Monetary and Fiscal Policy Interactions with Idiosyncratic Uncertainty and Bounded Rationality*

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Abstract

I study monetary and fiscal policy interactions in a tractable HANK model with bounded rationality and idiosyncratic uncertainty where the central bank and the government disagree about inflation determination. I show that in this framework inflation is jointly determined by the two policies, while it is undetermined in the rational expectations counterpart, but a new short run versus long run monetary policy trade-off emerges. The interaction of bounded rationality and idiosyncratic uncertainty on one side implies that the central bank is more effective at controlling inflation in the short-run but on the other side generates a new demand externality that prevents the monetary authority to stabilize inflation to the target in the long-run. Agents, indeed, fail to internalize the impact of their financial decision on consumption inequality: when interest rate increases, they over-save leading to a persistently higher debt, a persistently lower consumption inequality and a persistently higher inflation. A fiscal transfer proportional to consumption inequality corrects the externality and dampens the persistency of inflation above the target in the long run.

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1 Introduction

In the last period the global economy has been characterized by high levels of public debt and inflation. The Covid-19 pandemic and Russia's invasion of Ukraine, indeed, disrupted the global supply chains resulting in substantial inflationary pressures and a drop in aggregate demand. In response to the latter, the government made transfers to households, leading in this way public debt levels to an unprecedented scale. This environment has created a conflict in terms of inflation between the monetary and the fiscal authority: on one side, the central bank aims at reducing inflation to pursue its price stability objective but on the other side, the government requires high inflation levels to reduce the real value of its huge debt. Against this background a question arises: how inflation is determined?

Motivated by this conundrum, in this paper I study monetary and fiscal policy interactions with bounded rationality and idiosyncratic uncertainty when the two authorities face a conflict in terms of inflation. I show that in this model inflation is jointly determined by the two policies. Here, the conflict does not generate indeterminacy, as in the standard framework, but rather a short-run versus long-run monetary policy trade-off. In a nutshell, the interaction of bounded rationality and idiosyncratic uncertainty on one side amplifies the power of monetary policy on inflation making the central bank more effective at controlling it in the short run but on the other side it also generates a new aggregate demand externality that prevents the monetary authority from stabilizing inflation to the target in the long-run. When the government runs a persistent deficit since agents are bounded rational they do not fully internalize the effects of their financial decisions on consumption inequality and as a result when the interest rate increases they over-save, leading to a persistently higher debt, a persistently lower consumption inequality and a persistently higher inflation.

To formalize this intuition, I build on the framework developed by Bilbiie (2024) extended along two dimensions: *i)* I introduce bounded rationality in the form of level-k-thinking, and *ii)* I consider financial income deriving from public debt holdings. In this tractable HANK model, households are either savers or hand-to-mouth and they are subject to idiosyncratic risk in the form of a stochastic transition between types. Savers are patient and have a low marginal propensity to consume. They smooth consumption over time investing in government bonds, they work in the production sector, own firms and pay lump sum taxes. Hand-to-mouth consume their labor income and the per-capita share of payoff on the portfolio of government bonds from the previous period brought by the savers that have turned hand-to-mouth at the beginning of the period and they also pay lump-sum taxes. Agents are bounded rational in the form of level-k-thinking. Each agent is characterized by a different level of thinking which determines his expectations about the effects of current policies on future endogenous variables. More specifically agents with level-1-thinking which is the lowest level of thinking, do not update their expectations and as a result they do not internalize the effects produced by the interaction of the two authorities having conflicting inflation objectives as it happens under the rational expectation equilibrium. Level-2 thinkers, on the other hand, update their expectations but they think that the economy is populated only by level 1 thinkers. Expectations are thus constructed through an iterative procedure. In order to compute the equilibrium of the economy with different level-k-thinkers we use the concept of reflective equilibrium that allows the coexistence of agents with different levels of thinking. The central bank follows a standard Taylor rule while the government collects lump sum taxes to fund debt and constant public expenditure. The supply side of the economy is standard but also firms have heterogeneous beliefs.

In the simplified version of the model where I assume a static Phillips curve and a static value function to update agents' expectations I show that the interplay between idiosyncratic uncertainty and bounded rationality is crucial to ensure inflation determinacy despite the conflict between the two authorities. Let's analyze at first the effects of the two deviations in isolation.

Idiosyncratic uncertainty implies that fiscal policy directly affects aggregate demand: an increase in public debt not only raises the consumption growth of hand-to-mouth (distributional channel) but it also affects savers' expectations because raising the future consumption of hand-to-mouth it reduces expected consumption inequality (precautionary saving channel). There is a parallel with Angeletos et al. (2025) who show that when agents are non-Ricardian, deficit always affects aggregate demand. Here, anyway, there is also an important difference: idiosyncratic uncertainty implies that the steady state real interest rate is lower than the discount factor while in Angeletos et al. (2025) it is exactly equal to the discount factor. The main implication of this result is that public debt grows at a lower rate and as a result fiscal policy is weaker both with respect to the standard fiscal theory of price level but also with respect to the predictions of Angeletos et al. (2025). On the monetary policy side, idiosyncratic uncertainty implies that the short-term interest rate affects the economy not only through the standard intertemporal substitution channel but also through a distributional financial income channel according to which positive variations of the short term interest rate generates a positive financial income that stimulates the consumption of hand-to-mouth as well as aggregate demand. Finally there is also the precautionary financial income channel, through which, positive variations of the short term interest rate raising the expected consumption of hand-to-mouth reduces savers' precautionary savings and stimulates their current consumption. If the steady state real interest rate is negative and low enough, the third channel amplifies the power of monetary policy and a more stringent Taylor principle is required to ensure determinacy, while the reverse is true if the real interest rate is higher. Bounded rationality considered in isolation dampens the power of monetary policy because individuals are less forward-looking and as a result a less stringent Taylor principle is required but has no impact on fiscal policy.

When the two deviations interact, the speed of transmission of fiscal policy becomes even slower. Bounded rationality, indeed, weakens both the distributional channel and the financial wealth channel dampening even further the power of fiscal policy with respect to the case in which only idiosyncratic uncertainty is considered. On the monetary policy side, on the other hand, the two deviations act in opposite directions. When the steady state real interest rate is negative and low enough, the power of monetary policy is amplified but bounded rationality partially dampens it. On the other hand, when the steady-state real interest rate is high enough the power of monetary policy is weakened but bounded rationality partially amplifies it. Thus, it is possible to conclude that the combination of bounded rationality and idiosyncratic uncertainty dampening both the effects of the two policies implies the local determinacy of inflation despite the conflict existing between the two authorities.

Then, using an extended version of the model where the assumptions of the simplified model are relaxed I conduct a simple calibration exercise calibration exercise where I simulate a cost-push shock. I show that due to the interaction between bounded rationality and idiosyncratic uncertainty, the central bank is more effective at controlling inflation but only in the short-run. The same interaction, indeed, generates an aggregate demand externality: agents indeed fail to internalize the impact of their financial decisions on consumption inequality. As a result, when the government runs a persistent deficit and interest rate increases, they over-save leading to a persistent increase of public debt as well as inflation, and a persistent reduction of consumption inequality. A fiscal transfer proportional to consumption inequality can mitigate the externality and soften the short-run versus long-run monetary policy trade-off.

This paper contributes mainly to three strands of literature. The first is the literature about monetary and fiscal policy interactions and in particular about monetary and fiscal policy interactions in analytical HANK models. Angeletos et al. (2025) analyze the fiscal theory of price level in a heterogeneous agents model focusing on the case in which the steady state real interest rate is equal to the discount factor. Their aim is to show that on one side FTPL in HANK is free of the fragilities and controversies that are present in RANK models and, on the other side, to demonstrate that HANK models reproduce FTPL's core empirical predictions regarding the relation between deficits and inflation. Differently from them, I focus on the incomplete market case which implies a steady state real interest rate lower than the discount factor. My aim, indeed, is to analyze monetary and fiscal policy interactions in HANK models when the government bonds are used for precautionary saving reasons. Dupraz and Rogantini Picco (2025) also analyzes monetary and fiscal policy interactions in a heterogeneous agents model showing that even if the two policies are coordinated new requirements, different from the ones in the RANK model, are needed to ensure price determinacy. Here, instead I analyze the case in which the two policies are uncoordinated. Campos et al. (2025) analyze monetary and fiscal policy interactions in a heterogeneous agents model with a fiscal block and they show that since public debt affects the natural interest rate, then the monetary policy rule should react to the fiscal stance to ensure that inflation remains at its target. Anyway, while in Campos et al. (2025) the central bank should react more aggressively to ensure that inflation remains at its target in this model this not only doesn't insure the stabilization of inflation to the target but in some cases (when the steady state real interest rate is negative but high enough) might lead to the opposite result. This is due to the fact that in this model variations of the short term interest rate, rather than exogenous shocks as in Campos et al. (2025), induce persistent changes of public debt which in turn affect long-run consumption inequality as well as inflation.

Second, this paper is related to the literature on monetary and fiscal policy interactions with bounded rationality. Xie (2020) analyzes monetary and fiscal policy interactions when agents have heterogeneous finite planning horizons. I also add agents' heterogeneity in terms of access to the financial markets and idiosyncratic uncertainty. Eusepi and Preston (2018) show that since imperfect knowledge breaks Ricardian equivalence, the scale and composition of the public debt matter for inflation. High and moderate duration debt generates wealth effects on consumption demand that impairs the intertemporal substitution channel of monetary policy: aggressive monetary policy is required to anchor inflation expectations. In this model, the interaction of bounded rationality and precautionary savings implies that if monetary policy reacts too aggressively to inflation, public debt persistently changes affecting also long-run inflation.

Finally, this paper is connected to the literature on externalities. Bianchi (2011), Korinek (2010) show that the presence of pecuniary externalities justify macroprudential interventions. Farhi and Werning (2016) offer an alternative general theory for macroprudential interventions based on aggregate demand externality. In this paper I identify an aggregate demand externality that generates a short run versus long-run monetary policy trade-off and justifies the use of a fiscal transfer proportional to consumption inequality to allow the central bank to stabilize inflation to the target.

The paper is organized as follows. Section 2 presents the model framework. Section 3 presents the linear model and derives the main analytical results. Section 4 contains the quantitative model, presents the monetary policy trade-off and discusses the policies that mitigate the trade-off. Section 5 concludes.

2 The model economy

In this paper we study monetary and fiscal policy interactions in a tractable heterogeneous New Keynesian model as in Bilbiie (2018), that I extend introducing bounded rationality and financial income. The economy is populated by two types of households: savers and hand-to-mouth. Savers can save in risk-free government bonds and each period they face a probability (1-s) to switch type and become hand-to-mouth. Government bonds can be used to self-insure before idiosyncratic uncertainty is revealed. Following Iovino and Sergeyev (2024), I assume that savers have heterogeneous beliefs in the form of level-k-thinking: they are perfectly aware of current policies but they are not able to anticipate all the future effects of these policies because each agent is characterized by a "level of thinking" which determines her expectations about the effects of these policies on future endogenous variables. Hand-to-mouth consume their labor income, the proceeds from the per capita share of government bonds accumulated in the previous period when they were savers and pay taxes. A fiscal authority issues risk-free government bonds, spend a fixed amount of government spending and collects lump-sum taxes. The central bank controls the short term interest rate that follows a Taylor rule. The supply side of the economy is composed by a continuum of monopolistic bounded rational firms that produce the differentiated goods using labor and technology subject to nominal price rigidities.

2.1 Households

Consider a closed economy populated by infinitely-lived households belonging to either one of two types: savers (denoted with an index "s") who invest in risk-free government bonds and hand-to-mouth (denoted with an index "h"). Savers and hand-to-mouth include a mass *1-z* and *z* of agents respectively. Each saver faces a probability (1-s) of becoming an hand-to-mouth as the next period begins and each hand-to-mouth faces a probability (1-h) of becoming a saver. To keep the relative mass of agents constant over time, I assume that: (1-z)(1-s) = z(1-h). I assume that households have an exponential per-period utility function and a discount factor β.

$$U(c_{it}) = 1 - exp(-vC_{it}) \tag{1}$$

for some positive parameter v and with i= s,h and where consumption is the usual Dixit-Stiglitz bundle

$$C = \left[\int_0^1 C(i)^{\frac{\epsilon-1}{\epsilon}} di\right]^{\frac{\epsilon}{\epsilon-1}} \tag{2}$$

where C(i) is the consumption of the differentiated good of brand i and $\epsilon > 1$ is the elasticity of substitution between any two brands in the continuum indexed by i.

2.1.1 Savers

As specified above, savers form expectations through an iterative level-k-thinking process which generates endogenous discounting of expectations about future endogenous variables. Thus, in order to define their problem, we specify their beliefs in the following way: we use a tilde on top of the variables that savers need to predict and a hat for planned choices. Beliefs about exogenous variables coincide with the true process of such variables. Savers maximize their expected discounted lifetime utility:

$$\mathcal{U}_{\int,\sqcup} = \hat{u}_{s,t} + \beta E_t\{s\tilde{\mathcal{U}}_{s,t+1} + (1-s)\tilde{\mathcal{U}}_{h,t+1}\} \tag{3}$$

subject to the following flow budget constraint:

$$P_t\hat{C}_{st} + \frac{\hat{B}_{t+1}}{(1+i_t^R)} = P_t(Y_{st} - T_{st}) + \hat{B}_{st} + P_t\Psi_{st} \tag{4}$$

At the beginning of each period t, savers receive labor income P_tY_{st}. Following Xie (2020) I abstract from endogenous labor supply. In particular, I assume that the labor market contains an organization in which a large number of representatives bargain wage contracts with firms on behalf of households. When a given labor supply is agreed upon with a given wage, each household is required to supply its share of the aggregate labor demanded by the representatives, and thus each household's labor income is equal to its share of the total value Y_t of composite consumption-goods production. This implies that the income of the household is out of her control. With probability s they earn a payoff on government bonds which pay the nominal interest rate i_t^R Finally they also receive dividends from firms shares $P_t\Psi_{st}$ that as in Bilbiie (2024) can be considered as completely illiquid. Households use these resources to buy a bundle of consumption goods $\hat{C}_{st}$, save in government bonds B_{t+1} and pay taxes T_{st}. The optimal choice of consumption and government bonds imply:

$$\eta u'(C_{st}) = (1+i_t^R)\beta E_t\left(\frac{su'(C_{st+1}) + (1-s)u'(C_{ht+1})}{\tilde{\Pi}_{t+1}}\right)\eta_{t+1} \tag{5}$$

where η_t represents a preference shock.

$$1 = (1+i_t^R)\beta E_t\{\Lambda_{t,t+1}^{s,s}\} \tag{6}$$

where we have defined $\Lambda_{t,t+1}^{s,s}$ as the nominal stochastic discount factor of savers when investing in government bonds:

$$\Lambda_{t,t+1}^{s,s} = \beta\left(\frac{su'(\tilde{C}_{st+1} + (1-s)u'(\tilde{C}_{ht+1}))}{\tilde{\Pi}_{t+1}\eta_t u'(C_{st})}\eta_{t+1}\right) \tag{7}$$

2.1.2 Hand-to-mouth

Hand-to-mouth consume all their income.

$$P_tC_{ht} = P_t(Y_{ht} - T_{ht}) + (1+i_t^R)B_t(1-s)\frac{1-z}{z} + P_t\Psi_{ht} \tag{8}$$

At the beginning of each period t they receive labor income P_tY_{ht}, with probability (1-s) earn the payoffs on the per capita share of government bonds which pay the nominal interest rate i_t^R, pay taxes T_{ht} and receive dividends $P_t\Psi_{ht}$ from firms.

2.1.3 Government

The government budget constraint is:

$$(1+i_t^R)B_t^G P_{t-1} = P_t(T_t - G)(1+i_t^R) + B_{t+1}^G P_t \tag{9}$$

The fiscal policy rule is:

$$T_t = (1-\vartheta)\frac{\bar{T}}{(1+i_t^R)} + \vartheta\left[\frac{B_t^G}{P_t} - \frac{\bar{B}^G}{P_t}\right] \tag{10}$$

The government issues risk-free nominal bonds B_{t+1}^G collects taxes and makes constant public expenditure. $\vartheta \in [0,1]$ represents the degree of adjustment of taxes to government debt. In this model we will focus on the case in which $\vartheta = 0$, that is, the government collects only exogenous taxes from both savers and hand-to-mouth.

2.1.4 Central bank

The central bank controls the short term interest rate:

$$i_t^R = max[i_t^T, 0] \tag{11}$$

that follows a Taylor rule:

$$i_t^T = r^* + \phi_\pi \pi_t \tag{12}$$

2.1.5 Firms

The production sector is standard with the only exceptions that firms have bounded rationality. A continuum of monopolistic firms produce intermediate goods using the following production function:

$$Y_t = A_t L_t \tag{13}$$

where A_t is an exogenous common productivity factor. The labor input combines the hours worked of savers and hand-to-mouth through the Cobb-Douglas bundle:

$$L_t = (L_{st})^{1-z}(L_{ht})^z \tag{14}$$

A perfectly competitive sector produces a final good by combining different varieties of intermediate goods produced by monopolistic firms. Monopolistically competitive firms set their price facing Calvo frictions: they only get a chance to change their price with probability *(1-θ)* at every date, and these opportunities are independent across firms. A firm that gets a chance to change its price at date t-1 can change its price from date t onwards. In a period t in which the price of the good is not reconsidered, we assume that $P_t = P_{t-1}\bar{\Pi}$. Following Woodford (2019), I assume that prices are automatically increased at the target inflation when the optimality of this default pricing rule is not considered. Thus, the rate of inflation π_t for each firm between periods t-1 and t will be given by:

$$1 = (1-\theta)\left(\frac{P_t^*}{P_t}\right)^{1-\epsilon} + \theta(1-\pi_t)^{epsilon-1} \tag{15}$$

where P_t^* is the common price level chosen by all firms that are able to reset. Each firm that reconsiders its price in a given period chooses the new price that it *believes* will maximize the present value of its profits from that period onward. In a Dixit-Stiglitz model of monopolistic competition, with a single economy-wide labor market, profits in any period are the same function of a firm's own price and of aggregate market conditions for each firm. Firms maximize their expected discounted stream of future profits:

$$\mathcal{V}_{f,t} = v_{f,t} + \alpha\Lambda_{s,t}^{s,s} E_t \tilde{\mathcal{V}}_{f,t+1} \tag{16}$$

where $v_{f,t}$ is:

$$v_{f,t} = \Pi\frac{P_t(i)}{P_t} - MC_t \tag{17}$$

The real marginal costs are given by:

$$MC_t = (1-\tau)\frac{W_t L_t}{P_t A_t} \tag{18}$$

where τ is an employment subsidy. Labor wage is determined by representatives within the organization of the labor market who bargain on behalf of households. Since there is a large number of representatives, no one has monopoly power. Therefore, the representatives will choose the number of hours L_t to maximize the average marginal utilities of households in the economy. This results in a first order condition for optimal labor-supply of the form:

$$v'(L_t) = \bar{\Lambda}_t W_t \tag{19}$$

where $\bar{\Lambda}_t$ is the average utility and where $v(L_t) = v'(L_t)L_t$ is the per period disutility of labor. Following Benigno et al. (2019) and Bilbiee (2021) we assume that profits distributed to hand-to-mouth and savers are $\Psi_t^h = (\varpi/z)\Psi_t^f$ and $\Psi_t^s = (1-\varpi/z)\Psi_t^f$

2.2 Beliefs

In this framework, households' expectations deviate from rationality. We assume that *i*) agents' beliefs about exogenous variables coincide with the true process of such variables, *ii*) beliefs about endogenous variables can deviate from rationality. The beliefs of the agents are a sequence of functions that map the histories of exogenous shocks ϵ_t^x t to actual realizations. We use a "tilde" to stress the fact that the beliefs about an endogenous variable might not be the same as its equilibrium counterpart. By making this assumption, we treat the government and the central bank as agents of the economy whose future actions, along with the future actions of the other households embedded in endogenous variables, are needed to be forecasted. Since we are departing from rational expectations, it is necessary to introduce a more general notion of equilibrium which is known as temporary equilibrium.

2.2.1 Temporary equilibrium

A temporary equilibrium generalizes the standard notion of rational expectations equilibrium by relaxing the assumption that beliefs about endogenous variables must be consistent with the equilibrium distribution of such variables. Instead, in a temporary equilibrium, agents' beliefs are free to deviate from their equilibrium counterparts. More specifically, in a temporary equilibrium markets clear in each period t and the outcomes are the results of the optimizing behavior of households and firms whose beliefs are specified in the model and do not need to be correct. Let (Z_t) denote the vector of endogenous variables, government and central bank's policies and let $(\mathcal{Z}_{t,t+1})$, denote a sequence of beliefs about future (Z_t).

Definition 1 *A collection of sequences of household beliefs $(\tilde{Z}_{t,t+1})$, aggregate variables (Z_t) and exogenous variables (X_t), form a **temporary equilibrium** if there exists a household plan, such that given beliefs $\tilde{Z}_{t,t+1}$, aggregate variables and initial conditions, the plan solves the household problem:*

assets market clear for all t,

$$B^G_{t+1} = B_{t+1}(1-z) \tag{20}$$

the goods market clears for all t

$$Y_t = (1-z)C_{st} + zC_{ht} + G \tag{21}$$

the treasury's constraint is satisfied for all t.

In a temporary equilibrium, one can define an operator mapping households' beliefs, into realized aggregate variables:

$$\mathcal{Z}_t = \phi(\{\tilde{\mathcal{Z}}_{t,t+1}\}, \{X_t\}) \tag{22}$$

where $\mathcal{Z}_t$ is the sequence of realized aggregate variables. The definition of temporary equilibrium applies to sequences of household beliefs. How it is possible to see from equation (22), households can change their forecasting functions over time. For example, agents may change these functions after observing realizations of endogenous variables that were forecast to be different given realized exogenous shock or because memory discounts distant past.

By modeling the economy as being in a temporary equilibrium allows us to deviate from rational expectations. In the next section we will describe the process of formation of expectations, namely, the level-k-thinking process.

2.2.2 Level-k-thinking

Let's assume that before the policy intervention, the economy is in a stationary steady state. Let's begin with level-1-agents that is the lowest level of thinking characterized by the failure to update their expectations. We assume that, after the policy intervention in period $t = 0$, these agents do not change their beliefs about future endogenous variables. Formally the beliefs of level-1-agents satisfy $\tilde{\mathcal{Z}}_{\sqcup} = \tilde{\mathcal{Z}}^{SQ}$ where the additional superscript "1" denotes "level-1" beliefs and where "SQ" denotes the "status quo" beliefs which we define as the beliefs of an agent in the stationary steady state before the policy intervention. This assumption can be justified through the empirical findings of Pfauti and Seyrich (2024) who show that expectations underreact to aggregate news about future compared to the rational expectations case, that is, they do not fully incorporate aggregate news into their expectations.

Level-2-agents update their expectations but at the same time, we assume that any such agent is overconfident and believes that all other agents in the economy are level-1-thinkers. As a result, her beliefs about future endogenous variables satisfy:

$$\tilde{Z}_t^2 = Z_t^1 = \phi(\tilde{Z}^{SQ}) \tag{23}$$

For example, a level-2-agent's belief about inflation at some future time s satisfies:

$$\tilde{\pi_s}^2 = \pi_s^1 \tag{24}$$

that is, it equals the actual inflation at time s in the temporary equilibrium of the economy with only level-1-thinkers. Proceeding recursively, we define the beliefs of level-k-agents fro any $k \geq 1$. We assume that any level-k-agent is overconfident and believes that all the other agents in the economy are level-(k-1)-thinkers. As a result, her beliefs about future endogenous variables satisfy:

$$\tilde{Z}_1^{k+1} = \phi(\tilde{Z}_1^k) \tag{25}$$

for all $k \geq 1$ and $t \geq 0$.

2.2.3 Reflective equilibrium

The concept of reflective equilibrium generalizes the notion of temporary equilibrium with level-k-thinkers by allowing agents with different levels of thinking to coexist in the economy. In this equilibrium the population is divided into different groups and each group contains households with the same level of thinking. Groups have a mass given by the probability density function $f(.)$, with $f(k) \geq 0$ and $\sum_{k=1}^{\infty} f(k) = 1$. When $f(.)$ assigns all the mass to some particular k, then the reflective equilibrium collapses to the temporary equilibrium of an economy where all agents have the same level of thinking. An advantage of using reflective equilibrium is that the economy is not indexed by a discrete level of thinking and as a consequence, by changing the mean of $f(.)$, we can vary the average level of thinking in the economy. Finally, also in the reflective equilibrium as well as in the temporary equilibrium an agent with level of thinking k believes that all other agents in the economy are level-(k-1)-thinkers. This also implies that, although agents with a high k compute beliefs of a very high order, their predictions are not necessarily closer to actual equilibrium outcomes because average k in the population might be low.

Definition 2 *A collection of sequences of household beliefs ($\tilde{Z}_{t,t+1}$), aggregate variables (Z_t) and exogenous variables (X_t), form a reflective equilibrium if there exists a household plan, such that:*

given beliefs $\tilde{Z}_{t,t+1}$, aggregate variables and initial conditions, the plan solves the household problem

asset market clears for all t:

$$B^G_{t+1} = \sum_{k=1}^{\infty} f(k) B^k_{t+1}(1-z) \tag{26}$$

the goods market clears:

$$Y_t = (1-z)\sum_{k=1}^{\infty} f(k) C^k_{st} + zC_{ht} + G \tag{27}$$

the treasury constraint is satisfied for all t.

3 The transmission mechanism of monetary and fiscal policy interactions

In this section I show the transmission channels of monetary and fiscal policy, their interactions and their implications for inflation determination.

3.1 The transmission channels of monetary and fiscal policy

I now illustrate how the interaction between bounded rationality and idiosyncratic uncertainty generates novel transmission channels for both monetary and fiscal policy.

Let's consider the dynamic IS equation.

$$\begin{aligned} y^{RE}_t = \lambda E_t y^{RE}_{t+1} - \frac{z}{1-z}\Bigg(&-\gamma_s t_{ht+1} + t_{ht} + (\gamma_s b^G_{t+1} - b^G_t)(1+\bar{r})\frac{1-s}{z} + (\gamma_s \lambda i^{RE}_{t+1} - i^{RE}_t)\frac{(1-s)}{z\Pi}B^G + \\ &- (\gamma_s \lambda \pi^{RE}_{t+1} - \pi^{RE}_t)(1+\bar{i})\frac{(1-s)}{z}B^G\Bigg) + \\ &+ 1 - \gamma_s\left(-t_{ht+1} + b^G_{t+1}(1+\bar{r})\frac{(1-s)}{z} + \lambda E_t i^{RE}_{t+1}\frac{(1-s)}{z}B^G - \lambda E_t \pi^{RE}_{t+1}(1+\bar{i})\frac{(1-s)}{z}B^G\right) + \\ &- \sigma\left(i^{RE}_t - \lambda E_t \pi^{RE}_{t+1} - \Delta\eta_{t+1}\right) + (1-\lambda)\left(\frac{\bar{i}}{(1+\bar{i})}\right) w^1_{st+1} \end{aligned} \tag{28}$$

Fiscal policy affects aggregate demand through two channels: *a distributional channel*, the third term in equation (28) and *a precautionary saving channel*, the seventh term in equation (28). The first channel implies that an increase in public debt raises the consumption growth of hand-to-mouth while the latter channel generates a wealth effect: an increase in public debt raising the expected consumption of hand-to-mouth reduces savers' precautionary savings and stimulates their current consumption. This channel is present also in Nisticó and Seccareccia (2025) but while they consider central bank reserves here, I focus on public debt.

Monetary policy on the other side, affects the economy not only through the standard *inter-temporal substitution channel* - the eleventh term in equation (28) but also through *a distributional financial income channel*- the fourth and the fifth terms in equation (28) and *a precautionary financial income channel*- the eighth and the ninth terms in equation (28). According to the first, an increase in the short term interest rate, stimulating savings, reduces aggregate demand. Through the second channel, positive variations of the short term interest rate generates a positive financial income that stimulates the consumption of hand-to-mouth as well as aggregate demand. Finally through the third channel, positive variations of the short term interest rate raising the expected consumption of hand-to-mouth reduces savers' precautionary savings and stimulates their current consumption. To our knowledge, the latter two are novel channels that imply an additional role for monetary policy.

Bounded rationality dampens the inter-temporal substitution channel and the precautionary financial income channel while it strengthens the distributional financial income channel of monetary policy.

3.1.1 Determinacy conditions

In this section I derive the new determinacy conditions in the bounded rational THANK model. To obtain analytical results, I assume a static Phillips curve and a static value function to update agents' expectations. To study how monetary and fiscal policy can steer the system toward the optimal equilibrium, I evaluate equilibrium determinacy assuming the following rules:

$$i_t = \phi_\pi \pi_t \tag{29}$$

$$T_t = (1-\vartheta)\frac{\bar{T}}{(1+i_t^R)} + \vartheta\left[\frac{B_t^G(1+i_t)}{\Pi_t} - \bar{B}^G\right] \tag{30}$$

Let's start the analysis considering the case in which only monetary policy is active. In the benchmark case where $\lambda = 1$ and $s = 1$, monetary policy is active if the Taylor principle is satisfied, that is:

$$\phi_\pi > 1 \tag{31}$$

When instead $\lambda < 1$ and $s = 1$, one gets:

$$\phi_\pi > \frac{\lambda + \lambda\sigma\gamma - 1}{\sigma\gamma} \tag{32}$$

As λ decreases, the inter-temporal substitution channel of monetary policy is dampened and the requirement imposed on monetary policy to ensure the determinacy of the equilibrium becomes slacker than the Taylor principle. When expectations are rational ($\lambda = 1$) and there is idiosyncratic uncertainty ($s < 1$):

$$\phi_\pi > \frac{\sigma\gamma + \left(1 - \frac{(1-s)}{z}\right) \frac{1-\gamma_s}{1-z} \gamma B^G (1+\bar{i})}{\sigma\gamma + \left(1 - \frac{(1-s)}{z}\right) \frac{1-\gamma_s}{1-z} \gamma B^G \Pi^{-1}} \tag{33}$$

Considering that the nominal interest rate target is positive, we have that since $(1+\bar{i}) > \Pi^{-1}$ the requirement on ϕ_π is less stringent than the Taylor principle. Thus one can conclude that the two frictions in isolation mitigate the power of monetary policy. Now let's consider the two frictions together.

Proposition 1 *When $\lambda < 1$ and $s < 1$ and monetary policy is active, the bounded rational THANK model has a determinate and locally unique equilibrium if and only if:*

$$\phi_\pi > \frac{\lambda(1+\sigma\gamma) - 1 + \left[\frac{z}{1-z}\left(1 - \frac{1-s}{z}\right) + \frac{(1-z-\gamma_s)}{(1-z)}\left(1 - \frac{1-s}{z}\right)\lambda\right](1+\bar{i})\gamma B^G}{\sigma\gamma + \left[\frac{z}{1-z}\left(1 - \frac{1-s}{z}\right) + \frac{(1-z-\gamma_s)}{(1-z)}\left(1 - \frac{1-s}{z}\right)\lambda\right]\Pi^{-1}\gamma B^G} \tag{34}$$

When the two frictions interact, also the distributional financial income channel contributes to ensure equilibrium determinacy and as a result the requirement on ϕ_π is even less stringent with respect to those implied by the two deviations in isolation.

Let's consider the case in which only fiscal policy is active.

In the benchmark case with $\lambda = 1$ and $s = 1$, fiscal policy is active as long as

$$\vartheta < 1 - \frac{1}{(1+\bar{r})} \tag{35}$$

When $\lambda < 1$ and $s = 1$, one gets:

$$\vartheta < 1 - \frac{1}{(1+\bar{r})} \tag{36}$$

Bounded rationality has no impact on the determinacy conditions of fiscal policy. When $s < 1$ and $\lambda = 1$ on the other hand, one gets:

$$(1+\bar{r})B(1-\vartheta)\left(\frac{z\gamma_s}{1-z} - (1-\gamma_s)\right)\left(\vartheta - \frac{1-s}{z}\right) - (1-\gamma_s)B\vartheta > \frac{\sigma}{(1+\bar{i})} - \frac{1-s}{z}(1-\gamma_s)B \tag{37}$$

The precautionary saving channel weakens the requirement on fiscal policy.

Proposition 2 *When $\lambda < 1$ and $s < 1$ and only fiscal policy is active, the bounded rational THANK* *has a determinate and locally unique equilibrium if and only if:*

$$(1+\bar{r})B(1-\vartheta)\left(\frac{z\gamma_s}{1-z}-(1-\gamma_s)\right)\left(\vartheta-\frac{1-s}{z}\right)+ \\ +\left(-\frac{z(1-\lambda\gamma_s)}{1-z}-(1-\gamma_s)\lambda\right)B\vartheta > \frac{-1+\lambda+\sigma\lambda}{(1+\bar{i})}+\left(-\frac{z(1-\lambda\gamma_s)}{1-z}-(1-\gamma_s)\lambda\right)\frac{1-s}{z}B \quad (38)$$

When the two frictions interact, the determinacy conditions are even slacker because also the distributional channel will play a role.

Finally let's analyze the case in which the two policies are active at the same time. In the benchmark case where $\lambda = 1$ and $s = 1$, there exists a unique equilibrium if and only if:

$$\phi_\pi > \frac{1+\sigma\gamma}{\sigma\gamma(1-\vartheta)(1+\bar{r})}-\frac{1}{\sigma\gamma} \quad (39)$$

As long as monetary policy is active, the Taylor principle has to be satisfied, and as a consequence one needs to impose that:

$$\frac{1+\sigma\gamma}{\sigma\gamma(1-\vartheta)(1+\bar{r})}-\frac{1}{\sigma\gamma} > 1 \quad (40)$$

The above condition implies $\vartheta > 1-\frac{1}{1+\bar{r}}$ which violates condition (35) meaning that fiscal policy should be passive. This means that absent bounded rationality and idiosyncratic uncertainty, the two policies cannot be active at the same time.

When $\lambda < 1$ and $s = 1$, the determinacy conditions becomes:

$$\phi_\pi > \frac{\lambda+\lambda\sigma\gamma}{\sigma\gamma(1-\vartheta)(1+\bar{r})}-\frac{1}{\sigma\gamma} \quad (41)$$

As long as monetary policy is active, condition (32) has to be satisfied, and as a consequence one needs to impose that:

$$\frac{\lambda+\lambda\sigma\gamma}{\sigma\gamma(1-\vartheta)(1+\bar{r})}-\frac{1}{\sigma\gamma} > \frac{\lambda+\lambda\sigma\gamma-1}{\sigma\gamma} \quad (42)$$

The above condition implies $\vartheta > 1-\frac{1}{1+\bar{r}}$ which violates condition (35) meaning that fiscal policy should be passive. This means that absent bounded rationality and idiosyncratic uncertainty, the two policies cannot be active at the same time.

When $\lambda = 1$ and $s < 1$, one gets:

$$\phi_\pi > \frac{\sigma\gamma+\left(-\frac{z\gamma_s}{1-z}+(1-\gamma_s)\right)\vartheta(1-\vartheta)B\gamma(1+\bar{i})(1+\bar{r})\left(\vartheta-\frac{1-s}{z}\right)+\frac{(1-\gamma_s)}{1-z}B(1+\bar{i})\gamma\left(\vartheta-\frac{1-s}{z}\right)}{\sigma\gamma+\left(-\frac{z\gamma_s}{1-z}+(1-\gamma_s)\right)\vartheta(1-\vartheta)\frac{B}{\Pi}\gamma(1+\bar{r})\left(\vartheta-\frac{1-s}{z}\right)+\frac{(1-\gamma_s)}{1-z}\frac{B}{\Pi}\gamma\left(\vartheta-\frac{1-s}{z}\right)} \quad (43)$$

As long as monetary policy is active, condition (33) has to be satisfied, and as a consequence one needs to impose that:

$$\frac{\sigma\gamma+\left(-\frac{z\gamma_s}{1-z}+(1-\gamma_s)\right)\vartheta(1-\vartheta)B\gamma(1+\bar{i})(1+\bar{r})\left(\vartheta-\frac{1-s}{z}\right)+\frac{(1-\gamma_s)}{1-z}B(1+\bar{i})\gamma\left(\vartheta-\frac{1-s}{z}\right)}{\sigma\gamma+\left(-\frac{z\gamma_s}{1-z}+(1-\gamma_s)\right)\vartheta(1-\vartheta)\frac{B}{\Pi}\gamma(1+\bar{r})\left(\vartheta-\frac{1-s}{z}\right)+\frac{(1-\gamma_s)}{1-z}\frac{B}{\Pi}\gamma\left(\vartheta-\frac{1-s}{z}\right)}>\frac{\sigma\gamma+\left(1-\frac{(1-s)}{z}\right)\frac{1-\gamma_s}{1-z}\gamma B^G(1+\bar{i})}{\sigma\gamma+\left(1-\frac{(1-s)}{z}\right)\frac{1-\gamma_s}{1-z}\gamma B^G\Pi^{-1}} \tag{44}$$

The above equation implies:

$$\left(\frac{z\gamma_s}{1-z}-(1-\gamma_s)\right)(1-\vartheta)B(1+\bar{r})\left(\vartheta-\frac{1-s}{z}\right)-\frac{(1-\gamma_s)}{1-z}B\vartheta>-(1-\gamma_s)B^G \tag{45}$$

Condition (45) violates condition (36) and as a result, one can conclude that the two policies cannot be active at the same time.

Proposition 3 *When $\lambda<1$ and $s<1$ and the two policies are active at the same time, the bounded rational THANK model has a determinate and locally unique equilibrium if and only if:*

$$\phi_\pi>\frac{\lambda(1+\sigma\gamma)-1+\left[\left(\frac{z(1-\lambda\gamma_s)}{1-z}+\lambda(1-\gamma_s)\right)\left(\vartheta-\frac{1-s}{z}\right)+\frac{(1-z-\gamma_s)}{(1-z)}\left(\vartheta-\frac{1-s}{z}\right)(1+\bar{r})(1-\vartheta)\right](1+\bar{i})\gamma B^G}{\sigma\gamma+\left[\left(\frac{z(1-\lambda\gamma_s)}{1-z}+\lambda(1-\gamma_s)\right)\left(\vartheta-\frac{1-s}{z}\right)+\frac{(1-z-\gamma_s)}{(1-z)}\left(\vartheta-\frac{1-s}{z}\right)(1+\bar{r})(1-\vartheta)\right]\Pi^{-1}\gamma B^G} \tag{46}$$

As long as monetary policy is active, condition (34) has to be satisfied, and as a consequence one needs to impose that:

$$\frac{\lambda(1+\sigma\gamma)-1+\left[\left(\frac{z(1-\lambda\gamma_s)}{1-z}+\lambda(1-\gamma_s)\right)\left(\vartheta-\frac{1-s}{z}\right)+\frac{(1-z-\gamma_s)}{(1-z)}\left(\vartheta-\frac{1-s}{z}\right)(1+\bar{r})(1-\vartheta)\right](1+\bar{i})\gamma B^G}{\sigma\gamma+\left[\left(\frac{z(1-\lambda\gamma_s)}{1-z}+\lambda(1-\gamma_s)\right)\left(\vartheta-\frac{1-s}{z}\right)+\frac{(1-z-\gamma_s)}{(1-z)}\left(\vartheta-\frac{1-s}{z}\right)(1+\bar{r})(1-\vartheta)\right]\Pi^{-1}\gamma B^G}>\frac{\lambda(1+\sigma\gamma)-1+\left[\frac{z}{1-z}\left(1-\frac{1-s}{z}\right)+\frac{(1-z-\gamma_s)}{(1-z)}\left(1-\frac{1-s}{z}\right)\lambda\right](1+\bar{i})\gamma B^G}{\sigma\gamma+\left[\frac{z}{1-z}\left(1-\frac{1-s}{z}\right)+\frac{(1-z-\gamma_s)}{(1-z)}\left(1-\frac{1-s}{z}\right)\lambda\right]\Pi^{-1}\gamma B^G} \tag{47}$$

The above equation implies:

$$(1+\bar{r})B^G(1-\vartheta)\left(\frac{z\gamma_s}{1-z}-(1-\gamma_s)\right)\left(\vartheta-\frac{1-s}{z}\right)+ -\left(\frac{z(1-\lambda\gamma_s)}{1-z}+\lambda(1-\gamma_s)\right)B^G\vartheta>-\left(\frac{z(1-\lambda\gamma_s)}{1-z}+\lambda(1-\gamma_s)\right)B^G \tag{48}$$

Since condition (48) is more restrictive than condition 38, then, one can conclude that the two policies can be active at the same time.

4 Quantitative model

To analyze the quantitative model we will consider a dynamic Phillips curve and we also assume that agents no longer use fixed value functions learned from the stationary environment. Indeed, we allow them to update their value functions based on their past experiences. Similarly to Woodford (2019), we model the learning behaviors of households and firms as a constant-gain process. Let $v_t()$ and $\tilde{v}_t$ denote the value functions used by households and firms, respectively, for their time-t planning exercises. At the beginning of the following period, they update their value functions, $v_{t+1}()$ and $\tilde{v}_{t+1}$ which they will use for the planning exercise at time $t+1$, as follows:

$$v_{t+1} = \gamma_v v_t^{est} + (1-\gamma_v)v_t \tag{49}$$

$$\tilde{v}_{t+1} = \gamma_v \tilde{v}_t^{est} + (1-\gamma_v)\tilde{v}_t \tag{50}$$

where $v_t^{est}()$ and $\tilde{v}_t^{est}$ are the estimated value functions obtained by households and firms, respectively from their planning exercise at time t. The parameters γ_v and $\tilde{\gamma}_v \in [0,1]$ are learning gain parameters that determine the weights assigned to the estimated value functions. This process implies that decision-makers extrapolate their priors with estimates obtained from their current planning exercises. Consequently their perceptions of the future, beyond their planning horizons, reflect a weighted average of past beliefs and the newly acquired estimates of their value function. We approximate the dynamics implied by the constant gain learning rule using a local perturbation around the steady state solution of value functions. We approximate the dynamics implied by the constant-gain learning rule using a local perturbation around the steady-state solution of value functions.

$$log(v_t'(B)/v'^*(0)) = -\sigma^{-1}[\nu_t + \chi_t b] \tag{51}$$

Let ν_t represents the households' negative marginal values of holding bonds in their time-t prior value function $v_t()$. The derivative of the estimated value function will equal:

$$v_t^{est'}(B) = E_t[u_c(C_t(B)))/\Pi_t] \tag{52}$$

Hence to a log-linear approximation,

$$log(v_t^{est}(B)/v^{*'}(0)) = -\sigma^{-1}\left(\frac{\gamma_s}{1-z}(y_t^k - zc_{ht}^k) + (1-\gamma_s)c_{ht}^k - \left(\chi_t^{est}\frac{sb_t^G}{(1-z)\Pi}\right)\right) - \pi_t^k \tag{53}$$

Applying equation (51), one gets:

$$\nu_t^{est} = -\sigma^{-1}\left(\frac{\gamma_s}{1-z}(y_t - zc_{ht}) + (1-\gamma_s)c_{ht} - \left(\chi_t^{est}\frac{sb_t^G}{(1-z)\Pi}\right)\right) - \pi_t \tag{54}$$

$$\chi_t^{est} = (c_{st}') \tag{55}$$

Similarly, let ν_t^{est} denotes the corresponding negative marginal values derived from their time-t estimated value functions v_t^{est}. The above equation can be approximated in the following way:

$$log(v_t^{'est}(B)/v^{'*}(0)) = -\sigma^{-1}[\nu_t^{est} + \chi_t^{est} b] \quad (56)$$

Since χ_t^{est} converges to $\frac{\bar{i}}{(1+\bar{i})}$ then one gets:

$$\nu_{t+1} = \gamma_v \nu_t^{est} + (1-\gamma_v)\nu_t \quad (57)$$

The same reasoning applies also for firms. For the whole derivation consider Woodford (2018). Let's assume that $\tilde{\nu}_t$ represents the negative marginal values of increasing relative prices in the value functions of firms $\tilde{v}_t$. Its law of motion satisfies:

$$\tilde{\nu}_{t+1} = \gamma_v \tilde{\nu}_t est + (1-\gamma_v)\tilde{\nu}_t \quad (58)$$

where $\tilde{\nu}_t^{est}$ is given by:

$$\tilde{\nu}_t^{est} = (1-\theta)^{-1}\pi_t \quad (59)$$

Thus the equations with the lowest level of thinking become:

$$c_{st}^1 = -\sigma i_t^1 + (1-\gamma_s) b_{t+1}^{G,1}(1+\bar{r})\frac{1-s}{z} + \frac{\bar{i}}{(1+\bar{i})} w_{st+1}^1 + (1-z)\nu_t \quad (60)$$

$$pi_t^1 = \gamma y_t^1 + (1-\theta)\beta\tilde{\nu}_t \quad (61)$$

while the remaining equations are the same.

4.1 Monetary and Fiscal Policy Interactions during high inflation-high debt periods

Here we provide a numerical illustration of the mechanisms discussed above and perform a simple calibration exercise considering a cost-push shock. Our baseline policy scenario assumes that, when the cost-push shock hits the economy, the central bank seeks to stabilize inflation using the conventional interest-rate tool while the government is running a persistent deficit.

Figure 1 and 2 then shows the simulated response of the economy to the war under two alternatives calibration of the real interest rate monetary. In particular, in figure 1 I calibrate the real interest rate in such a way to make monetary policy more effective ($(1+\bar{i}) < \Pi^{-1}$ while in figure 2 the reverse is true. Then, in both the numerical illustrations I consider a milder and a more aggressive degree of monetary policy responsiveness. There a two important differences that need to be discussed. In figure 1, fiscal policy doesn't limit the degree of responsiveness of the monetary authority that can aggressively react to inflation deviations from the target. In figure 2 on the other hand, monetary policy is less powerful and as a result its degree of responsiveness is more limited.

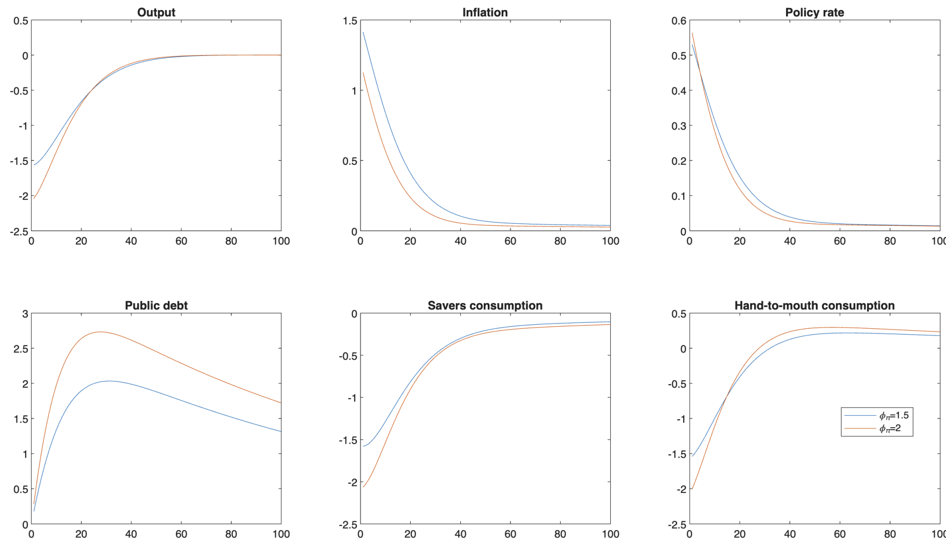

Figure 1: Response of the economy to a cost push shock when the government is running a persistent deficit of 3% and the steady state real interest rate is negative $(1 + r) = 0.9892$ and steady state public debt is $\frac{B}{Y} = 1.01$.

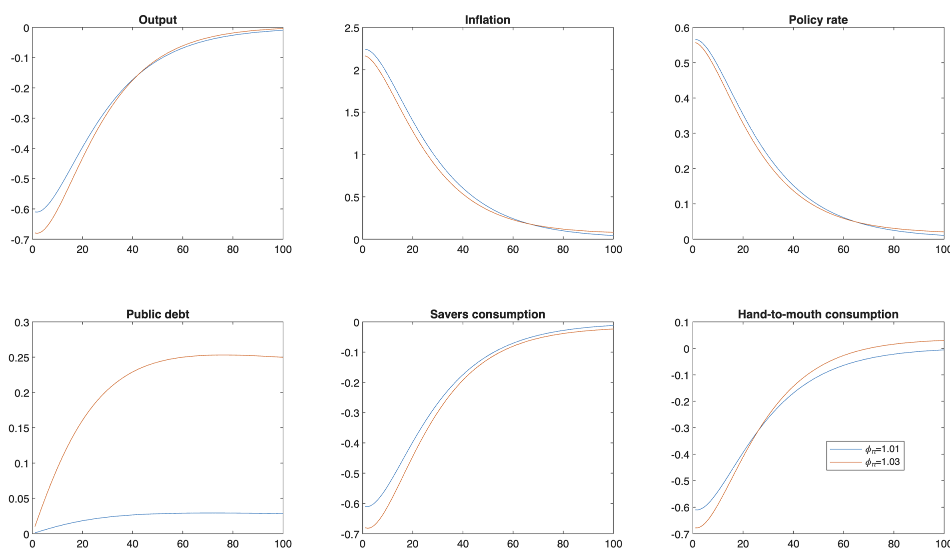

Figure 2: Response of the economy to a cost push shock when the government is running a persistent deficit of 3% and the steady state real interest rate is negative $(1 + r) = 0.9976$ and steady state public debt is $\frac{B}{Y} = 0.8$.

The second difference is instead related to the persistency of inflation above the target over time: while in figure 1 the more aggressive is the reaction of the central bank the lower is the persistency of inflation, in figure 2 the reverse is true. Moreover, in neither case monetary policy alone is able to fully stabilize inflation to the target. This result is due to the fact that since agents are bounded rational, they do not internalize the effects of their financial decisions on consumption inequality. As a result, when the government runs a persistent deficit, and the central bank raises the short term interest rate, agents over-save leading to a persistently higher debt as well as inflation and a persistently lower consumption inequality. This observation challenges one of the main messages of earlier contributions like Campos et al. (2025), according to which when public debt persistently increases, monetary policy by being more aggressive can fully stabilize inflation to the target. The discussion above suggests that this needs not be the case in our framework because here the permanent debt increase is not exogenous as in Campos et al. (2025) but is determined by the increase of the short term interest rate and moreover public debt is not backed by future taxes as it is in their case.

4.1.1 Redistributive tax/transfers during high inflation-high debt periods

We have seen that when fiscal policy collects only exogenous taxes, monetary policy alone is not able to fully stabilize inflation to the target because an aggregate demand externality emerges. How can this externality be mitigated? In this section, I show that taxes/transfers proportional to consumption inequality are a suitable instrument to internalize the externality as shown in figure 3. The reduction of consumption inequality, indeed, reduces the precautionary saving motive of savers who in turn save less and at the same time it also stabilizes the supply of public debt. Finally figure 4 compares tax/transfer proportional to consumption inequality with tax/transfer proportional to labor income. The latter are not a suitable instrument during cost-push shock because they contribute to raise rather than to stabilize debt. In this case, indeed, since output is negative the government is making transfers rather than collecting taxes which contribute to further increase the persistency of inflation above the target.

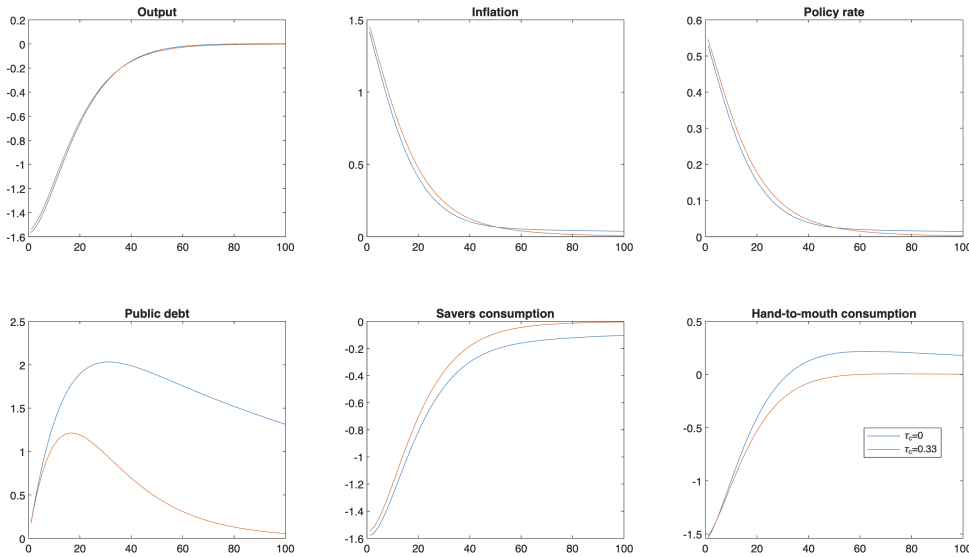

Figure 3: Response of the economy to a cost push shock when the government is running a persistent deficit of 3% and the steady state real interest rate is negative $(1+r) = 0.9892$ and steady state public debt is $\frac{B}{Y} = 1.01$ when the government also collect a tax/transfer proportional to consumption inequality $\tau_c = 0.33$ and the central bank reacts with $\phi_\pi = 1.5$

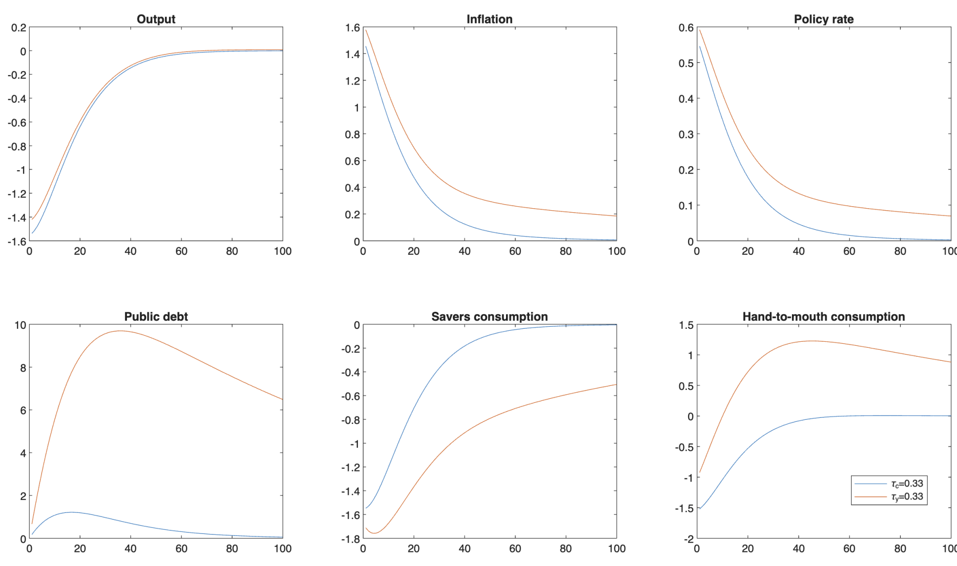

Figure 4: Response of the economy to a cost push shock when the government is running a persistent deficit of 3% and the steady state real interest rate is negative $(1+r) = 0.9892$ and steady state public debt is $\frac{B}{Y} = 1.01$ comparing the case in which the government collects a tax/transfer proportional to consumption inequality $\tau_c = 0.33$ with the case in which he collects a tax/transfer proportional to labor income $\tau_y = 0.33$ and the central bank reacts with $\phi_\pi = 1.5$

5 Conclusions

This paper studies monetary and fiscal policy interactions when households are bounded rational and face idiosyncratic uncertainty, the central bank controls the interest rate and the government issues short term debt, makes exogenous expenditure and collects exogenous taxes. Moreover a conflict exists between the two authorities: the central bank wants to control inflation to stabilize it to the target while the government wants to raise inflation to decrease the real value of public debt in a such a way to stabilize it. Accounting for bounded rationality and idiosyncratic uncertainty implies that inflation can be jointly determined by the two policies at the same time despite the existing conflict. It turns out that the monetary authority is more effective than the fiscal to control inflation in the short run, but differently from recent related literature, it cannot stabilize it to the target. A fiscal policy rule that also reacts to consumption inequality can mitigate the conflict between the two authorities and dampens the short-run versus long-run monetary policy trade-off.

6 Appendix

This appendix provides additional details of several derivations referred to in the main text.

6.1 Derivation of the temporary equilibrium

The budget constraint of the savers is:

$$P_t \hat{C}_{st} + \frac{\hat{B}_{t+1}}{(1+i_t^R)} = P_t(Y_{st} - T_{st}) + \hat{B}_{st} + P_t \Psi_{st} \tag{62}$$

and in log-linear form it can be rewritten in the following way:

$$b_{t+1} = \left(y_{st} - c_{s,t} - t_{st} + s\frac{b_t}{\Pi} + \psi_{st} \right)(1+\bar{i}) + sB\left(\frac{i_t}{\Pi} - \pi_t(1+\bar{i}) \right) \tag{63}$$

A local linear approximation of the savers' Euler equation is:

$$c_{st} = \gamma_s E_t c_{st+1} + (1-\gamma_s)E_t c_{ht+1} - \sigma(i_t - E_t \pi_{t+1}) \tag{64}$$

For each individual agent, a transversality condition for bond holdings

$$\lim_{T\to\infty} E_t b_t = 0 \tag{65}$$

is necessary for an optimal choice. Solving forward the budget constraint of the savers, one gets:

$$\frac{sb_t}{\Pi} = -\sum_{T=t}^{\infty} \left(\frac{1}{(1+\bar{i})} \right)^{T-t} \left[y_{sT} - c_{sT} - t_{sT} + \psi_{sT} + sB\frac{i_T}{\Pi} - sB\pi_T(1+\bar{i}) \right] \tag{66}$$

Iterating forward the Euler equation of the savers, one gets:

$$c_{st+T} = c_{st} - (1-\gamma_s)\sum_{u=t}^{T-1} E_t(c_{hu+1} - c_{su+1}) + \sigma \sum_{u=t}^{T-1}(i_u - E_t \pi_{u+1}) \tag{67}$$

so that:

$$\sum_{T=t}^{\infty} \left(\frac{1}{(1+\bar{i})} \right)^{T-t} E_t c_{st+T} = \frac{(1+\bar{i})}{\bar{i}} c_{st} - \frac{(1+\bar{i})}{\bar{i}}(1-\gamma_s) \sum_{T=t}^{\infty} \left(\frac{1}{(1+\bar{i})} \right)^{T-t+1} E_t(c_{hT+1} - c_{sT+1}) + \\ + \frac{(1+\bar{i})}{\bar{i}} \sigma \sum_{T=t}^{\infty} \left(\frac{1}{(1+\bar{i})} \right)^{T-t+1} (i_T - E_t \pi_{T+1}) \tag{68}$$

Substituting this last result in equation (51), one gets:

$$\frac{sb_t}{\Pi} = -\sum_{T=t}^{\infty}\left(\frac{1}{(1+\bar{i})}\right)^{T-t}\Bigg[y_{sT} - t_{sT} + \psi_{sT} + sB\frac{i_T}{\Pi} - sB\pi_T(1+\bar{i}) + \frac{(1+\bar{i})}{\bar{i}}(1-\gamma_s)E_t(c_{hT+1} - c_{sT+1}) + \\ - \frac{(1+\bar{i})}{\bar{i}}\sigma(i_T - E_t\pi_{T+1})\Bigg] + \frac{(1+\bar{i})}{\bar{i}}c_{st} \quad (69)$$

$$c_{st} = \frac{\bar{i}}{(1+\bar{i})}\frac{sb_t}{\Pi} + \sum_{T=t}^{\infty}\left(\frac{1}{(1+\bar{i})}\right)^{T-t}\Bigg[(y_{sT} - t_{sT} + \psi_{sT} + sB\frac{i_T}{\Pi} - sB\pi_T(1+\bar{i}))\frac{\bar{i}}{(1+\bar{i})} + \\ + (1-\gamma_s)E_t(c_{hT+1} - c_{sT+1}) - \sigma(i_T - E_t\pi_{T+1})\Bigg] \quad (70)$$

$$c_{st} = \frac{\bar{i}}{(1+\bar{i})}\frac{sb_t}{\Pi} + \frac{\bar{i}}{(1+\bar{i})}(y_{sT} - t_{sT} + \psi_{sT} + sB\frac{i_T}{\Pi} - sB\pi_T(1+\bar{i})) + \frac{\bar{i}}{(1+\bar{i})}v_{t+1} \quad (71)$$

where v_t is defined as:

$$v_t = \sum_{T=t}^{\infty}\left(\frac{1}{(1+\bar{i})}\right)^{T-t}\Bigg[(y_{sT} - t_{sT} + \psi_{sT} + sB\frac{i_T}{\Pi} - sB\pi_T(1+\bar{i}))\frac{\bar{i}}{(1+\bar{i})} + \\ + (1-\gamma_s)E_t(c_{hT} - c_{sT}) - \sigma(i_T - E_t\pi_T)\Bigg] \quad (72)$$

Aggregating one gets:

$$v_t = \frac{\gamma_s}{1-z}(y_t - zc_{ht}) + (1-\gamma_s)c_{ht} - \left(\frac{\bar{i}}{(1+\bar{i})}\right)\frac{sb_t^G}{(1-z)\Pi} + \sigma\pi_t \quad (73)$$

6.2 The linearized model of agents who do not update expectations

$$c_{st}^1 = -\sigma i_t^1 + (1-\gamma_s)b_{t+1}^{G,1}(1+\bar{r})\frac{1-s}{z} + \frac{\bar{i}}{(1+\bar{i})}w_{st+1}^1 \quad (74)$$

$$w_{st+1}^1 = \frac{s}{1-z}b_{t+1}^{G,1} \quad (75)$$

$$y_t^1 = (1-z)c_{st}^1 + zch_t^1 \quad (76)$$

$$c_{ht}^1 = \left(1 + \sigma\left(1 - \frac{\varpi}{z}\right)\right)y_t^1 - t_t^1 + \frac{1-s}{z}\frac{B^G}{\Pi}i_t^1 + b_t^{G,2}(1+\bar{r})\frac{1-s}{z} - \pi_t^1\frac{1-s}{z}B^G(1+\bar{i}) \quad (77)$$

$$\pi_t^1 = \gamma y_t^1 \quad (78)$$

$$(1-\vartheta)((1+\bar{r})b_t^{G,2} + i_t^1\frac{B^G}{\Pi} - \pi_t^1(1+\bar{i}B^G)) = b_{t+1}^{G,1} \quad (79)$$

6.3 The linearized model of agents who update expectations

$$c_{st}^k = \gamma_s E_t c_{st+1}^{k-1} + (1-\gamma_s)E_t c_{ht+1}^{k-1} - \sigma(i_t^k - E_t\pi_{t+1}^{k-1}) \quad (80)$$

$$y_t^k = (1-z)c_{st}^k + zch_t^k \quad (81)$$

$$c_{ht}^k = \left(1+\sigma\left(1-\frac{\varpi}{z}\right)\right) y_t^k - t_t^k + \frac{1-s}{z}\frac{B^G}{\Pi} i_t^k + b_t^{G,k+1}(1+\bar{r})\frac{1-s}{z} - \pi_t^k \frac{1-s}{z} B^G(1+\bar{i}) \tag{82}$$

$$\pi_t^k = \gamma y_t^k + \beta E_t \pi_{t+1}^{k-1} \tag{83}$$

$$(1-\vartheta)((1+\bar{r})b_t^{G,k+1} + i_t^k \frac{B^G}{\Pi} - \pi_t^k(1+\bar{i}B^G)) = b_{t+1}^{G,k} \tag{84}$$

6.4 The linearized model of agents with heterogeneous beliefs

When savers have heterogeneous beliefs, one needs to use the concept of reflective equilibrium. Assuming that $f(k) = (1-\lambda)\lambda^{k-1}$, one gets:

$$c_{st}^{RE} = \gamma_s E_t \lambda c_{st+1}^{RE} + (1-\gamma_s) E_t \left(-t_{ht+1} + b_{t+1}^{G,RE}(1+\bar{r})\frac{(1-s)}{z} + \lambda E_t i_{t+1}^{RE} \frac{(1-s)}{z}\frac{B^G}{\Pi} - \lambda E_t \pi_{t+1}^{RE}(1+\bar{i})\frac{(1-s)}{z} B^G\right) - \sigma(i_t^{RE} - E_t \lambda \pi_{t+1}^{RE}) + (1-\lambda)\frac{\bar{i}}{(1+\bar{i})} w_{st+1}^1 \tag{85}$$

where $t_{ht+1}^{RE} = \vartheta(b_{t+1}^G(1+\bar{r}) + \lambda E_t i_{t+1}^{RE} \frac{B^G}{\Pi} - \lambda E_t \pi_{t+1}^{RE}(1+\bar{i})B^G)$

$$y_t^{RE} = (1-z)c_{st}^{RE} + zch_t^{RE} \tag{86}$$

$$c_{ht}^{RE} = \left(1+\sigma\left(1-\frac{\varpi}{z}\right)\right) y_t^{RE} - t_t^{RE} + \frac{1-s}{z}\frac{B^G}{\Pi} i_t^{RE} + b_t^{G,k+1}(1+\bar{r})\frac{1-s}{z} - \pi_t^{RE}\frac{1-s}{z} B^G(1+\bar{i}) \tag{87}$$

$$\pi_t^{RE} = \gamma y_t^{RE} + \beta\lambda E_t \pi_{t+1}^{RE} \tag{88}$$

$$(1-\vartheta)((1+\bar{r})b_t^G + i_t^{RE}\frac{B^G}{\Pi} - \pi_t^{RE}(1+\bar{i}B^G)) = b_{t+1}^{G,RE} \tag{89}$$

6.5 Derivation determinacy conditions

6.5.1 Proposition 1

Proof. To derive the determinacy conditions where only monetary policy is active we consider the IS equation, a static Phillips curve, passive fiscal policy, i.e. $\vartheta = 1$ implying that public debt is constant and a Taylor rule for the short term interest rate. Substituting all the conditions in the IS equation, one gets:

$$y_t^{RE} = \lambda E_t y_{t+1}^{RE} + \gamma B^G \left(\lambda E_t y_{t+1}\left(-\frac{z\gamma_s}{1-z} + (1-\gamma_s)\right) + \frac{z}{1-z} y_t\right)\left(1-\frac{1-s}{z}\right)\left(\frac{\phi_\pi}{\Pi} - (1+\bar{i})\right) + - \sigma\left(\phi_\pi \gamma y_t^{RE} - \lambda\gamma E_t y_{t+1}^{RE} - \Delta\eta_{t+1}\right) + (1-\lambda)\left(\frac{\bar{i}}{(1+\bar{i})}\right) w_{st+1}^1 \tag{90}$$

Which can be rewritten as:

$$y_t = \nu E_t y_{t+1} + (1-\lambda)\left(\frac{\bar{i}}{(1+\bar{i})}\right) w_{st+1}^1 \tag{91}$$

where $\nu = \frac{\lambda\left(1+B^G\gamma\left(\frac{z\gamma_s}{1-z}-(1-\gamma_s)\right)\left(1-\frac{1-s}{z}\right)\left(\frac{\phi_\pi}{\Pi}-(1+\bar{i})\right)+\sigma\gamma\right)}{1+\frac{z}{1-z}B^G\gamma\left(1-\frac{1-s}{z}\right)\left(\frac{\phi_\pi}{\Pi}-(1+\bar{i})\right)+\sigma\phi_\pi\gamma}$ Determinacy requires that $\nu < 1$ which in turn implies:

$$\phi_\pi > \frac{\lambda(1+\sigma\gamma) - 1 + \left[\frac{z}{1-z}\left(1-\frac{1-s}{z}\right) + \frac{(1-z-\gamma_s)}{(1-z)}\left(1-\frac{1-s}{z}\right)\lambda\right](1+\bar{i})\gamma B^G}{\sigma\gamma + \left[\frac{z}{1-z}\left(1-\frac{1-s}{z}\right) + \frac{(1-z-\gamma_s)}{(1-z)}\left(1-\frac{1-s}{z}\right)\lambda\right]\Pi^{-1}\gamma B^G} \quad (92)$$

6.5.2 Proposition 2

Proof. To derive the determinacy conditions where only monetary policy is active we consider the IS equation, a static Phillips curve, passive monetary policy, i.e. $\phi_\pi = 0$. Substituting all the conditions in the IS equation, one gets:

$$\begin{aligned} y_t^{RE} = \lambda E_t y_{t+1}^{RE} + \left(-\frac{z\gamma_s}{1-z} + (1-\gamma_s)\right)\left(-(1-\vartheta)((1+\bar{r})b_t - \gamma y_t B^G(1+\bar{i})) + \lambda\gamma E_t y_{t+1} B^G(1+\bar{i})\right) \\ \left(\vartheta - \frac{1-s}{z}\right)(1+\bar{r}) + \frac{z}{1-z}((1+\bar{r})b_t - \gamma y_t B^G(1+\bar{i}))\left(\vartheta - \frac{1-s}{z}\right) \\ - \sigma\left(-\lambda\gamma E_t y_{t+1}^{RE} - \Delta\eta_{t+1}\right) + (1-\lambda)\left(\frac{\bar{i}}{(1+\bar{i})}\right) w_{st+1}^1 \end{aligned} \quad (93)$$

Which can be rewritten as:

$$y_t = \nu E_t y_{t+1} + \omega b_t + (1-\lambda)\left(\frac{\bar{i}}{(1+\bar{i})}\right) w_{st+1}^1 \quad (94)$$

where $\nu = \frac{\lambda\left(1+\left(-\frac{z\gamma_s}{1-z}+(1-\gamma_s)\right)\left(\vartheta-\frac{1-s}{z}\right)\gamma B^G(1+\bar{i})+\sigma\gamma\right)}{1-\left(B^G\gamma(1+\bar{i})\left(\left(-\frac{z\gamma_s}{1-z}+(1-\gamma_s)\right)(1-\vartheta)(1+\bar{r})+\frac{z}{1-z}\right)\left(\vartheta-\frac{1-s}{z}\right)\right)}$ Determinacy requires that $\nu < 1$ which in turn implies:

$$\begin{aligned} (1+\bar{r})B^G\gamma(1-\vartheta)\left(\frac{z\gamma_s}{1-z} - (1-\gamma_s)\right)\left(\vartheta - \frac{1-s}{z}\right) + \\ + \left(-\frac{z(1-\lambda\gamma_s)}{1-z} - (1-\gamma_s)\lambda\right) B^G\vartheta\gamma > \frac{-1+\lambda-\sigma\gamma\lambda}{(1+\bar{i})} + \left(-\frac{z(1-\lambda\gamma_s)}{1-z} - (1-\gamma_s)\lambda\right)\frac{1-s}{z}B^G\gamma \end{aligned} \quad (95)$$

6.5.3 Proposition 3

$$\begin{aligned} y_t^{RE} = \lambda E_t y_{t+1}^{RE} + \left(-\frac{z\gamma_s}{1-z} + (1-\gamma_s)\right)\left(-(1-\vartheta)\left((1+\bar{r})b_t + \gamma y_t B^G\left(\frac{\phi_\pi}{\Pi} - (1+\bar{i})\right)\right) + \right. \\ \left. -\lambda\gamma E_t y_{t+1} B^G\left(\frac{\phi_\pi}{\Pi} - (1+\bar{i})\right)\right)\left(\vartheta - \frac{1-s}{z}\right)(1+\bar{r}) + \\ + \frac{z}{1-z}\left((1+\bar{r})b_t + \gamma y_t B^G\left(\frac{\phi_\pi}{\Pi} - (1+\bar{i})\right)\right)\left(\vartheta - \frac{1-s}{z}\right) \\ - \sigma\left(\phi_\pi\gamma y_t - \lambda\gamma E_t y_{t+1}^{RE} - \Delta\eta_{t+1}\right) + (1-\lambda)\left(\frac{\bar{i}}{(1+\bar{i})}\right) w_{st+1}^1 \end{aligned} \quad (96)$$

Which can be rewritten as:

$$y_t = \nu E_t y_{t+1} + \omega b_t + (1-\lambda)\left(\frac{\bar{i}}{(1+\bar{i})}\right) w^1_{st+1} \tag{97}$$

where $\nu = \frac{\lambda\left(1-\left(-\frac{z\gamma_s}{1-z}+(1-\gamma_s)\right)\left(\vartheta-\frac{1-s}{z}\right)\gamma B^G\left(\frac{\phi_\pi}{\Pi}-(1+\bar{i})\right)+\sigma\gamma\right)}{1+\sigma\gamma+\left(B^G\gamma\left(\frac{\phi_\pi}{\Pi}-(1+\bar{i})\right)\left(\left(-\frac{z\gamma_s}{1-z}+(1-\gamma_s)\right)(1-\vartheta)+\frac{z}{1-z}\right)\left(\vartheta-\frac{1-s}{z}\right)\right)}$ Determinacy requires that $\nu < 1$ which in turn implies:

$$\phi_\pi > \frac{\lambda(1+\sigma\gamma)-1+\left[\left(\frac{z(1-\lambda\gamma_s)}{1-z}+\lambda(1-\gamma_s)\right)\left(\vartheta-\frac{1-s}{z}\right)+\frac{(1-z-\gamma_s)}{(1-z)}\left(\vartheta-\frac{1-s}{z}\right)(1+\bar{r})(1-\vartheta)\right](1+\bar{i})\gamma B^G}{\sigma\gamma+\left[\left(\frac{z(1-\lambda\gamma_s)}{1-z}+\lambda(1-\gamma_s)\right)\left(\vartheta-\frac{1-s}{z}\right)+\frac{(1-z-\gamma_s)}{(1-z)}\left(\vartheta-\frac{1-s}{z}\right)(1+\bar{r})(1-\vartheta)\right]\Pi^{-1}\gamma B^G} \tag{98}$$