	0.90 / 0.93
ϕ_f	–	–	10.13	2.74	– / 0.43
ρ_g	–	0.55	–	-0.79	0.82 / 0.82
$\theta_{g,y}$	-0.11	0.08	0.16	0.17	0.05 / 0.05
$\theta_{g,b}$	-0.04	0.04	0.10	-0.04	0.12 / 0.12
$\theta_{g,f}$	–	–	0.20	-0.01	– / –
$\mathscr{L} \to 0\%$	44	28	16	12	–
ΔW (%)	0.401	0.549	0.714	0.701	– / 0.538
$\Delta W/\sigma(W_{\text{base}})$	1.723	2.360	3.067	3.012	– / 2.311
CE (%)	0.485	0.665	0.865	0.849	– / 0.651

Notes: JO1–JO4 correspond to the four OSR regimes in the text. Definitions of $\mathscr{L}$, ΔW, CE, and scaling as in Table 2.

4 Conclusion

This paper extended a DSGE model to explicitly consider monetary-fiscal coordination. We explored scenarios to identify an improved policy mix.

The model simulations suggest that the optimal strategy is a coordinated one. This can be achieved with each authority pursuing a credible rule-based policy. Fiscal policy should commit to a credible debt-stabilisation rule, and monetary policy should focus on its inflation mandate while accommodating the fiscal adjustment when appropriate.

In quantitative terms, we find that including a strong response to the fiscal gap in the central bank's rule does not yield large additional benefits if fiscal policy is fixed on a good path. The central bank already indirectly benefits from the fiscal consolidation through lower risk premia and inflation, so it does not need an overly aggressive fiscal conditions term in its rule. In fact, our analysis of the augmented Taylor rule indicates potential risks if the central bank overreacts to fiscal variables this could introduce instability in interest rates and inflation dynamics. Essentially, if monetary policy leans too hard against fiscal conditions, it could create feedback loops that destabilize expectations (in extreme cases, one could get multiple equilibria or a policy mix that markets perceive as unsustainable). The model's message is that the heavy lifting has to come from fiscal side in closing the r vs. r_f gap, while the central bank's role is to maintain price stability and facilitate growth during the adjustment.

The policy implication is clear: without a change in fiscal behaviour, monetary policy will face difficult choices and possibly suboptimal outcomes (either letting inflation stay above target to help debt, or raising rates and worsening debt). However, with a credible fiscal correction, the need for unconventional monetary responses diminishes – each policy can better achieve its goal, and the "stars" can align.

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A.1 Appendix

A.1.1 Observable variables used in estimation

The estimation relies on a broad set of domestic and external observables, ensuring identification of both monetary and fiscal transmission channels.

- **Domestic:** output, inflation, employment, real wages, short-term interest rate, import inflation, export inflation, government debt-to-GDP, inflation target, and six fiscal instruments (value-added tax, personal income tax, corporate income tax, consumption spending, investment spending, and transfers).
- **Foreign:** output, inflation, and the short-term interest rate (using the United States as a proxy, which provides a more stable benchmark than a trade-weighted composite of South Africa's main trading partners; i.e., trade-weighting multiple series can create noise and spurious effects).

Bayesian estimation allows for more structural shocks than observables since the Kalman filter integrates out unobserved states. Identification therefore depends on the model's theoretical structure and priors. All parameters are identified according to the Dynare Identification Toolbox. Estimation uses the Metropolis–Hastings MCMC algorithm with three chains of 200,000 draws, a 50% burn-in, and an average acceptance rate of 25%. Tables A.4 to A.6 present the prior and posterior statistics for the estimated parameters along with information about the observable variables.

A.1.2 Figures

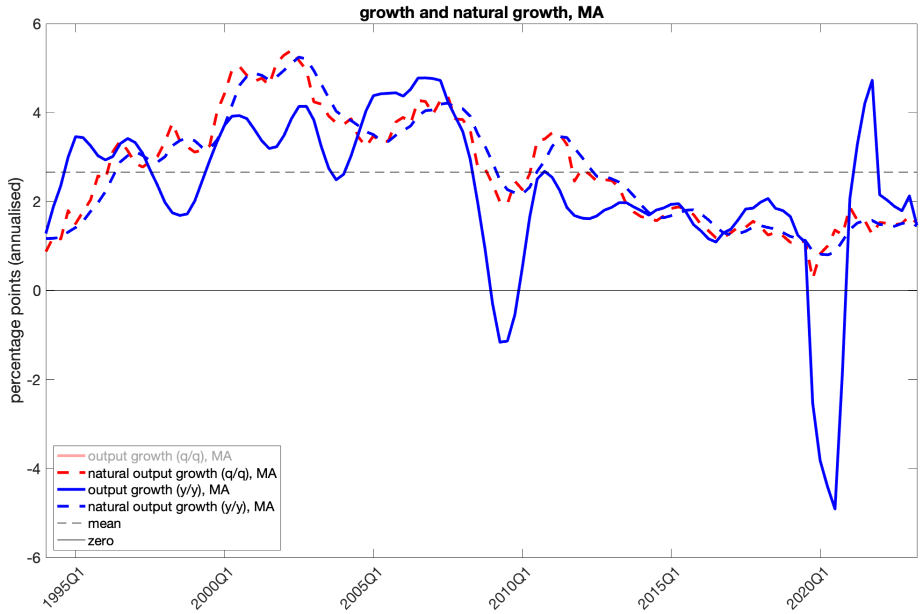

Figure 9: Natural growth: quarterly and annual growth, moving average and gap.

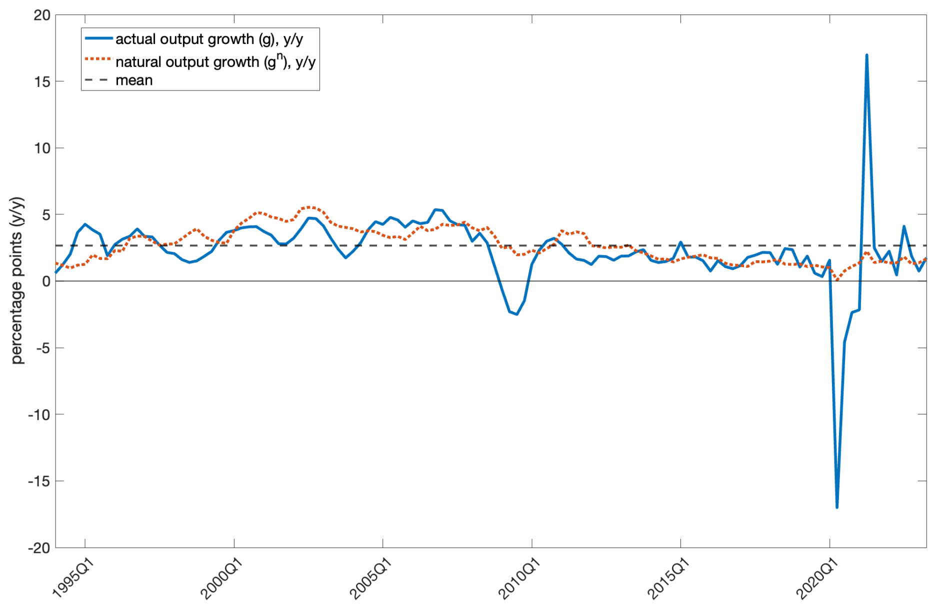

Figure 10: Natural growth: year-on-year gap.

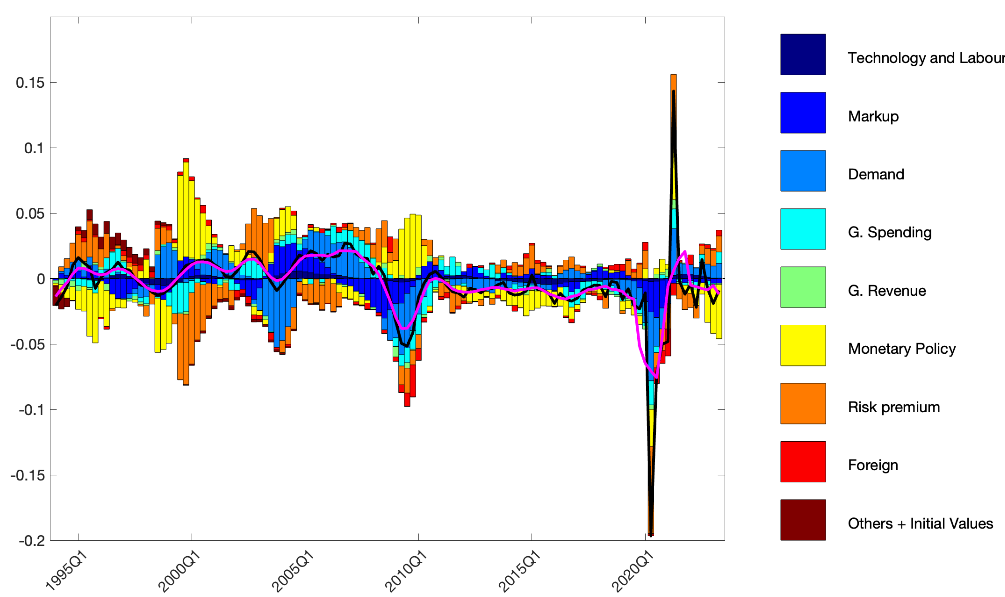

Figure 11: Growth historical decomposition (4-quarter change).

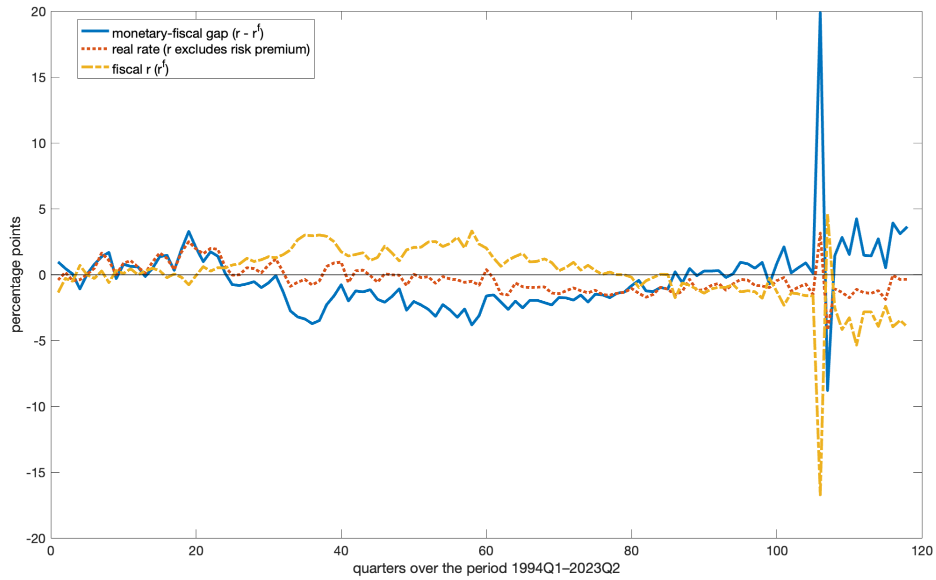

Figure 12: Actual rates: policy, risk-premium-adjusted, and fiscal.

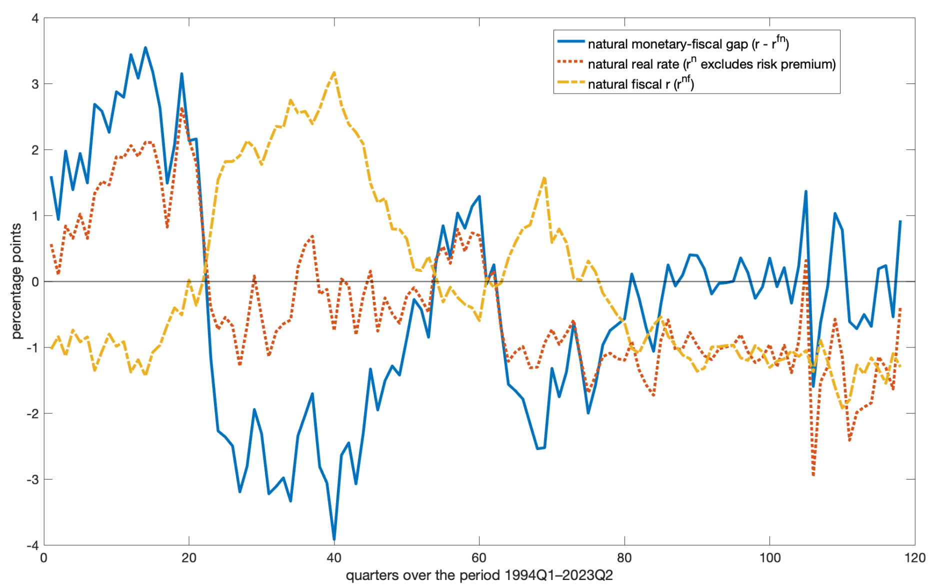

Figure 13: Natural rates: monetary versus fiscal.

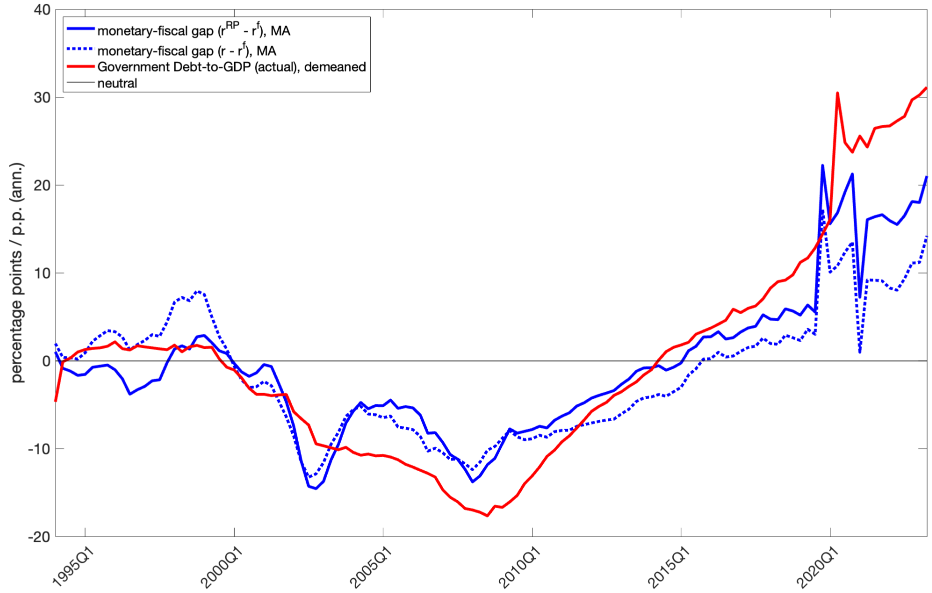

Figure 14: Monetary-fiscal gap and government debt-to-GDP ratio
Our estimate of the gap between the optimal monetary policy interest rate and the optimal fiscal policy interest rate shows that a gap opened up in 2015

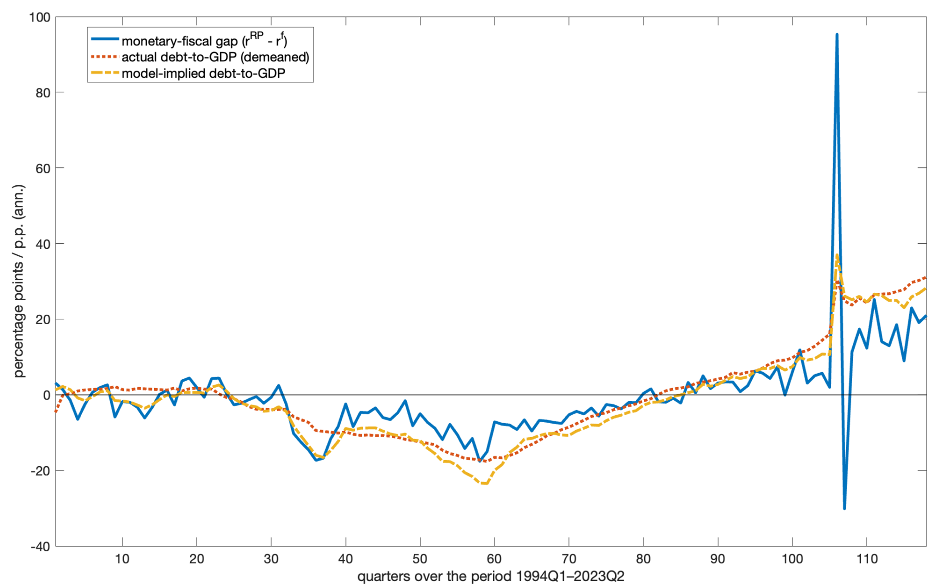

Figure 15: Monetary–fiscal gap and government debt.

A.1.3 Tables

Table A.1: **Estimated parameters: Extended Taylor rule with fiscal-gap response ϕ_f**

Parameter	**Description**	**Prior mean**	**Post. mean**	**5% HPD**	**95% HPD**	**Prior**	**Pstdev**
ω	Share of RoT HHs	0.250	0.395	0.200	0.592	Beta	0.100
tr2rot	Transfer share to RoT HHs	0.750	0.776	0.632	0.931	Beta	0.100
κ	Habit formation	0.650	0.598	0.406	0.801	Beta	0.100
σ_L	Labour supply elasticity	3.000	2.985	2.105	3.813	Gamma	0.500
μ_C	Consumption elasticity	1.500	1.443	1.110	1.742	Gamma	0.200
μ^*	Foreign goods elasticity	1.250	1.365	1.062	1.656	Gamma	0.200
θ_H	Home price rigidity	0.800	0.744	0.651	0.833	Beta	0.050
χ_H	Home indexation	0.750	0.448	0.276	0.624	Beta	0.100
θ_X	Export price rigidity	0.800	0.756	0.667	0.843	Beta	0.050
χ_X	Export indexation	0.750	0.690	0.522	0.872	Beta	0.100
θ_M	Import price rigidity	0.800	0.760	0.685	0.836	Beta	0.050
χ_M	Import indexation	0.750	0.560	0.357	0.774	Beta	0.100
θ_W	Wage rigidity	0.750	0.545	0.371	0.705	Beta	0.100
χ_W	Wage indexation	0.500	0.471	0.308	0.635	Beta	0.100
γ_B	Risk-premium elasticity	0.050	0.047	0.040	0.054	Gamma	0.005
ϕ_R	Interest-rate smoothing	0.750	0.931	0.913	0.948	Beta	0.100
ϕ_π	Inflation response	1.500	1.480	1.318	1.646	Normal	0.100
ϕ_y	Output response	0.350	0.360	0.279	0.440	Normal	0.050
ϕ_f	Fiscal gap response	0.000	0.426	0.228	0.636	Normal	1.000
$\theta_{tr,y}$	Transfers: output feedback	0.200	0.165	0.038	0.283	Gamma	0.100
$\theta_{g,y}$	Gov. cons.: output feedback	0.200	0.047	0.016	0.078	Gamma	0.100
$\theta_{i_G,y}$	Gov. inv.: output feedback	0.200	0.105	0.028	0.184	Gamma	0.100
$\theta_{\tau^c,y}$	Cons. tax: output feedback	0.500	0.202	0.137	0.271	Gamma	0.300
$\theta_{\tau^w,y}$	Labour tax: output feedback	0.500	0.079	0.028	0.134	Gamma	0.300
$\theta_{\tau^k,y}$	Capital tax: output feedback	0.500	0.234	0.132	0.337	Gamma	0.300
$\theta_{g,b}$	Gov. cons.: debt feedback	0.400	0.101	0.044	0.155	Gamma	0.200
$\theta_{i_G,b}$	Gov. inv.: debt feedback	0.400	0.399	0.180	0.595	Gamma	0.200
$\theta_{tr,b}$	Transfers: debt feedback	0.400	0.339	0.117	0.556	Gamma	0.200
$\theta_{\tau^w,b}$	Labour tax: debt feedback	0.400	0.105	0.051	0.156	Gamma	0.200
$\theta_{\tau^k,b}$	Capital tax: debt feedback	0.400	0.098	0.029	0.169	Gamma	0.200
$\theta_{\tau^c,b}$	Consumption tax: debt feedback	0.400	0.197	0.126	0.261	Gamma	0.200

Notes: Posterior means and 90% HPD intervals; all values rounded to three decimals.

Table A.2: **Estimated parameters (cont.): Extended rule with ϕ_f**

Shock s.d.	**Description**	**Prior mean**	**Post. mean (%)**	**5% HPD**	**95% HPD**	**Prior**	**Pstdev**
AR(1) shock persistences							
ρ_{ϵ^g}	Gov. cons. shock persistence	0.750	0.790	0.662	0.916	Beta	0.100
$\rho_{\epsilon^{i_G}}$	Gov. inv. shock persistence	0.750	0.638	0.444	0.905	Beta	0.100
$\rho_{\epsilon^{tr}}$	Transfers shock persistence	0.750	0.443	0.251	0.638	Beta	0.100
$\rho_{\epsilon^{\tau^c}}$	Cons. tax shock persistence	0.750	0.377	0.209	0.547	Beta	0.100
$\rho_{\epsilon^{\tau^w}}$	Labour tax shock persistence	0.750	0.510	0.280	0.725	Beta	0.100
$\rho_{\epsilon^{\tau^k}}$	Capital tax shock persistence	0.750	0.331	0.201	0.461	Beta	0.100
ξ_E	Employment adj. (Calvo-style)	0.500	0.591	0.478	0.697	Beta	0.100
ρ_{RP}	Dom. risk premium persistence	0.750	0.865	0.795	0.942	Beta	0.100
ρ_{RP^*}	Foreign risk premium persistence	0.750	0.890	0.859	0.920	Beta	0.100
ρ_{Y^*}	Foreign output persistence	0.750	0.987	0.980	0.995	Beta	0.100
$\rho_{\epsilon^{R^*}}$	Foreign MP shock persistence	0.750	0.536	0.483	0.597	Beta	0.100
ρ_{g_z}	Trend growth persistence	0.750	0.603	0.434	0.766	Beta	0.100
ρ_{ϵ}	Transitory tech. persistence	0.750	0.726	0.556	0.892	Beta	0.100
ρ_N	Labour shock persistence	0.750	0.746	0.587	0.905	Beta	0.100
ρ_C	Preference shock persistence	0.750	0.750	0.588	0.906	Beta	0.100
ρ_I	Investment shock persistence	0.750	0.841	0.730	0.949	Beta	0.100
ρ_{ϕ^W}	Wage markup persistence	0.750	0.492	0.342	0.631	Beta	0.100
ρ_{ϕ^H}	Domestic markup persistence	0.750	0.454	0.283	0.617	Beta	0.100
ρ_{ϕ^X}	Export markup persistence	0.750	0.666	0.491	0.864	Beta	0.100
ρ_{ϕ^*}	Import markup persistence	0.750	0.608	0.437	0.792	Beta	0.100
ρ_g	Gov. cons. process AR(1)	0.750	0.799	0.696	0.911	Beta	0.100
ρ_{i_G}	Gov. inv. process AR(1)	0.750	0.809	0.640	0.944	Beta	0.100
ρ_{tr}	Transfers process AR(1)	0.750	0.453	0.256	0.640	Beta	0.100
ρ_{τ^c}	Cons. tax process AR(1)	0.750	0.228	0.131	0.310	Beta	0.100
ρ_{τ^w}	Labour tax process AR(1)	0.750	0.381	0.184	0.565	Beta	0.100
ρ_{τ^k}	Capital tax process AR(1)	0.750	0.363	0.228	0.489	Beta	0.100

Notes: Posterior means and 90% HPD intervals; all values rounded to three decimals.

Table A.3: **Standard deviation of shocks (in percent): Extended rule with ϕ_f**

Shock s.d.	**Description**	**Prior mean**	**Post. mean (%)**	**5% HPD**	**95% HPD**	**Prior**	**Pstdev**
η_{Y^*}	Foreign output	0.010	1.190	1.050	1.320	InvGamma	∞
η_{R^*}	Foreign policy rate	0.010	0.200	0.180	0.230	InvGamma	∞
η_g	Gov. consumption	0.010	0.710	0.590	0.810	InvGamma	∞
η_{i_G}	Gov. investment	0.010	4.210	3.770	4.680	InvGamma	∞
η_{tr}	Transfers	0.010	8.960	7.920	9.910	InvGamma	∞
η_R	Monetary policy	0.010	0.230	0.210	0.260	InvGamma	∞
η_{RP}	Dom. risk premium	0.010	0.500	0.310	0.690	InvGamma	∞
η_{RP^*}	Foreign risk premium	0.010	0.200	0.150	0.240	InvGamma	∞
η_{g_z}	Trend growth	0.010	0.330	0.220	0.440	InvGamma	∞
η_ϵ	Transitory technology	0.010	0.540	0.250	0.840	InvGamma	∞
η_N	Labour disutility	0.010	0.570	0.240	0.880	InvGamma	∞
η_C	Preferences	0.010	0.690	0.260	1.180	InvGamma	∞
η_I	Investment-specific	0.010	0.990	0.320	1.700	InvGamma	∞
η_{ϕ^H}	Domestic markup	0.010	0.570	0.350	0.760	InvGamma	∞
η_{ϕ^X}	Export markup	0.010	0.380	0.220	0.530	InvGamma	∞
η_{ϕ^*}	Import markup	0.010	0.600	0.240	0.950	InvGamma	∞
η_{ϕ^W}	Wage markup	0.010	0.280	0.180	0.370	InvGamma	∞
η_{τ^c}	Consumption tax	0.010	0.870	0.740	0.980	InvGamma	∞
η_{τ^w}	Labour tax	0.010	1.040	0.920	1.160	InvGamma	∞
η_{τ^k}	Capital tax	0.010	2.250	2.000	2.520	InvGamma	∞
$\eta_{\bar{\pi}^C}$	Inflation target	0.010	0.450	0.400	0.500	InvGamma	∞

Notes: Posterior means and 90% HPD intervals. Values shown are ×100 (percent).

Table A.4: **Estimated parameters: Baseline Taylor rule ($\phi_f = 0$)**

Parameter	**Description**	**Prior mean**	**Post. mean**	**5% HPD**	**95% HPD**	**Prior**	**Pstdev**
ω	Share of RoT HHs	0.250	0.430	0.238	0.626	Beta	0.100
tr2rot	Transfer share to RoT HHs	0.750	0.780	0.631	0.926	Beta	0.100
κ	Habit formation	0.650	0.752	0.593	0.907	Beta	0.100
σ_L	Labour supply elasticity	3.000	3.053	2.236	3.924	Gamma	0.500
μ_C	Consumption elasticity	1.500	1.470	1.137	1.798	Gamma	0.200
μ^*	Foreign goods elasticity	1.250	1.190	0.921	1.455	Gamma	0.200
θ_H	Home price rigidity	0.800	0.709	0.630	0.794	Beta	0.050
χ_H	Home indexation	0.750	0.462	0.274	0.642	Beta	0.100
θ_X	Export price rigidity	0.800	0.752	0.664	0.835	Beta	0.050
χ_X	Export indexation	0.750	0.685	0.507	0.874	Beta	0.100
θ_M	Import price rigidity	0.800	0.761	0.689	0.835	Beta	0.050
χ_M	Import indexation	0.750	0.585	0.372	0.791	Beta	0.100
θ_W	Wage rigidity	0.750	0.522	0.380	0.660	Beta	0.100
χ_W	Wage indexation	0.500	0.514	0.348	0.676	Beta	0.100
γ_B	Risk-premium elasticity	0.050	0.040	0.033	0.046	Gamma	0.005
ϕ_R	Interest-rate smoothing	0.750	0.903	0.889	0.918	Beta	0.100
ϕ_π	Inflation response	1.500	1.570	1.425	1.709	Normal	0.100
ϕ_y	Output response	0.350	0.397	0.321	0.474	Normal	0.050
ϕ_f	Fiscal gap response	0.000	–	–	–	Fixed	–
$\theta_{tr,y}$	Transfers: output feedback	0.200	0.157	0.036	0.271	Gamma	0.100
$\theta_{g,y}$	Gov. cons.: output feedback	0.200	0.046	0.015	0.075	Gamma	0.100
$\theta_{i_G,y}$	Gov. inv.: output feedback	0.200	0.098	0.023	0.168	Gamma	0.100
$\theta_{\tau^c,y}$	Cons. tax: output feedback	0.500	0.202	0.137	0.269	Gamma	0.300
$\theta_{\tau^w,y}$	Labour tax: output feedback	0.500	0.080	0.025	0.134	Gamma	0.300
$\theta_{\tau^k,y}$	Capital tax: output feedback	0.500	0.229	0.124	0.333	Gamma	0.300
$\theta_{g,b}$	Gov. cons.: debt feedback	0.400	0.116	0.059	0.169	Gamma	0.200
$\theta_{i_G,b}$	Gov. inv.: debt feedback	0.400	0.480	0.267	0.691	Gamma	0.200
$\theta_{tr,b}$	Transfers: debt feedback	0.400	0.363	0.137	0.588	Gamma	0.200
$\theta_{\tau^w,b}$	Labour tax: debt feedback	0.400	0.113	0.061	0.167	Gamma	0.200
$\theta_{\tau^k,b}$	Capital tax: debt feedback	0.400	0.101	0.031	0.169	Gamma	0.200
$\theta_{\tau^c,b}$	Consumption tax: debt feedback	0.400	0.206	0.142	0.269	Gamma	0.200

Notes: Posterior means and 90% HPD intervals; all values rounded to three decimals.

Table A.5: **Estimated parameters (cont.): Baseline Taylor rule ($\phi_f = 0$) model**

Parameter	Description	Prior mean	Post. mean	5% HPD	95% HPD	Prior	Pstdev
AR(1) shock persistences							
ρ_{ϵ^g}	Gov. cons. shock persistence	0.750	0.743	0.616	0.884	Beta	0.100
$\rho_{\epsilon^{i_G}}$	Gov. inv. shock persistence	0.750	0.589	0.395	0.716	Beta	0.100
$\rho_{\epsilon^{tr}}$	Transfers shock persistence	0.750	0.428	0.239	0.612	Beta	0.100
$\rho_{\epsilon^{\tau^c}}$	Cons. tax shock persistence	0.750	0.387	0.219	0.558	Beta	0.100
$\rho_{\epsilon^{\tau^w}}$	Labour tax shock persistence	0.750	0.459	0.246	0.674	Beta	0.100
$\rho_{\epsilon^{\tau^k}}$	Capital tax shock persistence	0.750	0.317	0.186	0.446	Beta	0.100
ξ_E	Employment adj. (Calvo-style)	0.500	0.602	0.492	0.710	Beta	0.100
ρ_{RP}	Dom. risk premium persistence	0.750	0.873	0.812	0.932	Beta	0.100
ρ_{RP^*}	Foreign risk premium persistence	0.750	0.891	0.861	0.921	Beta	0.100
ρ_{Y^*}	Foreign output persistence	0.750	0.984	0.975	0.993	Beta	0.100
$\rho_{\epsilon^{R^*}}$	Foreign MP shock persistence	0.750	0.535	0.479	0.595	Beta	0.100
ρ_{g_z}	Trend growth persistence	0.750	0.612	0.455	0.770	Beta	0.100
ρ_{ϵ}	Transitory tech. persistence	0.750	0.743	0.586	0.918	Beta	0.100
ρ_N	Labour shock persistence	0.750	0.739	0.576	0.906	Beta	0.100
ρ_C	Preference shock persistence	0.750	0.752	0.597	0.919	Beta	0.100
ρ_I	Investment shock persistence	0.750	0.760	0.605	0.912	Beta	0.100
ρ_{ϕ^W}	Wage markup persistence	0.750	0.559	0.398	0.714	Beta	0.100
ρ_{ϕ^H}	Domestic markup persistence	0.750	0.475	0.311	0.641	Beta	0.100
ρ_{ϕ^X}	Export markup persistence	0.750	0.656	0.486	0.829	Beta	0.100
ρ_{ϕ^*}	Import markup persistence	0.750	0.632	0.458	0.806	Beta	0.100
ρ_g	Gov. cons. process AR(1)	0.750	0.821	0.718	0.921	Beta	0.100
ρ_{i_G}	Gov. inv. process AR(1)	0.750	0.839	0.752	0.926	Beta	0.100
ρ_{tr}	Transfers process AR(1)	0.750	0.462	0.270	0.652	Beta	0.100
ρ_{τ^c}	Cons. tax process AR(1)	0.750	0.243	0.141	0.339	Beta	0.100
ρ_{τ^w}	Labour tax process AR(1)	0.750	0.418	0.219	0.626	Beta	0.100
ρ_{τ^k}	Capital tax process AR(1)	0.750	0.374	0.238	0.506	Beta	0.100

Notes: Posterior means and 90% HPD intervals; all values rounded to three decimals.

Table A.6: **Standard deviation of shocks (percent): Baseline rule ($\phi_f = 0$)**

Shock s.d.	**Description**	**Prior mean**	**Post. mean (%)**	**5% HPD**	**95% HPD**	**Prior**	**Pstdev**
η_{Y^*}	Foreign output	0.010	1.180	1.060	1.300	InvGamma	∞
η_{R^*}	Foreign policy rate	0.010	0.200	0.180	0.230	InvGamma	∞
η_g	Gov. consumption	0.010	0.690	0.580	0.810	InvGamma	∞
η_{i_G}	Gov. investment	0.010	4.160	3.710	4.610	InvGamma	∞
η_{tr}	Transfers	0.010	8.980	7.970	9.980	InvGamma	∞
η_R	Monetary policy	0.010	0.220	0.200	0.250	InvGamma	∞
η_{RP}	Dom. risk premium	0.010	0.410	0.270	0.560	InvGamma	∞
η_{RP^*}	Foreign risk premium	0.010	0.200	0.160	0.240	InvGamma	∞
η_{g_z}	Trend growth	0.010	0.350	0.220	0.480	InvGamma	∞
η_ϵ	Transitory technology	0.010	0.580	0.240	0.920	InvGamma	∞
η_N	Labour disutility	0.010	0.570	0.240	0.890	InvGamma	∞
η_C	Preferences	0.010	0.820	0.250	1.550	InvGamma	∞
η_I	Investment-specific	0.010	0.710	0.260	1.160	InvGamma	∞
η_{ϕ^H}	Domestic markup	0.010	0.580	0.350	0.820	InvGamma	∞
η_{ϕ^X}	Export markup	0.010	0.380	0.220	0.520	InvGamma	∞
η_{ϕ^*}	Import markup	0.010	0.700	0.340	1.060	InvGamma	∞
η_{ϕ^W}	Wage markup	0.010	0.290	0.190	0.390	InvGamma	∞
η_{τ^c}	Consumption tax	0.010	0.880	0.750	1.010	InvGamma	∞
η_{τ^w}	Labour tax	0.010	1.020	0.910	1.150	InvGamma	∞
η_{τ^k}	Capital tax	0.010	2.260	2.000	2.530	InvGamma	∞
$\eta_{\bar{\pi}^C}$	Inflation target	0.010	0.450	0.400	0.500	InvGamma	∞

Notes: Posterior means and 90% HPD intervals. Values shown are ×100 (percent).

Table A.7: OSR ranking with parameter values, welfare and CE gains (vs Estimated baseline, no-gap)

Scenario	ϕ_π	ϕ_y	ϕ_i	ϕ_f	ρ_g	$\theta_{g,y}$	$\theta_{g,b}$	$\theta_{g,f}$	ΔW (%)	CE (%)	$\Delta W/\sigma$
JO3	3.20	0.89	–	10.13	–	0.16	0.10	0.20	0.714	0.865	3.067
MD6	3.17	0.84	–	8.26	–	–	–	–	0.704	0.852	3.024
JO4	2.07	0.59	-2.42	2.74	-0.79	0.17	-0.04	-0.01	0.701	0.849	3.012
MD3	2.11	0.52	–	2.83	–	–	–	–	0.697	0.844	2.994
FD2	0.95	0.52	0.30	37.32	0.88	-0.16	0.49	0.16	0.643	0.778	2.763
JO2	1.72	0.45	0.16	–	0.55	0.08	0.04	–	0.549	0.665	2.360
MD2	1.67	0.42	0.19	–	–	–	–	–	0.543	0.657	2.333
MD5	1.65	0.42	0.29	–	–	–	–	–	0.541	0.654	2.323
Est. (with-gap)	1.48	0.36	0.93	0.43	0.82	0.05	0.12	–	0.538	0.651	2.311
MD1	4.79	1.10	–	–	–	–	–	–	0.438	0.530	1.884
JO1	3.01	0.76	–	–	0.90	-0.11	-0.04	–	0.401	0.485	1.723
MD4	4.70	1.27	–	–	–	–	–	–	0.313	0.379	1.346
Est. (no-gap)	1.57	0.40	0.90	–	0.82	0.05	0.12	–	0.000	0.000	0.000

Notes: ΔW and CE denote welfare and consumption-equivalent gains (in %) relative to the *Estimated (baseline, no-gap)* rule. $\Delta W/\sigma$ scales the welfare gain by the baseline standard deviation of W. Dashes indicate parameters not active in the given OSR configuration. The table ranks optimal simple rules by overall welfare/CE performance.

Table A.8: OSR ranking by household type with welfare and CE gains (vs Estimated baseline, no-gap)

Scenario	W_R (%)	W_{NR} (%)	ΔW (%)	CE (%)	CE_R (%)	CE_{NR} (%)
JO3	0.835	0.988	0.714	0.865	0.783	0.722
MD6	0.824	0.973	0.704	0.852	0.772	0.712
JO4	0.819	0.968	0.701	0.849	0.768	0.708
MD3	0.815	0.964	0.697	0.844	0.765	0.705
FD2	0.752	0.887	0.643	0.778	0.704	0.649
JO2	0.638	0.748	0.549	0.665	0.598	0.547
MD2	0.633	0.745	0.543	0.657	0.593	0.544
MD5	0.629	0.739	0.541	0.654	0.589	0.540
Estimated (with-gap)	0.640	0.768	0.538	0.651	0.600	0.561
MD1	0.511	0.602	0.438	0.530	0.479	0.440
JO1	0.457	0.528	0.401	0.485	0.428	0.386
MD4	0.367	0.435	0.313	0.379	0.344	0.317
Estimated (no-gap)	0.000	0.000	0.000	0.000	0.000	0.000

Notes: Definitions of $\mathscr{L}$, ΔW, CE, and scaling as in Table A.7. The table ranks optimal simple rules by overall welfare/CE performance. Percent welfare/CE gains for Ricardian and non-Ricardian households are computed relative to each group's own baseline utility/consumption. As a result, the aggregate percentage need not be a weighted-average of the subgroup percentages, and rankings may differ across panels. Subscripts R and NR refer to Ricardian and non-Ricardian households, respectively. CE gains rescale utility improvements by steady-state consumption. Because Ricardian households have higher consumption and lower marginal utility, a smaller welfare improvement can yield a larger CE for Ricardians than for non-Ricardians.

- **MD1–MD6:** Monetary-dominant regimes capturing various mandate changes and stabilisation designs.
  - MD1: Active, hawkish monetary rule prioritising price stability above fiscal or output objectives (inflation targeting with interest-rate smoothing).
  - MD2: Active monetary policy with limited interest-rate smoothing and no fiscal response (inflation targeting with flexible interest rate setting).
  - MD3: Active rule incorporating a strong fiscal-gap response, signalling coordination via the monetary-fiscal gap.
  - MD4: Quasi-active, hawkish monetary rule targeting fiscal conditions (maintains price stability via fiscal pressures on aggregate demand: see MD1 vs MD4).
  - MD5: Quasi-active monetary rule with low smoothing, reflecting, as in MD4, a mandate change.
  - MD6: Quasi-active, hawkish monetary rule with a fiscal-gap term capturing feedback from fiscal conditions.
- **FD1–FD2:** Fiscal-dominant or fiscally-led coordination regimes.
  - FD1: Quasi-fiscal financial repression or passive monetary adjustment consistent with active fiscal policy and passive monetary policy.
  - FD2: Fiscal-led coordination with active fiscal feedback on spending and debt—representing a credible fiscal rule under constrained monetary autonomy (fiscal dominance). Taylor principle broken.
- **JO1–JO4:** Joint-objective coordination frameworks.
  - JO1: Very hawkish monetary rule allowing fiscal drift (mildly unsustainable fiscal consumption spending).
  - JO2: Balanced monetary–fiscal coordination, with flexible interest rate setting.
  - JO3: Joint targeting rule with explicit response to the fiscal gap—representing the strongest welfare improvement under coordination.
  - JO4: Exhibits a significantly negative ϕ_i, which precludes interpreting it as a plausible coordination rule, especially since it cannot improve on JO3 welfare, which suggests no gains from flexible monetary and fiscal policy adjustments.

- *Estimated (with-gap):* Empirical benchmark including the monetary–fiscal gap term in the Taylor rule; reflects observed post-2010 coordination tendencies.
- *Estimated (no-gap):* Empirical baseline excluding the gap term; benchmark for welfare comparisons and a proxy for pure monetary targeting.