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Research article

Linking policy targets in navigating through fiscal-monetary crosswinds

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Abstract: The acceleration of debt dynamics resulting from increasing crises is a key issue in today's economic landscape. In this study, we proposed a solution by examining the relationship between money supply and public debt, adjusted for crisis distress. Applying this relationship to the intertemporal budget constraint of a consolidated government agent revealed the direct link between the public debt threshold and the inflation target. Building on this idea, we submitted a revised version of fiscal and monetary sustainability rules by linking their policy targets. The job was performed by introducing a joint component to monitor the gap between the money and public debt deviations from their equilibrium values. The given revision of the policy rules related to a strand of research in which the bond-to-money ratio was used as an effective joint nominal anchor to ensure fiscal and monetary solvency. Quantitative results demonstrated that such a revision could help counter abnormal financial volatility and shorten the time lag needed to restore debt sustainability and price stability under economic turbulence. In particular, the results outlined the initial conditions necessary to get on a promising growth path when the crisis hits. These conditions require balancing the short-term impact of the adjusted key policy rate and the long-term impact of public investment as a percentage of total public spending. An important implication of the study is that sharing responsibility by coordinating fiscal and monetary policy targets makes it less stressful for the economy under economic uncertainty. With this setup, fiscal mobility proves to be nearly twice as beneficial as monetary mobility when a fiscal dominance regime is appointed. Given these policy conditions, fiscal policy should be more responsive to the comparative volatility of the money supply and public debt to maximize the fiscal multiplier and welfare gains.

Keywords: fiscal-monetary interaction; fiscal policy target; monetary policy target; public debt; anti-crisis regulation; fiscal multiplier; welfare analysis; DSGE modeling

JEL Codes: C68, E63, G18, H63, O23

Abbreviations: DSGE—dynamic stochastic general equilibrium model; AF/PM—active fiscal passive monetary policy; PF/AM—passive fiscal active monetary policy; AF/AM—active fiscal active monetary policy; ZLB—zero lower bound.

1. Introduction

The acceleration of debt dynamics resulting from increasing crises is a key topic of discussion in today's policy debates. This discussion focuses on balancing cooperation and dominance in the fiscal-monetary interactions. Available data on these interactions prior to the COVID-19 pandemic suggest that introducing the alternative active and passive stances does the job as long as the policy actions are short-lived (e.g., Traum and Yang, 2010; Davig and Leeper, 2011; Cevik et al., 2014; Chen et al., 2022). The situation is different when the actions require more time to deliver policy goals. A recent example is the introduction of anti-crisis measures to overcome the economic turbulence associated with the COVID-19 pandemic. The turbulence was later exacerbated by the significant disruptions in logistics and excessive volatility in the energy markets. These factors accelerated the debt dynamics and led to a surge in inflation. Over time, it was clear that extreme price dynamics were challenging to handle using conventional monetary policy instruments when fiscal dominance lasted longer than usual. Raising the key policy rate was more or less successful in combating the unexpected inflation leap, which proved to be more persistent and required a tighter move (Michelis et al., 2024). However, a prolonged period of monetary tightening did not contribute to growth, opening a new stage of fiscal-monetary interactions that could take the form of a debt-inflation spiral (Bianchi and Melosi, 2019). This spiral could further accelerate the debt dynamics and bring it closer to the next financial crisis; this time, to be fiscal in nature (Honda et al., 2022).

It is uncommon for fiscal and monetary authorities to launch their policies on equal terms. In the real world, regardless of the four available combinations of active/passive stances, one policymaker often prevails over the other, or they may even act in opposition to each other: one entity tries to stimulate demand while the other does the opposite. This is because of the goals to be achieved that differ in implementation and timing. Given the limited timeframe for addressing the multiple crises, a combination of the active fiscal and monetary policies looks more beneficial. However, the joint proactive steps are not applicable in practice due to the potential for explosive pattern (the case of AF/AM in Leeper, 1991). A promising solution to this situation is to link the targets of fiscal and monetary sustainability. Thus far, several attempts have been made in the literature to do the trick by engaging a relationship between money supply and public debt. The general purpose was to find an effective joint nominal anchor to ensure fiscal and monetary solvency by pursuing local equilibrium determinacy (Schabert, 2006; Gokan and Turnovsky, 2025; Jin and Wang, 2024). Before the COVID-19 pandemic, the bond-to-money ratio remained relatively stable within a framework of policy decisions. However, as the pandemic unfolded, the ratio began to deviate more due to the prolonged period of fiscal dominance, requiring advanced solutions to operate in the newly established environment. Following the selected research strand, we address this issue by examining the relationship between money supply and public debt, adjusted for crisis distress.

Our results reveal four key findings: First, the direct link between the public debt threshold and the inflation target is proven. Second, the fiscal and monetary policy rules are revised to include a joint component that monitors the gap between the money and public debt deviations from their equilibrium values. The results of the quantitative analysis demonstrate that such a revision could help counteract abnormal financial volatility and shorten the time lag needed to restore debt sustainability and price stability. Third, we identify the initial conditions necessary to get on a promising growth path when the crisis hits. These conditions require balancing the short-term impact of the adjusted key policy rate and the long-term impact of public investment as a percentage of total public spending. Fourth, the research specifies the optimal policy conditions for maximizing the fiscal multiplier and welfare gains under a prolonged fiscal dominance regime. The study posits that fiscal policy should be more flexible since its mobility is nearly twice as beneficial as that of monetary policy.

2. Literature review

The edition of the IMF's Fiscal Monitor, dated April 2025, focused on the medium-term outlook and associated risks, mainly related to the accelerating trend of the global debt-to-GDP ratio. This trend is deteriorating as more than one-third of the countries in the sample, which account for 75% of global GDP, continue accumulating public debt faster in 2025 compared to 2024. In this regard, the structure of public spending will expand in the face of climate, technological, demographic, and political challenges. It is clear that fiscal and monetary adjustments are not the only reasonable measures to control debt accumulation, but comprehensive solutions involving novel policy patterns are needed.

Examining the modalities of the policy mix scenarios, Afonso and Gomes-Pereira (2024) argue that the active monetary stance is not the only necessary condition to ensure price stability, but it is also an influential factor in supporting fiscal sustainability. In this view, monetary stimulus could mitigate fiscal fatigue through the primary balance channel, increasing the potential for maintaining financial stability and compressing the horizon for achieving it. Using the same logic for fiscal policy, Caramp and Silva (2023) posit that, when the monetary authority initiates tightening, the first step in policy restrictions should be fiscal to address inflationary pressures effectively. Mao et al. (2024) confirm that the fiscal authority's timely and appropriate policy actions to control debt dynamics could contribute to private savings and balance inflation records. The proposed interaction is highly desirable in recessions when time is limited, and decisions are more pressing than usual (Kloosterman et al., 2024).

The value of the time-consistent policy in the fiscal-monetary nexus was discussed by Burgert and Schmidt (2014), who predict optimistic outcomes if the fiscal authority is forced to change its spending plans when the public debt indicator exceeds the acceptable limits. Consistent with this judgment, Hodula and Melecký (2020) found it beneficial for the fiscal authorities to design their expansion plans with a longer-term focus to meet sustainability conditions. The researchers, in particular, refer to the Tinbergen Principle, which expands on different goals with different instruments to be considered in policy decisions. This argument is also supported by Bianchi et al. (2022), who studied the introduction of an emergency budget component to address uncertainty in the policy mix scenario once the terms of fiscal dominance are protracted. Expanding on this concept, Cochrane (2022) revealed the fiscal theory of monetary policy, a special case that assumes fiscal dominance or a fiscally-led regime. In another paper, Bianchi et al. (2023) presented the fiscal theory of persistent inflation by analyzing the interaction of the fiscally-led and monetary-led policy mix patterns in scenarios where these policies interact in response to funded and unfunded fiscal shocks.

Given the variety of demonstrated techniques for introducing complex policy-mix environments, the biased moves of the fiscal and monetary agents to mitigate unnecessary outcomes prove to be justified. In this regard, trying to advance the monetary policy position, Ascari et al. (2023) examined the price level targeting regime under four policy mix scenarios. The researchers claim that, when following the neo-Fisherian effect, it is reasonable for the monetary authority to respond positively by raising the policy rate in the AF/PM regime. This finding remains valid under the inflation targeting regime when the key coefficient in the Taylor rule specification is changed to negative, thereby proving the logic of maximizing the wealth effect and avoiding a liquidity trap. Moreover, Rodriguez-Rodriguez et al. (2024) emphasized the importance of incorporating money growth in the monetary policy rule to address the fruitful fiscal expansion plans and effectively tame the unexpected inflation records.

As crises are getting progressively longer, leaving shorter periods for restoring sustainability conditions, the pronounced distinctions between AF/PM and PF/AM regimes gradually dissipate amid escalating disruptions. In support of this statement, if the fiscal and monetary dominance is extended in time due to prolonged economic turmoil, the growing structural imbalances could translate into widening gaps that would be difficult to reverse when operating on limited time horizons. In this regard, Bolhuis et al. (2024) introduced a new term, "fiscal-monetary gap", focusing on fiscal policy as a leader. This term represents the gap between two policy rates: the "fiscal R-star" and the "monetary R-star", also known as the neutral R-star. The "fiscal R-star" is a more complex term because its validity as a real interest rate used for stabilization purposes involves fulfilling four targets: the target for the public debt ratio, the long-term cyclically adjusted primary balance, the inflation target, and the potential growth rate. The monetary R-star instead considers only two targets: the inflation target and the potential growth rate. To prevent the fiscal-monetary gap from widening, the fiscal and monetary authorities should collaborate in establishing shared targets when pursuing sustainability policies. In support of this claim, Afonso and Sousa (2024) considered scenarios involving a cross-link between fiscal and monetary policy instruments. The obtained conclusions are encouraging in that the monetary policy reaction function incorporates a cyclically adjusted primary balance to address price stability effectively. Conversely, fiscal policy is impacted by a short-term interest rate, which is vital for preserving debt sustainability.

Another promising solution to effectively address the fiscal-monetary gap, especially in periods of economic turbulence accompanied by fiscal stress, involves anchoring expectations by binding them to a jointly established target within a framework of fiscal-monetary interaction. Building on this idea, Bartsch et al. (2019) proposed a "going direct" policy for situations where fiscal and monetary anti-crisis measures have been exhausted. In particular, they emphasize the importance of a policy anchor that fiscal and monetary authorities should consider to counteract long-lasting economic distress. According to Schabert (2006), this nominal anchor could be the relationship between public debt and money supply. Gokan and Turnovsky (2025) defended this idea by pointing to the relatively stable dynamics of the bond-to-money ratio even during short-term crises. Jin and Wang (2024) took this proposition further and examined the "mixed-targeting rule", which considers a combined response of the monetary authority to the public debt growth and inflation pressures. The mixed rule takes into account the public debt and inflation deviations from their targets, depending on how much these deviations influence the central bank's decision to balance active fiscal measures through the money-financed channel.

The central bank's initiative to monitor a key fiscal indicator proposed by Jin and Wang (2024) serves as a joint nominal anchor, but the plan is implemented on the monetary side. The longer fiscal dominance persists, the more power the monetary authority should be granted to restore sustainability.

Tian et al. (2025) also corroborated this thesis by examining the efficacy of monetary accommodation strategies in response to fiscal stimulus. The authors emphasize that the success of the two policy interactions is contingent upon the persistence of fiscal expansion, which affects them through the channels of expected inflation and the financial accelerator. However, it should be noted that, even with the full arsenal of policy instruments, the central bank cannot accurately predict the duration of the observed dominance regime and subsequent recovery period. Consequently, it is challenging to determine the optimal measure of policy responsiveness to operate effectively over extended horizons. This study fills the gap by linking fiscal and monetary policy targets within a framework that exploits the potential of a joint nominal anchor to be considered by fiscal and monetary agents. For this, we employed an equation that captures the relationship between money supply and public debt, adjusted for crisis distress. The given equation was then used to revise the fiscal and monetary policy rules by adding a joint component that monitors the gap between the money and public debt deviations from their equilibrium values. The study results demonstrate that this policy revision could help reduce unnecessary volatility in financial indicators and shorten the time lag for restoring debt sustainability and price stability.

3. Fiscal and monetary dominance: The stylized facts

The research presented is closely linked to three key concepts that must be understood from the outset: Dominance score, dominance regime, and the joint policy target. A dominance score measures the extent to which the fiscal and monetary authorities can implement policy decisions, resulting in comparative volatility in public debt and money supply. A dominance regime relates to fiscal or monetary superiority in making policy decisions and depends on whether the dynamics of the dominance score are accelerating or decelerating. A joint policy target is a component of the policy sustainability rule that applies to the implementation of both fiscal and monetary policy.

Fiscal dominance, a non-Ricardian policy introduced by Woodford (1995), and monetary dominance are opposing regimes that have a "purely theoretical nature" (Hinterlang and Hollmayr, 2022). In the territory of fiscal-monetary interaction, it is better to deal with fiscally-led and monetary-led concepts, which were effectively employed by Bianchi et al. (2022) and Ascari et al. (2023). In their interpretation, the fiscally-led regime considers active fiscal and passive monetary policy. However, monetary policy is not only obliged to be passive, but also less active for a considerable period of time until debt sustainability and price stability are restored. Conversely, the monetary-led regime coexists with a passive fiscal policy, which is not an obstacle to being always passive but rather less active in some crucial situations.

The literature review above argues for anchoring expectations by linking the fiscal and monetary policy targets. As suggested by Schabert (2006), Gokan and Turnovsky (2025), and Jin and Wang (2024), linking public debt with money supply can provide an effective joint nominal anchor in the pursuit of local equilibrium determinacy. Following this suggestion, the relationship between public debt (a fiscal target) and money supply (a monetary target) can be a good benchmark for distinguishing between fiscal and monetary dominance. In this regard, the extent to which the money supply responds to the change in public debt can be interpreted as a dominance score (k^d). The given approach is reasonable given that the bond-to-money ratio remained relatively stable until the COVID-19 pandemic. This stability ensured fiscal and monetary solvency within the framework of policy decisions. However, being relatively stable does not necessarily mean that the dominance score is

always a constant parameter. A more comprehensive study of the dominance score and its dynamics over time allows for more progressive conclusions.

The distinction between fiscal and monetary dominance provides insights into the realism and consistency of policy leadership in balancing cooperation and dominance. A closer look at the dynamics of the dominance score (k^d) reveals that fiscal and monetary authorities can effectively alternate their leadership during policy implementations. A linear trend is one possible trajectory for the dominance score dynamics. If $\boldsymbol{k^d}$ changes over the observation period with acceleration (the value of the derivative is above zero), the dominance is fiscal. Conversely, if the dynamics of the dominance score slow down (the value of the derivative is below zero), the dominance is monetary. There is also a third option when the value of the dominance score remains unchanged for some time (the derivative is zero):

$$Monetary - led < \frac{\partial k_t^d}{\partial_t} = 0 < Fiscally - led, \quad (1)$$

The proposed distinction between fiscal and monetary dominance relates to the nature of fiscal-monetary nexus. In the event of a public spending shock, the fiscal authority finances the deficit using available instruments, including debt, thereby increasing the demand for money. This demand can be satisfied through various financial channels. Suppose the monetary authority adopts a restrictive measure rather than an expansionary one (an active monetary stance). In this case, the dynamics of public debt must exceed the dynamics of money supply, leading to a slowdown in the dynamics of the dominance score. Conversely, the dominance score must accelerate if the monetary authority anticipates the fiscal expansion and reacts positively (a passive monetary stance).

Applying Assumption (1) and fixing the relationship between the monetary aggregate M3 and public debt, a more systemic picture of the dominance score dynamics arises by swapping fiscal and monetary policy advantages. In the case of the United States over 1992–2023, the trend of the dominance score was broken four times, when advancing monetary activity gave a pathway to fiscal superiority with more or less impressive movements (Figure 1). It is not always the case that the monetary or fiscal superiority changes to fiscal or monetary inferiority in a rational order. The degree of active position is also a matter of speculation. That is, monetary dominance can be changed to a less active position, leaving space for fiscal superiority for future interaction.

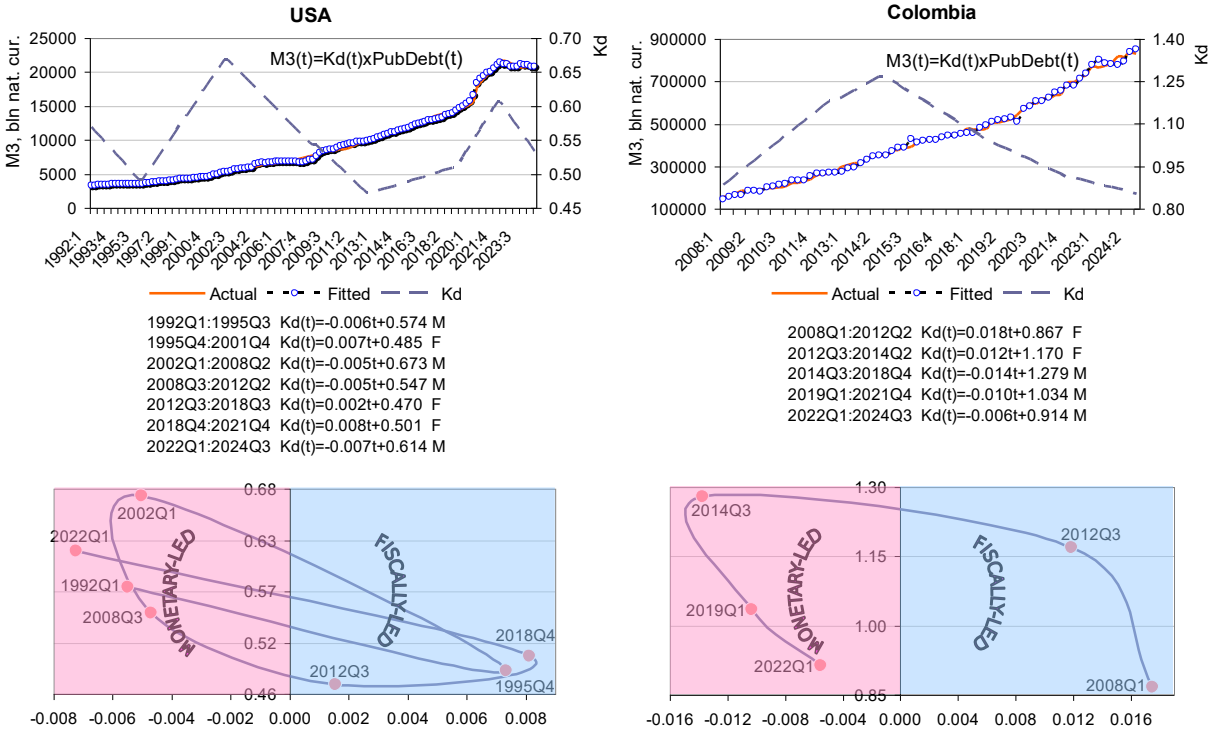

Figure 1. Distinguishing fiscal and monetary dominance: The case of the United States versus the case of Colombia. Source: OECD statistics and the author's calculations.

What is remarkable in the presented differentiation format is how many times the dominance score changed its direction: Four times in the case of the United States and only once in the case of Colombia (see Figure 1). With a leading world currency, the developed economy of the United States enabled changing the active positions of fiscal and monetary authorities, which was more often than a developing economy or even an emerging market can allow itself. Furthermore, all these significant changes in the dominance score dynamics are brought about by mounting economic turbulence. From this perspective, a developed economy can effectively switch between fiscal and monetary leadership to survive crises.

The relationship between money supply and public debt is a complex phenomenon that requires further detailed study. The dominance score introduced above measures the transmission mechanism through which public deficit financing affects the money creation channel. A closer look at the relationship between money supply and public debt requires considering two significant factors. The first factor is a big cluster of financial intermediaries involved in the broad money creation. These intermediaries carry out many transmission transactions to achieve equilibrium state in the money market. The second factor is related to economic turbulence. Attempting to capture the extent to which public debt deviates from its steady state during economic turbulence provides a comprehensive view of the monetary transmission mechanism. Should the gap of the public debt ratio relative to its steady state increase during a crisis, the transmission mechanism through which the money supply responds to the change in public debt becomes more robust. These two factors lead to a non-linearity, which must be considered when building the relationship between money supply and public debt. Following Shvets (2023), the given specification takes the form:

$$M_t = k^d B_t e^{\frac{B_t}{P_t Y} - \frac{\bar{B}}{\bar{Y}}}, \quad (2)$$

where M is the nominal money balances; B is the nominal holdings of government bonds; P is the aggregate price level; Y is output; and the dash above the indicator refers to the steady-state value.

In Equation (2), the dominance score (k^d) corresponds to the measure of debt burden that is translated into broad money creation. The nonlinear component represents irregular movements of the public debt-to-GDP ratio relative to the steady state, which simulates the turbulence the economy experiences during crises. The greater the deviation of the public debt ratio from the steady state, the more money is supplied to reinforce the given degree of the dominance position. Using the well-known equation of exchange, the nonlinear component can be interpreted as the ratio of public debt to the product of money and the velocity of the money. Assuming that fiscal and monetary authorities work together to mitigate the negative consequences of crises, such crises are unlikely to last long. Based on this assumption, the money velocity can be abstracted in the short term. Consequently, the nonlinear component in Equation (2) captures the deviation of the debt-to-money ratio from the steady state.

The nonlinear component of Equation (2) also represents how effective the fiscal and monetary authorities are in their cooperation without going beyond their policy targets. Since the public debt is measured at current prices (P_t), both fiscal and monetary authorities are responsible for the dynamics of public debt. This is particularly relevant to the central bank's mandate to keep the price level within a specific target range.

It is not the first time the term "dominance score" has been introduced. Resende (2007) initiated an interesting quantitative discussion on the dominance parameter and its explanation. In the researcher's interpretation, the parameter (k) takes the value from 0 to 1. In the case of $k = 1$, the fiscal authority is responsible for outstanding public debt backed by a primary surplus. Conversely, when $k = 0$, the monetary authority is responsible for the price mandate, provided that the outstanding public debt is backed by seigniorage revenues. Nonetheless, the presented parameter closely resembles the term of dominance score used in the current paper. When formulating the aggregate price level from the long-term perspective, Resende (2007) refers to the outstanding public debt backed by issuing money, which acts the same way as money creation. Following this point of view, there is a mere relationship between money supply and public debt, which is balanced by the value of dominance score.

4. The public debt threshold and the key policy target: Some simple arithmetics

The fiscal and monetary balance sheets are closely linked to the government's and the central bank's intertemporal budget constraint equations. These equations establish the relationship between accumulated financial reserves (liabilities) and the directions of spending funds, depending on their purpose and administration (assets). In developing and implementing economic policy, the balance sheets of the government and the central bank are usually considered a consolidated agent that confirms the interaction of monetary and fiscal policies:

$$\frac{B_t}{P_t} - \frac{B_{t-1}}{P_{t-1}\pi_t} + \frac{M_t}{P_t} - \frac{M_{t-1}}{P_{t-1}\pi_t} = G_t - T_t + i_t \frac{B_{t-1}}{P_{t-1}\pi_t}, \quad (3)$$

where ***B*** is the nominal holdings of government bonds; ***M*** is the nominal money balances; ***P*** is the aggregate price level; ***G*** is the real public spending; ***T*** is real taxes; ***π*** is inflation; and ***i*** is the nominal cost of public borrowing.

In terms of output share, Equation (3) can be rewritten as follows:

$$\frac{B_t}{P_t Y_t} - \frac{B_{t-1}}{P_{t-1}\pi_t Y_{t-1}}\frac{1}{1+g_t} + \frac{M_t}{P_t Y_t} - \frac{M_{t-1}}{P_{t-1}\pi_t Y_{t-1}}\frac{1}{1+g_t} = \frac{G_t - T_t}{Y_t} + i_t \frac{B_{t-1}}{P_{t-1}\pi_t Y_{t-1}}\frac{1}{1+g_t} \Rightarrow$$

$$\left|\frac{1+x}{1+y} - 1 = \frac{1+x-1-y}{1+y} = \frac{x-y}{1+y} \approx x - y(if\,|y|<1)\right| \Rightarrow b_t = \frac{1+r_t}{1+g_t} b_{t-1} + d_t - \Delta m_t \quad (4)$$

$$\Rightarrow b_t - b_{t-1} = (r_t - g_t)b_{t-1} + d_t - \Delta m_t,$$

where ***b*** is public debt ratio; ***r*** is the real cost of public borrowing related to the real key policy rate; ***g*** is growth rate; ***d*** is the budget deficit as a share of output; and ***Δm*** is the seigniorage as a share of output.

Equation (4) is a well-known equilibrium rule that tolerates debt accumulation without raising the debt-to-GDP ratio, or even enabling it to go down if the growth rate is higher than the real policy rate. However, a favorable "***r-g***" environment (so-called growth differential) does not necessarily guarantee debt sustainability, as it can legitimize fiscal profligacy and revitalize embedded risks by pulling in broader factors (Blanchard, 2019).

Equation (4) can be further transformed by incorporating the above-tested specification (2), which yields:

$$b_t - b_{t-1} = (r_t - g_t)b_{t-1} + d_t - \Delta m_t \Rightarrow \left\langle m_t = k^d b_t e^{b_t - \bar{b}} \right\rangle \Rightarrow$$

$$\left|t \to 0 \Rightarrow e^{b_{t-1}-\bar{b}} \approx e^{b_t - \bar{b}} \Rightarrow \Delta m_t = k^d \Delta b_t e^{b_t - \bar{b}}; d_t \cong b_t - b_{t-1}\right| \Rightarrow \quad (5)$$

$$\Rightarrow g_t = r_t - k^d \frac{b_t - b_{t-1}}{b_{t-1}} e^{b_t - \bar{b}},$$

Equation (5) posits that the growth rate depends on the difference between the real cost of public borrowing, which is consistent with the key policy rate (***r***), the monetary policy instrument for maintaining price stability, and the change in the public debt ratio (***b***), the fiscal policy instrument for maintaining debt sustainability. According to the given equation, the effects of fiscal and monetary policy interactions depend on the effectiveness of leveraging the highly liquid debt instruments. These instruments are government bonds and base money used to preserve sustainability in the specified perspectives. One perspective is that the public debt threshold determines the fiscal space available to implement the fiscal policy. The other perspective is that manipulating the key policy rate enables the central bank to maintain inflation within a specified target range. Given the reconstructed intertemporal budget constraint of the consolidated government agent, economic growth is promising when the real policy rate exceeds the growth rate of the public debt ratio, taking into account the dominance score and the deviation of the public debt ratio from its steady state.

An important point at the outset of implementing a fiscal dominance regime is the relationship between the real policy rate and the public debt ratio, as well as the significance of the dominance score value. However, the dominance score is not usually considered when making policy decisions. The real data of this indicator is used to be greater than 1 for developing economies, and less than 1 for advanced economies and emerging markets. The situation is consistent when considering the key

policy rate: The more developed an economy is, the lower the value of the key policy rate. For this reason, developing economies cannot be so committed to debt manipulation, which is not the case for advanced economies (see Figure 1). Additionally, it is important to note that monetary control through manipulation of the key policy rate may be less effective for developing economies, particularly over longer horizons, due to imperfect financial institutions (Bublyk et al., 2023).

Until the onset of the COVID-19 pandemic, the monetary authority responded to fiscal dominance with a lag, allowing the real policy rate to remain low. This fiscal and monetary policy mix is essential for supporting aggregate demand and mitigating the economic downturns during crises. Looking ahead, if fiscal dominance is combined with monetary accommodation over an extended period, there is a risk that the public debt ratio could deviate significantly from its steady state, thereby increasing the probability of the next financial crisis.

By transforming Equation (5) with a simple arithmetic procedure, it is possible to determine the public debt threshold above which public debt contributes negatively to growth. The transformation involves calculating the derivative of the ratio of the growth rate (g_t) to the public debt-to-GDP ratio at the previous period (b_{t-1}) and equating the solution to zero. The obtained results are significantly affected by the gap between the public debt ratio in the current and previous periods and by the observation interval. If this gap is negligible, the theoretical value of the public debt threshold approaches 100% of GDP, determined within the range of 10% to 160% (Figure 2):

$$\frac{\partial g_t}{\partial b_{t-1}} = k^d \frac{b_t}{{b_{t-1}}^2} e^{b_t - \bar{b}}$$

$$\frac{b_t}{{b_{t-1}}^2} e^{b_t} \to min \Rightarrow b_t - b_{t-1} \to 0 \Rightarrow b_{thr} \to 100\% \tag{6}$$

$$min \frac{b_t}{{b_{t-1}}^2} e^{b_t} \approx e^{b_{thr}} = e^1 = 2.718,$$

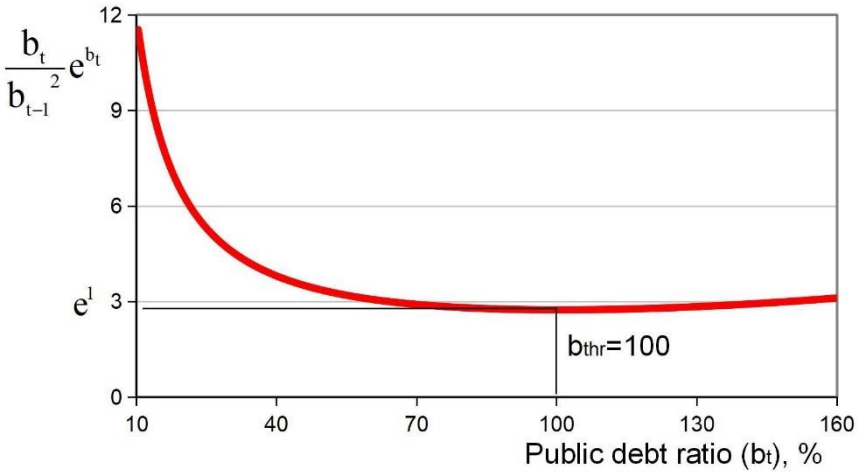

Figure 2. Estimating the public debt ratio threshold.

The assumption that b_t-b_{t-1} is negligible relates to estimating the theoretical value of the public debt-to-GDP threshold. In the real economy, however, the actual difference can be greater than indicated, resulting in the debt threshold figures that exceed the theoretical value of 100%. These figures become even more pronounced during crises due to increased public demand for financing growing expenditures. Though under other things being equal, the indicated threshold ratio would hardly surpass the theoretical level by ten percentage points during economic unrest, the theoretical underpinning for evaluating the public debt threshold remains valid.

At least four corollaries can be drawn from the obtained results by assessing the public debt threshold. The first is that the greater the deviation of the public debt-to-GDP ratio from the threshold toward higher values, the more output the economy must produce to offset the adverse effects of the inflated debt. According to the IMF's 2024 World Debt Monitor, public debt resumed its upward trend and reached 94% of GDP. This value is very close to the theoretical threshold of 100%. The second corollary is that the rate at which public debt is accumulated must be considered first when calculating the public debt threshold. The third corollary is that the rising trajectory of the public debt-to-GDP ratio (exponential function) is not robust in measuring the threshold value (see Figure 2). A good example is Japan, where the public debt-to-GDP ratio equals 263% of GDP as of the beginning of 2025. The rational explanation is that the theoretical value of the public debt threshold is only a starting point since the equilibrium values of the dominance score, the key policy rate, and the inflation rate can update the result (see Equation (5)). Developing the logic of the last comment, one can guess that the equilibrium inflation rate is nothing more than an inflation target, which is the fourth corollary. According to this interpretation, equilibrium growth is related to the growth associated with a public debt threshold (see Figure 2). This viewpoint is based on the assumption that without sufficient "crucial" innovations, a sustainable economy can reach the public debt threshold within an extended timeframe. Using Equation (5) and its derivative (6), the inflation target can be obtained by equating the equilibrium growth rate to zero:

$$g_t = i_t - \pi_t - k^d \frac{b_t - b_{t-1}}{b_{t-1}} e^{b_t - \bar{b}}$$

$$\bar{g} = \bar{\imath} - \bar{\pi} - \bar{k}^d e^{\bar{b}} \tag{7}$$

$$\bar{g} = 0 \Rightarrow \bar{\pi} = \bar{\imath} - \bar{k}^d e^{\bar{b}},$$

The resulting Equation (7) proves the relationship between the public debt threshold and the inflation target. This significant statement validates the direct link between the fiscal and monetary policy targets. Specifically, it suggests that heavily indebted economies must prepare for rising prices to offset the negative consequences of inflated debt. Figure 3 illustrates the data confirmation of the established relationship between the fiscal and monetary policy targets in the US economy. The first chart shows the core relationship between the public debt trend and the inflation target, where the public debt trend is equivalent to the equilibrium trajectory of the central government debt. This indicator is considered an alternative to general government debt, highlighting the impact of the highest component of the US public debt, which is on an upward trend, changing from 79% in 1960 to 85% in 2024. Until 2008, the 2% target effectively anchored monetary policy decisions. Since then, the central government's debt has grown rapidly, prompting the Federal Reserve System to update the target rate to a higher value. When additional factors are considered, including the key policy rate and the

dominance score, the outcome remains consistent but is more pronounced (see Figure 3, second chart). The turning point is associated with the spread of the COVID-19 pandemic. Since then, inflation has consistently exceeded the 2% target and even the target range, indicating an upward trend. In this situation, the rational proposal would be to raise the policy target to provide the monetary authority with more "ammunition" for manipulation, at least as a short-lived preventive measure (Bernanke and Blanchard, 2025). Rachel and Summers (2019) also argue for raising the monetary policy target, emphasizing a secular stagnation hypothesis.

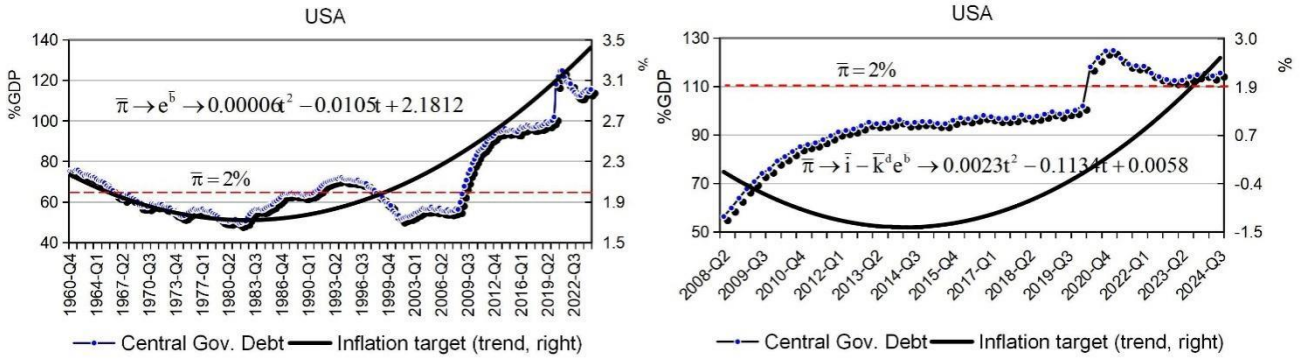

Figure 3. Relationship between public debt and inflation targeting in the United States. Source: OECD statistics and the author's calculations. Note: ***i*** is the immediate interest rates, call money, and interbank rate.

Given the global trend of rising public debt, it is only a matter of time before the open fiscal space is closed. Moreover, this time may come much sooner than expected due to the lack of "crucial" innovations and the acceleration of crisis distress. A more progressive movement of the dominance score creates an obvious risk of uncontrolled price dynamics. Therefore, the value of the dominance score is unlikely to be higher in the near future, leaving space for more intensive fiscal-monetary interplay.

5. Methods of the quantitative study

As outlined in Sections 3 and 4, the proven relationship between fiscal and monetary policy targets provides a theoretical framework that requires further examination using a quantitative study. Logical reasoning suggests reshaping this relationship into the modified fiscal and monetary policy sustainability rules. With these modified rules in hand, fiscal and monetary authorities could pursue a joint policy target to achieve the desired sustainability effect.

Implementing fiscal dominance leaves no choice but to decide on well-considered policy steps to weather the public spending shock. Fiscal dominance will likely last longer than usual if the conditions are more severe. Such severe conditions require sizeable efforts to achieve the expected results. Thus, the destabilizing and recovery periods may be more extended in any case. To restart the story but with a more optimistic narrative, an attempt was made to restore debt sustainability and price stability within a reasonable timeframe by linking fiscal and monetary policy targets.

The assigned task involves using a quantitative framework to achieve the stated goals. This framework is the NK model based on the study of Shvets (2023) for a small open developing economy. Here, the researcher addresses fiscal and monetary issues by attempting to solve the

dominance-sustainability puzzle, a cornerstone of fiscal-monetary interaction. Specifically, the researcher examines how the modified fiscal and monetary sustainability rules could mitigate the negative consequences of fiscal dominance, such as the crowding-out effect and excessive macroeconomic volatility. The main contribution of the study is the introduction of an empirical specification that represents the nonlinear relationship between money supply and public debt.

The model structure incorporates a complex lifetime utility-generating function for Ricardian and non-Ricardian households with additive separability in preferences between private and government consumption, and the real money holdings. The model structure considers the low efficiency of public investment and the negative relationship between the interest rate premium and foreign price fluctuations. The firm's stuff exhibits a direct endogenous effect of public investment on output by including public capital in its production function. There are also several rigidities, such as deep habit formation, Calvo pricing, and the wage stickiness.

Central to the model structure are unique fiscal and monetary policy blocks. These blocks are reconstructed specifications of fiscal and monetary sustainability rules by referring to Equation (2). The revised specification introduces a new key factor that monitors the gap between the logarithms of money and public debt deviations from their equilibrium values. In the newly established policy framework, money, a purely monetary indicator, is used for fiscal adjustments. The logarithmic form of the expression encourages the fiscal authority to respond promptly, moving further away from the time reference point. The model underscores the monetary transmission channel for creating money through the issuance of debt financial instruments to meet fiscal adjustment needs and achieve fiscal sustainability goals. Taking the simple fiscal sustainability policy rule by Galí et al. (2007) and performing some arithmetic with Equation (2) yields the following:

$$T_t - \bar{T} = \sigma_g(G_t - \bar{G}) + \sigma_b\left(\frac{B_{t-1}}{P_{t-1}} - \bar{B}\right) \Rightarrow$$

$$\Rightarrow \frac{T_t - \bar{T}}{\bar{Y}} = \sigma_g \frac{G_t - \bar{G}}{\bar{Y}} + \sigma_b\left(\frac{B_{t-1}}{P_{t-1}\bar{Y}} - \frac{\bar{B}}{\bar{Y}}\right)$$

$$M_t = k^d(B_t)e^{\frac{B_t}{P_t\bar{Y}} - \frac{\bar{B}}{\bar{Y}}} \Rightarrow \frac{B_t}{P_t\bar{Y}} - \frac{\bar{B}}{\bar{Y}} = log\left(\frac{M_t}{B_t}\right) - log\, k^d \tag{8}$$

$$k^d = \frac{\bar{M}}{\bar{B}} \Rightarrow \frac{B_{t-1}}{P_{t-1}\bar{Y}} - \frac{\bar{B}}{\bar{Y}} = log\left(\frac{M_{t-1}}{B_{t-1}}\right) - log\left(\frac{\bar{M}}{\bar{B}}\right)$$

$$\frac{T_t - \bar{T}}{\bar{Y}} = \sigma_g \frac{G_t - \bar{G}}{\bar{Y}} + \sigma_b\left(log\frac{M_{t-1}}{\bar{M}} - log\frac{B_{t-1}}{\bar{B}}\right),$$

where $\boldsymbol{T}$ is lump-sum taxes; $\boldsymbol{G}$ is public spending; $\boldsymbol{\sigma_g}$ is the elasticity of lump-sum taxes to public spending; $\boldsymbol{\sigma_b}$ is the elasticity of lump-sum taxes to public debt; $\boldsymbol{B}$ is total public debt in domestic and foreign currencies; $\boldsymbol{M}$ is money balances; and $\boldsymbol{Y}$ is total output; and the dash above the indicators refers to the steady state.

The monetary policy sustainability rule is an alternative specification of the Taylor rule. Under the newly specified rule, the monetary authority reacts not only to deviations of inflation, output, and the exchange rate from their steady-state values, but also monitors the gap between the velocity of money creation and the degree of fiscal dominance by taking into account the contribution of public

debt movement. As long as the money creation remains within the limits of public debt accumulation, the potential threat of uncontrolled price dynamics is minimal. Otherwise, the nominal interest rate is expected to rise, which reduces the risk of unpredictable inflationary pressures. Using the modified Taylor rule proposed by Kumhof et al. (2010) and performing the identical arithmetic with Equation (2), as shown in Equation (8), gives the following result:

$$i_t^n = \bar{\imath}^n + \rho_i(i_{t-1}^n - \bar{\imath}^n) + \rho_\pi(\pi_{t-1} - \bar{\pi}) + \rho_y(Y_{t-1} - \bar{Y}) + \rho_s(s_{t-1} - \bar{s}) + \rho_b\left(\frac{B_{t-1}}{P_{t-1}\bar{Y}} - \frac{\bar{B}}{\bar{Y}}\right)$$

$$i_t^n = \bar{\imath}^n + \rho_i(i_{t-1}^n - \bar{\imath}^n) + \rho_\pi(\pi_{t-1} - \bar{\pi}) + \rho_y(Y_{t-1} - \bar{Y}) + \rho_s(s_{t-1} - \bar{s}) \quad (9)$$

$$+\rho_b\left(log\frac{M_{t-1}}{\bar{M}} - log\frac{B_{t-1}}{\bar{B}}\right),$$

where $\boldsymbol{i_n}$ is the nominal interest rate; $\boldsymbol{\rho_i}$, $\boldsymbol{\rho_\pi}$, $\boldsymbol{\rho_Y}$, $\boldsymbol{\rho_s}$, and $\boldsymbol{\rho_b}$ are positive parameters that measure the degree of reaction to deviations from the steady-state of the nominal interest rate, inflation, output, exchange rate, and the public debt, respectively.

The Dynare code of the DSGE model can be found in Appendix A.

6. Results

The presented DSGE model is used to generate two scenarios that simulate alternative economic recovery strategies when the crisis hits. Under given conditions, the fiscal authority triggers a public spending shock to maintain aggregate demand and mitigate economic downturn. To support these proactive fiscal steps, the government raises additional funds by issuing bonds in local and foreign currencies. Due to the risk of excessive exchange rate volatility, both scenarios restrict the amount of funds raised through external public borrowing, with priority given to financing the budget deficit by issuing domestic government bonds. Thus, the allocation of domestic and foreign bonds is valued at a ratio of 2 to 1. These conditions are closely linked to the COVID-19 pandemic, when each country could rely on itself to implement regional anti-crisis measures, which was a strong argument for survival. The two scenarios differ in how the monetary policy instruments are adjusted to weather the public spending shock. Scenario 1 assumes a passive monetary response to fiscal dominance ($\boldsymbol{\rho_b} = 0$), while scenario 2 considers an adequately motivated response ($\boldsymbol{\rho_b} = 0.1$). A tight monetary stance is associated with a lower degree of fiscal dominance ($\boldsymbol{k^d} = 0.9$), whereas a passive monetary stance corresponds to a higher dominance score under a fiscal dominance regime ($\boldsymbol{k^d} = 1.25$; see Figure 1 for Colombia's case).

Fiscal and monetary authorities take anti-crisis steps to effectively address the crisis and facilitate a rapid economic recovery by following a fiscally-led regime in the terminology of fiscal-monetary interaction. In this policy mix, it is important to know how long the fiscal dominance will be valid and how far the government is willing to go to pursue the expansion measures to achieve acceptable results. There are no direct answers to these questions, which typically arise at the initial stage of policy elaboration. The best solution in this situation is to consolidate the efforts of the monetary and fiscal authorities by coordinating their sustainability targets. This is accomplished by incorporating a unique component common to fiscal (8) and monetary (9) policy rules to address the issues associated with a prolonged fiscal dominance.

The simulation results of the economy's response to a public spending shock are encouraging. They provide a practical example of fiscal-monetary interaction under crisis distress. The results show that the time needed to restore debt sustainability and price stability is shorter in Scenario 2, which involves an active monetary response to public debt growth, than in Scenario 1, which involves a passive monetary stance (Figure 4). This is crucial because the faster the economy recovers from a shock, the shorter the destabilizing period and its negative consequences. In Scenario 1, the recovery period is prolonged, negatively impacting the output, which experiences the lasting crowding-out effect. A similar situation can be observed in the real world, which is on the way to achieving the outlined sustainability targets. This is why the Federal Open Market Committee began lowering the federal funds rate in September 2024, even though the US economy had not yet reached its inflation target range.

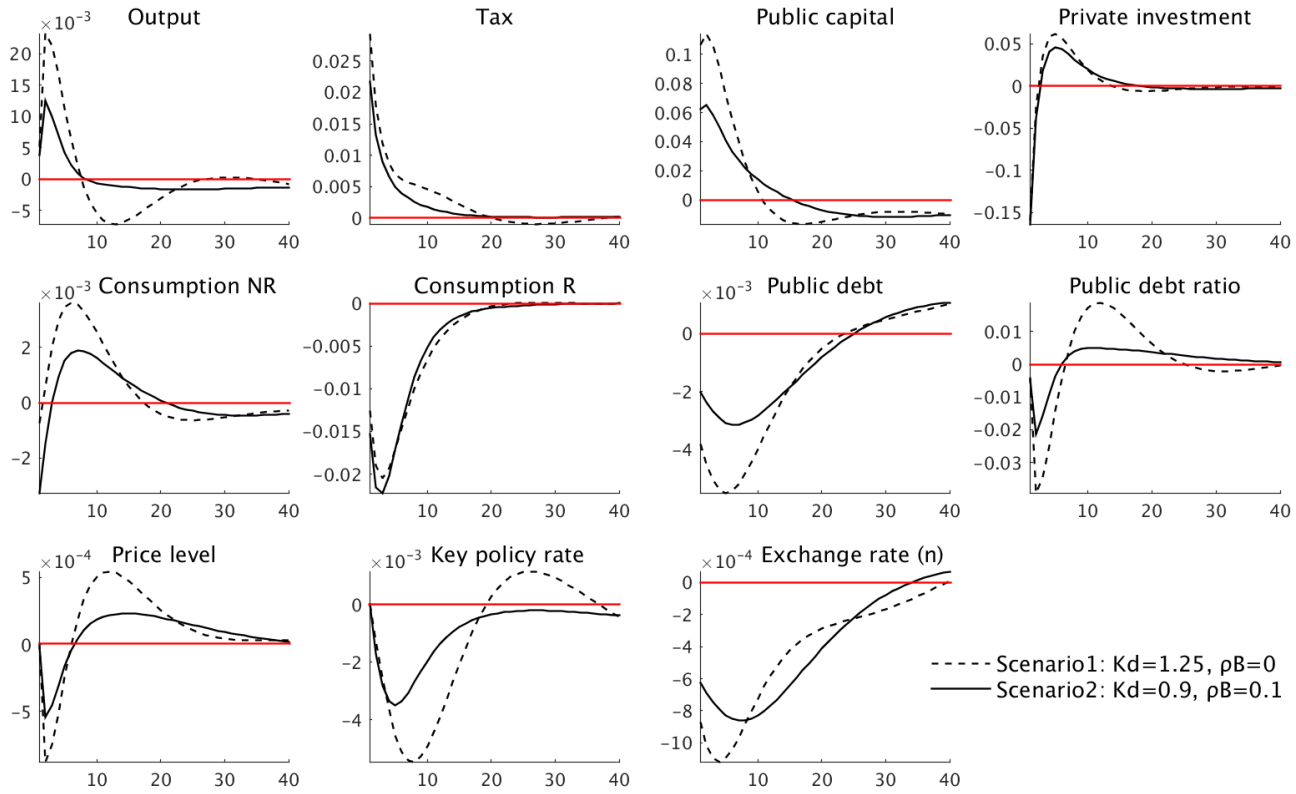

Figure 4. Reaction to a public spending shock, depending on the degree of the monetary policy response to the comparative volatility of the money supply and public debt (percentage deviation from the steady state). Note: The fiscal policy rule parameter $\sigma_B = 0.1$.

Active monetary steps to prevent the negative consequences of a prolonged fiscal dominance regime are helpful and motivating. However, they also have one drawback: They suppress the growth impulse. The point is that the degree of fiscal dominance is positively correlated with output in the short run because the dominance regime is a short-lived policy. A reasonable solution to the outlined problem would be for the fiscal and monetary authorities to work together from the outset of a public spending shock. This approach maintains debt sustainability and price stability while ensuring an optimal growth impulse. In this condition, it is acceptable to enable a more substantial increase in

public debt to translate fiscal measures into a rapid and, at the same time, sustainable economic recovery. Simulation results have confirmed this thesis by emphasizing that policy steps must be well-coordinated and well-managed.

The intended mutual efforts of fiscal and monetary authorities to achieve optimistic results regarding output and financial stability within an urgent timeline require that the interactive steps are motivated and synchronized. For this, three additional scenarios were generated to demonstrate the logic and conformity of fiscal-monetary interplay. These scenarios differ in terms of fiscal and monetary reactions to the gap of the money and public debt deviations from their equilibrium values (see Equations (8) and (9)). In Scenario 1, the fiscal authority has more control over public debt growth, whereas in Scenario 2, the more power is given to the central bank. Scenario 3 is a compromise case, in which delegated power is allocated equally between fiscal and monetary agents (Figure 5).

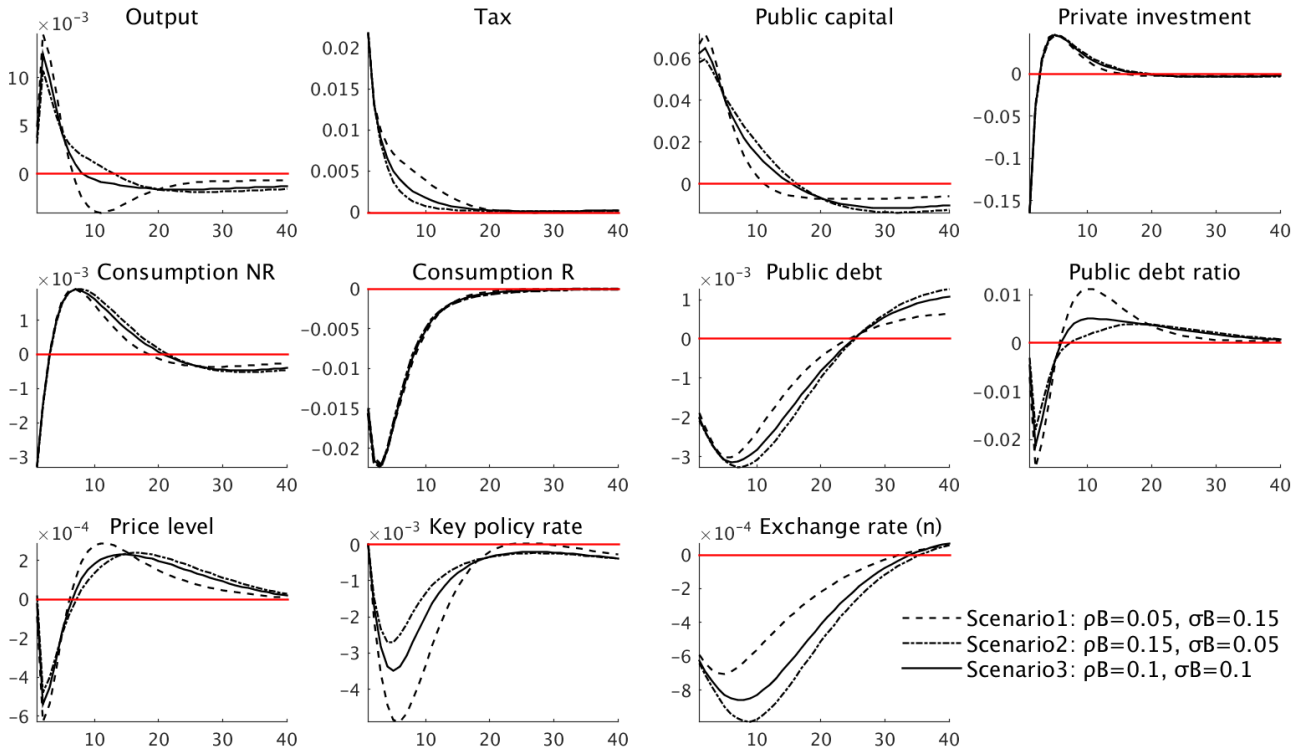

Figure 5. Reaction to a public spending shock, depending on the degree of the fiscal and monetary policy responses to the comparative volatility of the money supply and public debt (percentage deviation from the steady state). Note: Dominance score $\boldsymbol{k}^{d} = 0.9$.

In Scenario 1, which is characterized by the active fiscal and passive monetary policies (AF/PM regime), the observed growth impulse is the highest, as is the volatility of financial indicators. In Scenario 2, when more power to carry out the policy in response to public debt growth is delegated to the monetary authority (PF/AM regime), the growth impulse is the smallest, as is the volatility of financial indicators. Scenario 3 is a compromise between the first two scenarios because it equally shares the power of policy implementation between the fiscal and monetary authorities. Essentially, Scenario 3 validates the effectiveness of the joint fiscal and monetary policy efforts, thereby augmenting the responsibility of each policy agent and ensuring parity in policy implementations.

7. Discussion

For the discussion of results, we cover four major topics: A sensitivity analysis of key parameters, an examination of the initial conditions of fiscal and monetary policies, an analysis of fiscal multipliers, and an assessment of welfare gains.

7.1. Sensitivity analysis of key parameters

The model's sensitivity to calibrating key parameters described in the "Results" section is crucial for further discussion and evaluation procedure. Lack of identification leads to wrong conclusions from calibration, estimation, and inference. Thus, we present the sensitivity analysis for k^d, σ_B, ρ_B, and η. Of the calculation algorithms, we focus on the Monte-Carlo-Filtering method (Ratto, 2008). The unique feature of this method is the ability to estimate the model's behavior using random sample values within a given range of input factors and their probability distributions, which results in the Monte Carlo mean of sensitivity measures. The sensitivity measure addresses how changes to the elements of the parameter vector can impact the model moments, reduced-form solution, and the dynamic model. The task is completed locally using the corresponding Jacobian with certain normalizations to account for different parameter uncertainties. The normalization of the standardized Jacobian yields a single aggregated sensitivity measure for all moments, solution matrices, and Jacobians of the dynamic model for each parameter. In addition to the sensitivity measure, an identification procedure is committed, aimed at characterizing the identification of the parameters in a global sense, since an analytical estimate of local identification can be performed for a large number of points randomly selected from the prior distribution (Iskrev, 2010).

The Monte-Carlo-Filtering method is implemented using the Global Sensitivity Analysis (GSA) toolbox, which is included in the Dynare package. The probability distribution and specified ranges of values for key parameters are as follows: For η – gamma, [0.10, 1.00]; for k^d – gamma, [0.15, 2.00]; for σ_B – beta, [0.01, 0.25]; and for ρ_B – beta, [0.01, 0.25] (see Appendix A). The results of sensitivity analysis have shown that the four chosen parameters are well-identified within the specified ranges of variability and are quite influential. The observed variability in the degrees of parameter influence is consistent with the economic reasoning embedded with respect to the model structure. The most interesting results are associated with the parameters that measure the degree of the fiscal (σ_B) and monetary (ρ_B) policy response to the comparative volatility of the money supply and public debt. The value of the fiscal policy response is a bit greater than that of the monetary policy (Figure 6). This finding lends support to the idea that, under a fiscal dominance regime, fiscal involvement in ensuring sustainability is more beneficial than monetary activism. In other words, fiscal policy is expected to exhibit greater flexibility and authority in implementing sustainable policy commitments, thereby contributing to achieving the established policy targets effectively. In the subsequent sections, we provide a more detailed analysis of these findings, including an evaluation of fiscal multipliers and welfare gains.

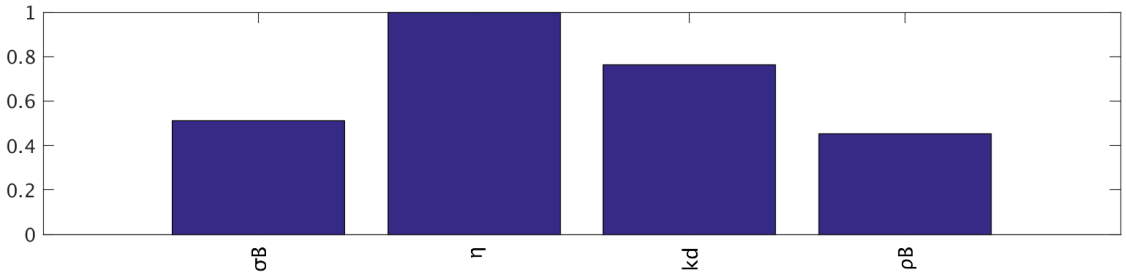

Figure 6. Monte Carlo mean of sensitivity measures (vertical axis).

7.2. Initial conditions of fiscal and monetary policies

According to the steady-state conditions defined for the scenario simulation, the task can be resolved by adjusting two initial indicators related to the instruments of the fiscal and monetary policy undertaking. These indicators are the share of public investment in total public spending (***Ig/G***) and the key policy rate (***i***) (see Appendix A). Notably, the first indicator (***Ig/G***) is a fiscal policy instrument, and the second indicator (***i***) is a monetary policy instrument. In the context of the "joint component" framework, this combination of initial conditions is unlikely to be a coincidence and requires thorough testing.

The mixed effect of setting the initial conditions is analyzed using scenario modeling to simulate the response to a public spending shock, which involves gradual changes in the indicator (***Ig/G***) and the indicator (***i***). It was achieved by fixing the maximum growth impulse (short-run effect) and the crowding-in effect, including the negative contribution of the crowding-out effect (long-run effect). The modeling results are summarized in a 3D graph, where the gradual changes are taken as starting points (Figure 7).

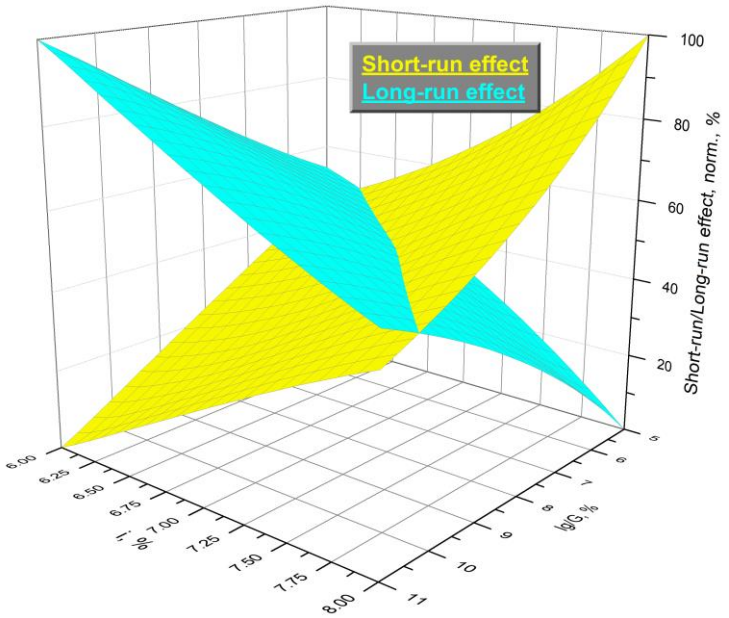

Figure 7. Binding the fiscal and monetary policy initial conditions. Notes: Dominance score $k^d = 0.9$; fiscal policy parameter $\sigma_B = 0.1$; and monetary policy parameter $\rho_B = 0.1$.

An increase in the share of public investment in total public spending (the amount of public spending remains the same or declines) has a negative impact on the growth impulse. According to the complex household utility function, government consumption is part of private consumption. Since the fraction of households with limited liquidity is predominant ($\eta = 0.6$, see Appendix A), a decrease in public consumption negatively impacts the income of these households and, consequently, the aggregate income. Furthermore, the multiplier effect of increased public investment is unlikely to offset the loss of income for liquidity-constrained consumers. Therefore, with a higher share of public investment in total public spending, the growth impulse in response to a public spending shock is weaker in the short term.

The situation changes when examining a more extended period. A systematic focus on public investment as an endogenous growth factor leads to considering the crowding-in effect. This effect generates a robust response from the private sector in the form of increased private investment, which improves the sustainability of the economy in the long run. Thus, the overall picture is somewhat controversial. In the short run, a higher share of public investment in total public spending generates a lower growth impulse, which reduces the debt burden and weakens the crowding-out effect. In the long run, an increase in the initial level of public investment results in higher sustainable growth, driven by a crowding-in effect.

It is worth noting that the share of public investment in total public spending is not the option to be determined independently. This is because the benevolent social planner is obliged to perform its functions relevant to current government expenditures. Therefore, when imposing a public spending shock, the level of public investment must be justified by striking a balance between short-term and long-term gains by choosing a reasonable (equilibrium) value among the available options of projected scenarios.

Maximizing the growth impulse in the initial phase of the economy's response to a public spending shock in the event of a prolonged fiscal dominance regime implies a more motivated reply of monetary authority. Initially, the monetary authority is interested in lowering the key policy rate to support fiscal stimulus of aggregate demand by reducing the cost of public borrowing. In order to implement such a monetary adjustment, the central bank needs some space for flexibility to ensure effective regulation. Therefore, the key policy rate should be set above a zero lower bound to avoid a liquidity trap. On the other hand, if the adjusted policy rate is too high, the government's borrowing costs will rise at the beginning of the fiscal expansion, reducing the effectiveness of the policy undertaking. For this reason, at the beginning of the response to a public spending shock, the monetary authority should set the policy rate at a level that is not below its initial value.

The data from the applied DSGE model are calibrated for a developing economy and consistent with the initial value of the key annual policy rate equal to 7% (see Appendix A). Under given conditions, there is always an opportunity to adjust the key policy rate to a lower level. However, this is not the case for developed economies, where the monetary policy target is in the 1% to 3% range. This restricts the operational space for monetary adjustment to pursue an effective lower bound. Furthermore, linking the fiscal and monetary policy targets, as proposed in this study, is not a common tactic of fiscal-monetary interaction. Consequently, if the economic recovery takes longer than usual, there is always a risk that conventional monetary policy will not be as effective in containing unexpected inflationary pressures. The rational proposal in this situation would be to raise the policy target to give the monetary authority more "ammunition" for manipulation, at least as a short-term preventive measure. However, a higher key policy rate puts the average household at a lower level of

well-being, which worsens its position as a saver or a money-holder (White, 2025). The lower level of well-being can only be partially restored in the newly created environment of multiple crises. Pursuing aggressive fiscal dominance in these circumstances could compromise monetary autonomy, which requires adequate cooperation in the complex policy mix environment.

Raising the key policy rate is a temporary measure because this policy target is related to another policy target used by the fiscal authority, the public debt ratio (see Equations (5), (6), and (7)). Bischi et al. (2022) confirm this observation by incorporating $arctan\left(b_{t-1}-\bar{b}\right)$ in the determination of the key policy rate and call it "a measure of the risk premium". In addition to expanding the policy space for manipulation, the new reference point provided for monetary decisions imposes an inflationary tax on money holdings. Consequently, all transactions in financial assets, including government bonds, become more expensive, thereby dissolving the original grade between the money and the stock markets. It will not be long before the upgraded monetary target reaches its end regarding policy decisions. After that, a higher pillar of policy targeting will be needed to address the emerging risks associated with the next stage of fiscal-monetary interactions. In today's formula for interactions, the key policy target is set within an agreed-upon range, pursuing the long-term target, which enables deviating slightly in short-term periods. This was effective until multiple crises became the new reality of economic turbulence. Under the newly created environment, the long-term target will never have a chance to be confirmed until the economy finally has reached the final stage of recovery. However, there is always a compelling argument for addressing the issue of "secular stagnation".

Given the analysis of the initial conditions above, it is important to emphasize that a shorter recovery period by following the effective fiscal (8) and monetary (9) policy sustainability rules is crucial in eliminating the negative consequences of crisis distress. By pursuing a promising growth path, the fiscal and monetary authorities should seek an optimal balance between the initial conditions imposed by the relevant policy instruments to enhance the growth impulse constrained by the joint policy measures. To this end, the public investment should be set at a sound (equilibrium) share of total public spending, and the key policy rate should be set at a level not lower than its equilibrium value. Adhering to the recommended initial conditions provides the fiscal and monetary authorities greater flexibility in making policy adjustments to maximize the growth impulse and assist in a crowding-in effect triggered by a public spending shock.

7.3. Fiscal multipliers

We consider calculating two fiscal multipliers: the instantaneous and the cumulative present value multipliers. Our aim is to evaluate the effectiveness of fiscal policy in adjusting the parameters that govern the monetary and fiscal policy responses to the gap between the money and public debt deviations from their equilibrium values. The instantaneous fiscal multiplier is the elasticity of output ($\boldsymbol{Y_t}$) to public spending ($\boldsymbol{G_t}$) at time $\boldsymbol{t}$. The multiplier is divided by the steady-state ratio $\bar{G}/\bar{Y}$ to match an average result, as outlined by Mountford and Uhlig (2009):

$$\mu_t^{IFM} = \frac{\frac{Y_t}{\bar{Y}} - 1}{\frac{G_t}{\bar{G}} - 1} \frac{1}{\bar{G}/\bar{Y}}, \tag{10}$$

Using the sum formula for the cumulative present value multiplier enables the analysis of different time horizons following a public spending shock:

$$\mu_t^{CFM} = \frac{\sum_{j=0}^{t}(\bar{\imath}+1)^{-j}\left(\frac{Y_j}{\bar{Y}}-1\right)}{\sum_{j=0}^{t}(\bar{\imath}+1)^{-j}\left(\frac{G_j}{\bar{G}}-1\right)}\frac{1}{\bar{G}/\bar{Y}}, \tag{11}$$

The visual representation of the results obtained reflects the maximum values of the instantaneous and cumulative present value fiscal multipliers. The calculation of the instantaneous fiscal multiplier considers a short-term scenario with respect to the growth impulse, which depends on the dynamics of public debt (Figure 8). The sensitivity of the parameters responsible for the monetary and fiscal policy reactions to the gap between the deviations of money and public debt from their equilibrium values is nearly linear. This is consistent with the direct impact of the parameters $\boldsymbol{\sigma_B}$ and $\boldsymbol{\rho_B}$, which are components of the additive specifications of the fiscal and monetary policy rules. It is worth noting that in the real economy, another important indicator, the dominance score, also varies depending on the fiscal and monetary response to the comparative volatility of the money supply and public debt. Thus, the dominance score affects the growth impulse as an additional parameter. Consequently, the instantaneous fiscal multiplier could lose linearity when the three parameters mentioned above change simultaneously.

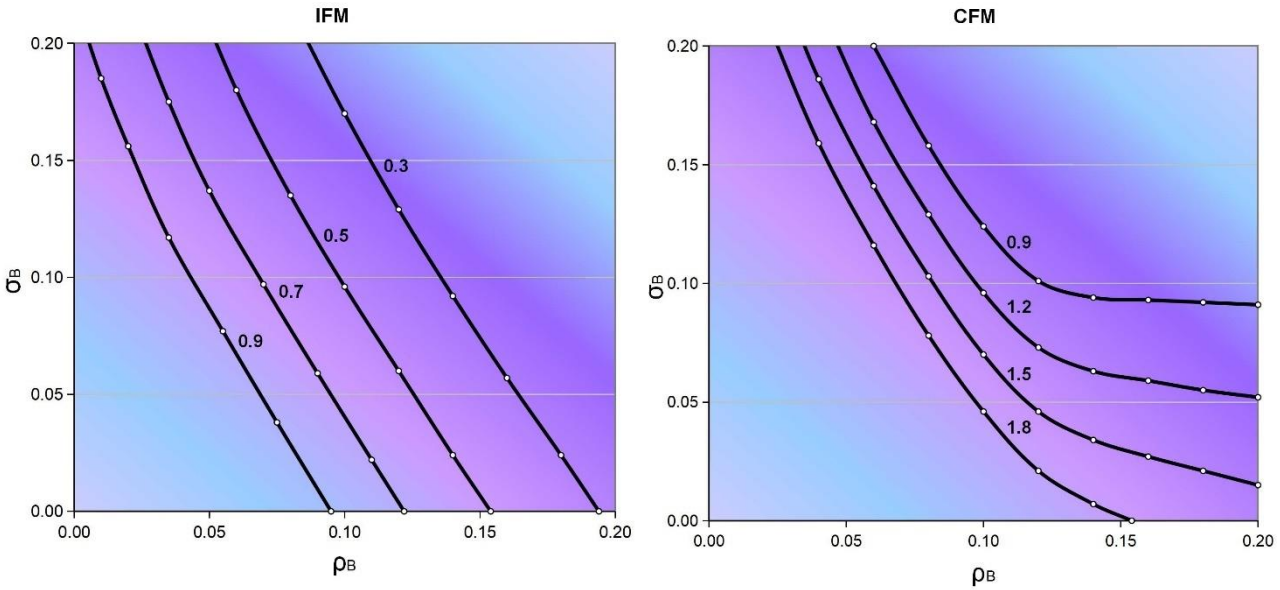

Figure 8. Instantaneous (IFM) and cumulative present value (CFM) fiscal multipliers: Sensitivity of selected fiscal and monetary policy parameters. Note: Dominance score $\boldsymbol{k^d} = 0.9$.

In the scenarios with higher instantaneous multipliers, the monetary policy response parameter ($\boldsymbol{\rho_B}$) has about twice the power of the similar parameter for the fiscal policy response ($\boldsymbol{\sigma_B}$). This finding corroborates the hypothesis that fiscal policy cannot ensure public debt sustainability in the short term alone without the involvement of monetary policy. The reason is that the monetary authority provides short-term regulation, while the fiscal authority makes decisions and implements policy over longer horizons. Moreover, in the short run, the monetary authority can handle the job alone, but the price is

not justified. This is because the excessive monetary tightening is associated with abnormal control over the volatility of financial indicators, which is offset by a decline in output growth (i.e., a lower instantaneous fiscal multiplier).

Regarding time preferences, the logarithmic function of the gap between the money and public debt deviations from their equilibrium values expects a faster response the further away from the time reference point. From this perspective, fiscal involvement is an effective policy complement that shares the power to achieve sustainability goals faster and with fewer output losses. Notably, the lower the fiscal ($\boldsymbol{\sigma_B}$) and monetary ($\boldsymbol{\rho_B}$) parameters, the higher the instantaneous fiscal multiplier. The given causal regularity is similar to the relaxation of a spring, which releases more and more power in the equivalent of fiscal multiplier units (see Figure 8). In this regard, Menguy (2024) discusses the controversy surrounding fiscal plans for achieving short- and long-term goals, which are linked to the dilemma of supporting growth while ensuring public debt sustainability. Since expansionary fiscal policy is usually associated with growing public debt, a restrictive policy should be implemented in the long run to ensure sustainability. Therefore, the long-term fiscal policy commitments are essential for examining the fiscal multiplier issue.

Estimating the cumulative present value fiscal multiplier considers a long-term scenario associated with the crowding-in effect, which depends on the endogenous factor of public investment financed mainly by public borrowing. This case highlights the importance of fiscal policy in maintaining sustainable growth over the longer horizons. The fiscal sustainability policy assists long-run growth, which, in this case, depends on the fiscal policy response to the comparative volatility of the money supply and public debt. In this regard, the fiscal response should not be less than $\boldsymbol{\sigma_B}$ = 0.1. In other words, the monetary authority cannot do the job alone if the fiscal support is insufficient ($\boldsymbol{\sigma_B}$ < 0.1). However, when the cumulative multiplier is 1.6 and higher (less-strain conditions), the monetary involvement becomes imperative (Figure 7). In the context of sustainable growth, Iwata and IIboshi (2023) argued that fiscal adjustments require greater responsibility than monetary commitments. In this regard, the government spending multiplier is more closely linked to the adjusted coefficients of the debt-stabilizing spending rule than the debt-to-GDP ratio. The comments above reflect the sensitivity analysis results of the key parameters presented in Subsection 7.1. In particular, the analysis revealed that fiscal involvement in ensuring sustainability under a fiscal dominance regime is more beneficial than monetary activism.

Logically extending the last point of view, there must be a limit, beyond which the crowding-in effect loses its power. This scenario is associated with a zero fiscal and/or monetary policy response to the comparative volatility of the money supply and public debt, which is accompanied by high volatility in financial indicators (see Figure 4 and Figure 5). Ma and Lv (2022) also highlighted the significant volatility in economic and financial indicators when the money-financed stimulus is used as a primary policy strategy. The researchers reported that the inflationary pressures resulting from abnormal financial volatility have the potential to pose a threat to the long-term outlook. In the other study, Marcos and Vale (2024) employed threshold methods to examine the nonlinear relationship between public and private investment. Their findings confirm the existence of an upper limit of private investment accumulation in response to a public spending shock. They argue, in particular, that the leading position of the interest rate, acting as a co-mover in the fiscal-monetary interactions, ensures the effectiveness of the crowding-in effect.

7.4. Welfare analysis

In this part of the study, we aim to verify the welfare gains and their dependence on fiscal-monetary interactions. The method used to estimate welfare gains involves solving structural equations subject to applied constraints. The method utilizes a second-order approximation proposed by Schmitt-Grohé and Uribe (2005) to calculate the lifetime utility function under the specified policy conditions. Employing the second-order approximation around the steady state effectively avoids false reversals in the welfare ordering that may occur when solving the model using a first-order approximation. Following the model structure, welfare is tested for two fractions of households: Ricardians and non-Ricardians. For these households, the present discounted values of the lifetime utility function under the optimally chosen sequences of consumption, money holdings, and labor are as follows:

$$U_t^R = E_t \sum_{t=0}^{\infty} \beta_R^t \left[log(C_t^R - hC_{t-1}^R + \varphi C_t^g) + \chi_M \, log \frac{M_t}{P_t} - \chi_L \frac{L_t^{R\,1+\phi}}{1+\phi} \right]$$
$$U_t^{NR} = E_t \sum_{t=0}^{\infty} \beta_{NR}^t \left[log(C_t^{NR} + \varphi C_t^G) - \chi_L \frac{L_t^{NR\,1+\phi}}{1+\phi} \right], \quad (12)$$

where C_t is consumption; C_{t-1} is habit formation; C^g_t is the utility-generating public consumption; M_t/P_t is the real money holdings; L_t is labor supply; β is discount factor; h is the degree of habit formation; ϕ is the elasticity of substitution between private and public consumption; φ is the inverse of the Frisch elasticity of labor supply; and χ_M and χ_L are the steady-state utility of real money holdings and labor supply, respectively.

As suggested by Mendicino and Pescatori (2004), the resulting welfare effect is the sum of Ricardian and non-Ricardian welfare weighted by an appropriate discount factor. We extend this approach by taking into account each household's share of total consumption (η), ensuring that savers and hand-to-mouth households obtain the same level of lifetime utility, given a constant flow of consumption:

$$U_t = (1 - \beta_R^t)(1 - \eta) U_t^R + (1 - \beta_{NR}^t) \eta U_t^{NR}. \quad (13)$$

The consideration of individual discount factors is not principal since the purpose of this study section is to compare welfare gains, depending on different degrees of fiscal-monetary nexus under the same policy rules. Therefore, for simplicity, the discount factor is not considered in the welfare calculation. The computational procedure involves setting the maximum value of the resulting lifetime utility function, which is measured in units of equivalent consumption over 40 quarters of the impulse response function.

From a welfare perspective, the high sensitivity of the responsiveness of fiscal and monetary authorities to the comparative volatility of the money supply and public debt (see Equations (8) and (9)) is not beneficial. This requires an operational space for joint policy co-movement. A less active fiscal stance and a more active monetary stance are associated with higher values of σ_B and ρ_B, respectively. However, the higher fiscal and monetary sensitivities are linked to a lower degree of fiscal dominance, which leads to less pronounced growth impulses and less favorable welfare effects. Given a complex utility-generating function with additive separability in preferences between private and government consumption, as well as a higher share of households with liquidity constraints (η = 0.6),

the restricted fiscal activity creates fewer incentives for hand-to-mouth households to spend more, thereby reducing the aggregate level of well-being. The presence of less optimistic signals regarding fiscal stimulus for short-term growth contributes to balanced public debt dynamics, resulting in a more substantial crowding-in effect. However, this factor cannot offset the weaker opportunities for welfare gains (Figure 9).

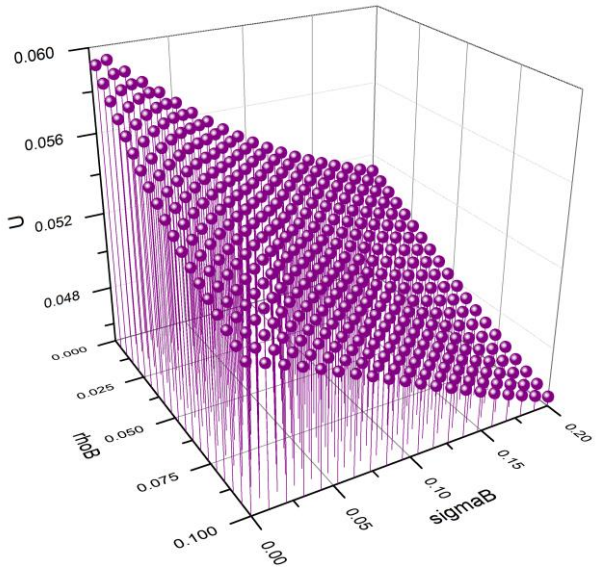

Figure 9. Welfare gains as a result of fiscal dominance: Sensitivity of selected fiscal and monetary policy parameters. Note: Dominance score $k^d = 0.9$.

In terms of welfare gains, in the complex conditions of fiscal-monetary interaction aimed at addressing the negative consequences of a public spending shock, the fiscal policy response to the comparative volatility of the money supply and public debt is more beneficial than that of monetary policy. The results of modeling simultaneous scenarios have shown that the impact of fiscal policy on welfare gains increases from 0.045 to 0.052 as σ_B rises from 0.1 to 0.2. However, when the monetary policy parameter ρ_B rises from 0.1 to 0.2, the opposite effect occurs: Welfare gains decrease from 0.045 to 0.044 (see Figure 9 and Table 1). Without simultaneous conditions, fiscal policy mobility is nearly twice as beneficial as monetary policy mobility. Therefore, fiscal policy should exhibit greater flexibility if a fiscal dominance regime is appointed. The last comment reflects the results of the sensitivity analysis results of the σ_B and ρ_B parameters presented in Subsection 7.1. The analysis reveals that the participation of fiscal policy in ensuring stability under a fiscal dominance regime is more beneficial than monetary activism.

Table 1. Welfare gains as a result of fiscal dominance: Sensitivity of selected fiscal and monetary policy parameters.

	Parameters of fiscal and monetary policy				
Fiscal policy sensitivity	$\sigma_B = 0$	$\sigma_B = 0.05$	$\sigma_B = 0.1$	$\sigma_B = 0.15$	$\sigma_B = 0.2$
Monetary policy sensitivity	$\rho_B = 0.2$	$\rho_B = 0.15$	$\rho_B = 0.1$	$\rho_B = 0.05$	$\rho_B = 0$
Welfare gains, U	0.0440	0.0444	0.0450	0.0462	0.0522

Note: Dominance score $k^d = 0.9$.

Given the comments above, from a welfare perspective, the fiscal authority should have more power in extreme cases when fiscal and monetary policies are highly responsive to the comparative volatility of the money supply and public debt. However, this scenario is less desirable because it prevents the benevolent social planner from realizing the full potential of fiscal stimulus. The most promising scenario in this situation is the distribution of equal responsibility between the fiscal and monetary authorities (Table 1). In summary, when a dominance regime is appointed, fiscal and monetary authorities should join their efforts to maximize economic performance and welfare gains while minimizing financial costs and time.

8. Conclusions

The acceleration of debt dynamics resulting from increasing crises is a key topic of discussion in today's policy debates. This discussion primarily focuses on balancing cooperation and dominance in the fiscal-monetary interactions. By considering these interactions, we propose a solution by examining the relationship between money supply and public debt, adjusted for crisis distress. Applying the given relationship to the intertemporal budget constraint of the consolidated government agent validates the direct link between the public debt threshold and the inflation target. This finding contributes to revising fiscal and monetary policy rules by adding a joint component that monitors the gap between the money and public debt deviations from their equilibrium values. Numerical simulation results show that the recommended revision of the policy rules could help contain abnormal financial volatility and shorten the time lag for restoring debt sustainability and price stability. However, implementing the joint policy measures suppresses the growth impulse crucial for economic recovery. To capture the full potential of growth in response to a public spending shock, the initial conditions of the binding commitments of fiscal and monetary policy should be reset to reflect a trade-off between the short-term impact of the adjusted key policy rate and the long-term impact of public investment as a percentage of total public spending. An important implication of the study is that sharing responsibility by coordinating fiscal and monetary policy targets makes it less stressful for the economy under economic turbulence. Analyzing fiscal multipliers and welfare gains resulting from a public spending shock reveals that fiscal mobility is nearly twice as beneficial as monetary mobility. This proves that fiscal policy should be more flexible under a fiscal dominance regime. In summary, in the newly established environment of multiple crises, it is necessary for the fiscal and monetary authorities to join their efforts to maximize economic performance and welfare gains while minimizing financial costs and time.

Use of AI tools declaration

I declare that I have not used Artificial Intelligence (AI) tools in the creation of this article.

Conflict of interest

The author declares no conflicts of interest in this paper.

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