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A monetary-fiscal theory of sudden inflations

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A Monetary-Fiscal Theory of Sudden Inflations*

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Abstract This paper posits an information channel as the explanation for sudden inflations. Consumers saving via nominal government bonds face a choice whether to acquire costly information about future government surpluses. They trade off the cost of acquiring information about the surpluses that back bond repayment against the benefit of a more informed saving decision. Through the information channel, small changes in the economic environment can trigger large responses in consumers' behavior and prices. This setting explains why there can be long stretches of time during which government surpluses have large movements with little inflation response; yet, at some point, something snaps, and a sudden inflation takes off that is strongly responsive to incoming fiscal news.

JEL classification: E31, E51, E52, E63

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1 Introduction

Countries can sustain variable government surpluses and large amounts of debt over long periods without an obvious connection between these quantities and inflation. Then at some point, as in the examples from Sargent (1983), they become connected, leading to a sudden inflation until fiscal and monetary authorities coordinate a response. We explain why surpluses, debt, and inflation appear disconnected and how they suddenly become connected using an information channel. The price of nominal government bonds is normally insensitive to information about the future government surpluses that back the bonds because it is difficult for households to research and understand information about those surpluses. Variable surpluses and high debt are sustainable until repayment risk drives households to worry enough that they acquire costly information about future surpluses, making the price of nominal bonds informationally sensitive, and potentially setting off a sudden inflation.

Our paper builds on the literature on the Fiscal Theory of the Price Level (FTPL). Sargent and Wallace (1981), Leeper (1991), Sims (1994), Woodford (1994), and Cochrane (2005) view the ultimate determinant of the price level to be the balance between the primary surpluses of the government and the value of its nominal debt.[1] An early challenge for the theory is contained in Canzoneri et al. (2001), who establish that the relationship between deficits and inflation in the United States from 1951 through 1995 seems inconsistent with the FTPL.[2] However, Cochrane (2022a,b) emphasized that we should expect fiscal policy to sometimes respond to news of incoming fiscal shocks, otherwise the government would never raise real resources from increasing its debt stock. Our work is related to more applied studies of regime-switching

[1] Sargent and Wallace (1981) put greater emphasis on the role of seigniorage revenues and *anticipated* inflation, while most recent papers on the FTPL stress the covariance between inflation and deficit *surprises* as an important source of contingent revenues for the government. Siu (2004) explored the optimal role of state-contingent inflation in the context of optimal taxation. Bassetto (2002) provides a richer description of the government strategies and the price-formation process that provide the theoretical underpinnings of the FTPL.

[2] Bassetto and Butters (2010) document several episodes in which large deficits in developed countries did not lead to inflation.

models of monetary-fiscal policy, such as Davig and Leeper (2007), Chung et al. (2007), and Bianchi and Melosi (2014, 2019). Bianchi and Melosi (2017) find evidence that beliefs of the possibility of a fiscally-led regime increased during the Great Recession. Bianchi and Melosi (2022) update their estimates to include the pandemic recession in an attempt to explain the sustained high inflation experienced in 2022. In these papers, the seeming lack of a response of fiscal policy to increasing amounts of debt serves as evidence that fiscal policy has entered into a new regime. We differ in the fact that, in our paper, economic agents within the model are not endowed with knowledge of the regime, but they can spend resources to learn about it.

In this paper, we start with a simple model where different fiscal regimes are present. In the long run, buying a nominal government bond is an investment in the government. The bond's nominal payoff will be the face value of the bond; the bond's real payoff is determined by the government's future real surplus. If the government's fiscal capacity is high enough, the price level is driven by considerations other than fiscal policy, such as the interest rate. Assuming that the country pursues low and stable inflation, the bond holder receives a stable repayment in real terms; we call this the "M" regime. However, there are instances in which the size of the surplus is constrained – due to a Laffer limit on tax revenue or, more likely, political constraints on austerity. In this case, the real payoff of the nominal bond has to adjust to fiscal shocks. Barring explicit default, this adjustment takes place through inflation; we call this the "F" regime. An example of this assumed long-run relationship is captured by Figure 1,[3] drawn for the numerical illustration that we develop in Section 4.[4] We view regime F as a low-probability event, so that informa-

[3]Inflation acts here as partial default on government debt, and in that way our paper is also related to the vast literature on sovereign default started by Eaton and Gersovitz (1981) and Calvo (1988). Our emphasis on endogenous information and its relationship with monetary-fiscal policy is what sets us apart. Bassetto and Galli (2019) develop a model of sovereign debt with heterogeneously informed agents, but the information structure there is taken as exogenous.

[4]In this example, there is a one-to-one relationship between the fiscal shock, that we assume impacts government spending, and the fiscal regime. Our theory is built on a more general case, where the fiscal regime and spending shocks are correlated, but the fiscal regime isn't necessarily uniquely determined by the size of spending shocks.

tion acquisition and big inflations are unlikely; in this we are connected to the literature on rare disasters pioneered by Barro (2006).[5]

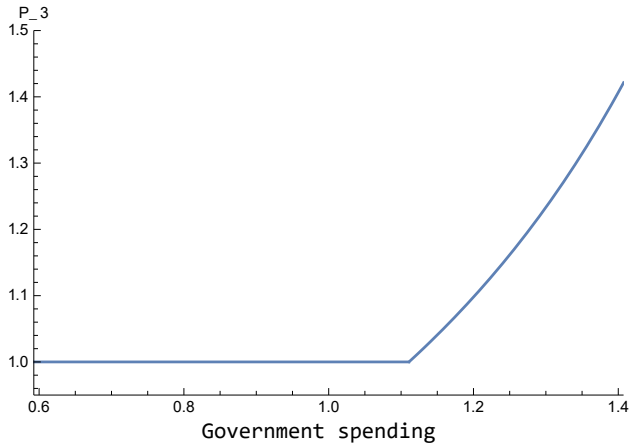

Figure 1: "Long-run" relationship between prices and government spending

When buying government bonds, debt holders anticipate the possibility that the economy may be in either regime, and form expectations accordingly. As long as they perceive the probability of the M regime to be high, they expect the future price level to be unresponsive to fiscal news, as in the flat portion of Figure 1. When signals about fiscal imbalances indicate a greater likelihood of the F regime, as when we get closer to the critical threshold/kink in Figure 1, the concern over higher future inflation spills over into current inflation as well. Bad news about current and future deficits have an immediate impact on prices. The M regime is likely to hold in times of ample fiscal capacity and the reverse is true for the F regime. The underlying asymmetry explains why there is greater potential for sudden fiscal inflations rather than deflations.[6]

[5]For a review of this literature, see Barro and Ursúa (2012). In our model, "rarity" is not in a dynamic sense, but it is interpreted across states of nature. A model of recurrent bouts of inflation interspersed with price stabilizations would require an explicit model of fiscal reforms over time, and is beyond the scope of what we pursue here.

[6]We deem it plausible that the government will not raise extra tax revenue to fund extra real returns, triggering large anticipated deflations. For example, as described in Jacobson et al. (2019), deflation caused by a rise in the price of gold would have required austere

When information about the future state of the economy arises from exogenous signals with a smooth distribution, inflation responds gradually to incoming news.[7] In order to explain the observed abruptness of the transition in the sensitivity of the price level to fiscal news, we push further by drawing connections to the literature on safe assets.

Pricing safe assets, and defining what safe assets are, has undergone intensive research since the Great Recession. Holmstrom (2015), Gorton (2017) and Caballero and Farhi (2017) develop a research agenda that views safe assets as special and necessary for their ability to provide savings and insurance. Safe assets are differentiated from other assets by the high cost to research their backing. In normal times, all households have uninformed positive beliefs about the repayment of a safe asset. In a crisis, when consumers doubt the backing of the assets, they will pay the price necessary to research the backing. As shown in Dang et al. (2017), actual knowledge of the safe assets' backing destroys the symmetric ignorance and leads to lower welfare through inability to insure.

In this paper, we build a bridge by relating safety to government strategies and inflation. When the M regime is very likely, such as on the left-hand side of Figure 1, government debt is an informationally insensitive asset. The incentive to acquire information about future deficits and their link to inflation is then low; a small amount of bad fiscal news is then unlikely to tip the balance and inflation will not respond much. However, if the incoming fiscal news generates more uncertainty about the future prevailing regime, a threshold can be reached where agents decide to acquire further information, possibly generating jumps in inflation. As suggestive evidence that this relationship may currently be in play, Figure 2 displays the behavior of Google searches including both the terms "inflation" and "stimulus" in the United States. Compared

fiscal policy in order to raise the surplus necessary to repay government debt. Faced with the required austerity, Roosevelt chose to leave the gold standard rather than deflate.

[7] In our statement, "gradual" is interpreted in the sense of comparative statics across different realizations of the signal. We discuss the counterpart in a richer dynamic context among the extensions of Section 5.2. It is worth noting that even a smooth increase in the response of inflation to deficit news may look abrupt quantitatively, depending on the nature of the underlying signals and shocks.

to the literature on safe assets, for simplicity we abstract from the liquidity role of government debt, focusing only on the role of endogenous information acquisition in generating jumps in the behavior of inflation. Adding a liquidity role that is disrupted when deficits generate uncertainty in the eventual real payoff of debt would further magnify the effects that we study here, thereby reinforcing the potential for discrete jumps.[8]

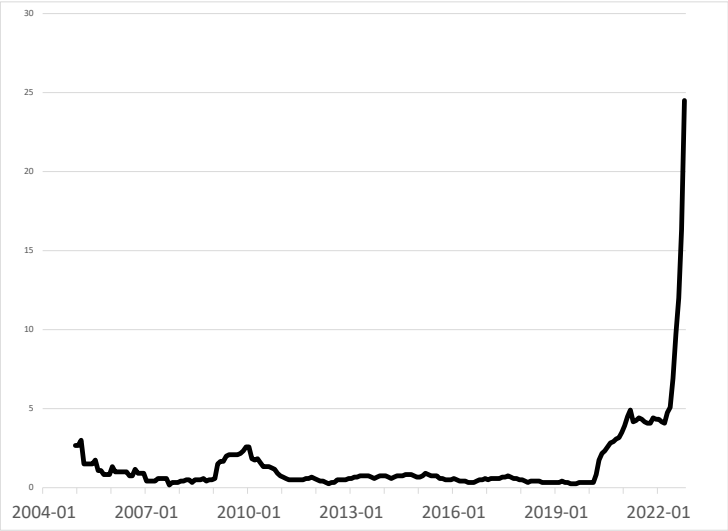

Figure 2: Google searches including both "inflation" and "stimulus," 12-month moving average (100=month with the highest search activity); retrieved from trends.google.com on 11/23/2022.

Our model features price-setting producers interacting with shoppers who choose quantities to purchase. The asymmetric nature of risks described in Figure 1 generates a complementarity in the choice of producers to acquire

[8]An analysis of the complications arising from the liquidity premium of government debt in relation to the FTPL is contained in Bassetto and Cui (2018), Berentsen and Waller (2018), Williamson (2018), and Brunnermeier et al. (2020). Also related is Andolfatto (2010), which embeds a version of the symmetric ignorance of safe assets in a macro money search model, but without the price level effects seen in this paper.

extra information about deficits and their consequence on future inflation. When other price setters are informed, an uninformed producer's greatest risk is to set a price lower than the optimal informed price charged by others, thereby having to meet a large demand below cost. This risk materializes when inflation ex post is high, so the right tail of the inflation distribution matters the most. In contrast, when other producers are uninformed, an informed producer's best scenario is to discover that it is optimal to set a lower price than others, in the anticipation of lower future inflation; this action again implies a high demand, but this time at the appropriate markup with correspondingly high profits.[9] In this case, uncertainty about the left tail of the distribution plays a predominant role.

Putting these two observations together, the right skewness of the long-run inflation distribution implies that information is more valuable when others choose to acquire it. In addition to the force that we highlight here, there may be other factors in play that determine the substitutability or complementarity of the information choice. As an example, in Grossman and Stiglitz (1980) information spill-overs make information acquisition a strategic substitute. Conversely, if collective desire for information leads mass media to pay closer attention to the relationship between government finances and inflation, the cost of acquiring information may be decreasing in the attention that others devote to the question. In either case, the robust feature is that endogenous attention acts as a force that magnifies the asymmetric response of inflation to deficit news when signals point to one fiscal regime versus the other.

The emphasis on endogenous information acquisition connects our paper to the literature on rational inattention.[10] In particular, the process by which quantities and prices are formed in the presence of endogenous information is a simplified version of Maćkowiak and Wiederholt (2015).

[9]Costs and benefits arise when uninformed producers err on the opposite side, but in that direction costs and benefits are bounded as production cannot fall below zero.

[10]See e.g. Sims (2003) and the review by Maćkowiak et al. (2022).

2 Description of the Model

Figure 3 presents an overview of the timing of the model. Our economy lasts three periods. The first period acts as a baseline, in which the price level is determined based on prior information alone; in the second period agents respond to incoming information and choose whether to acquire more, and the final period is "the long run," when all uncertainty is resolved and government debt is repaid according to the inflation and surplus regime that prevails.

To retain maximal transparency, we strip the model to its essentials while discussing some extensions in Section 5. While a representative agent model would suffice to describe our results under an exogenous information structure, more details are needed to illustrate the information channel. In particular, we need to describe an individual's choice of acquiring potentially more or less precise information than others, and the way in which learning from others may or may not take place. This description requires making explicit who is setting prices and who is choosing quantities. In order to separate prices and quantities, we follow Maćkowiak and Wiederholt (2015).[11]

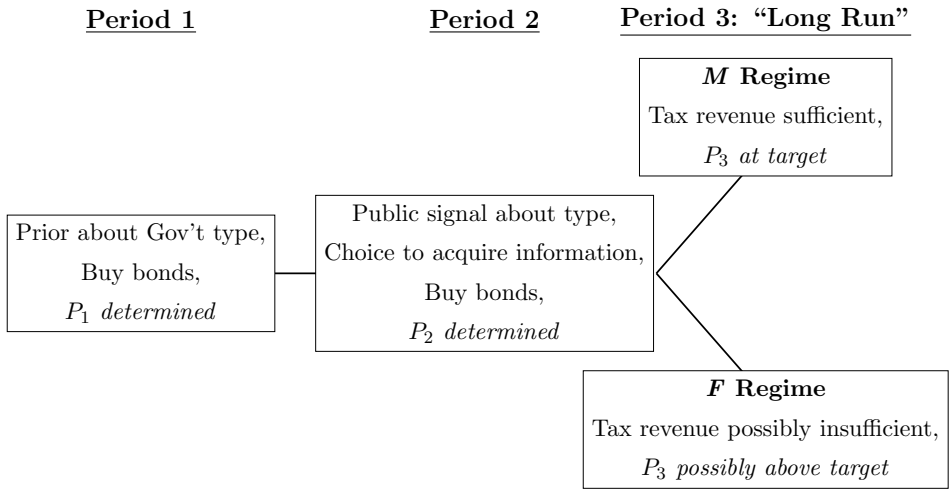

Figure 3: Outline of the Model's Timeline

[11] In Maćkowiak and Wiederholt (2015), a third group of agents set wages; we bypass this complication by letting workers own the firm.

2.1 Agents, Preferences and Technology:

The economy is populated by a continuum of identical households, indexed by $i \in [0,1]$. Each household is composed of a continuum of identical producers, indexed by $j \in [0,1]$, and a shopper. By separating consumers and producers, we separate the consumer problem of choosing quantity demanded from the producer problem of setting prices. The continuum of producers per household simplifies the information structure of the model. Each producer is atomistic with respect to both the household and the aggregate economy, hence takes as given marginal utility of consumption of the household to which the producer belongs and the aggregate price level.

Household i has preferences given by

$$\sum_{t=1}^{3} \beta^t E\left[u(c_{it}) - \int_0^1 \ell_{ijt} dj\right], \tag{1}$$

where c_{it} is consumption in period t and ℓ_{ijt} is the labor supplied by producer j of household i in period t, with one unit of labor producing one unit of the good.

c_{it} is a Dixit-Stiglitz aggregator of the differentiated varieties produced by each producer of each household:

$$c_{it} = \left(\int_0^1 \int_0^1 c_{kjt,i}^{\frac{\theta-1}{\theta}} dj dk\right)^{\frac{\theta}{\theta-1}}, \tag{2}$$

with $\theta > 1$.

2.2 Government

The government inherits an amount B_0 of nominal debt, held by the households, due at the beginning of period 1. To repay the debt, the government has access to lump sum taxes in each period t, denoted by T_t in real terms.[12]

[12]Real quantities are expressed in terms of the consumption aggregate.

There is no government spending in periods 1 and 2.[13] Lump sum taxes are set so as to keep debt constant in nominal terms until period 3.[14] The government has an exogenous and uncertain real spending requirement G_3 in period 3.[15]. There is a price level target P_3^* in the third period that the government attempts to achieve.

In period 3, the government is in one of two regimes: "price targeter," (M), or "fiscally-led," (F). In the M regime, real government taxes respond one for one to government spending and are given by $G_3 + B_2/P_3^*$, leaving a primary surplus of B_2/P_3^* to be distributed to bond holders. We call the M regime price targeting because, as we prove below, the primary surplus implies that the equilibrium price level will have to be P_3^*, independent of the realization of G_3. In the F regime, taxes are not able to respond to spending, possibly because they are at an upper bound determined by unmodeled political constraints, and are given by an exogenous real amount $\bar{T}$. We assume that $\bar{T}$ is known, but the quasilinear structure of our preferences implies that prices and private consumption are determined by deficits alone, regardless of the split between taxes and spending.[16]

Finally, the government sets "monetary policy" in the form of a fixed nominal interest rate i at which debt can be rolled over from period 1 to period 2 and from period 2 to period 3.[17] We normalize $1 + i = 1/\beta$, so that the price level would be constant in the absence of uncertainty.

[13] Assuming $G_1 = G_2 = 0$ is without loss of generality if government spending is deterministic in those periods; we discuss the consequences of uncertain deficits in period 2 in section 5.

[14] As with spending, in the absence of uncertainty this is without loss of generality.

[15] As is standard, we assume that the government purchases individual varieties so as to minimize the cost of providing G_3, yielding a demand for each variety that has the same price elasticity as that of the private sector.

[16] When $\bar{T}$ and G_3 are jointly lowered one for one, the only variable that adjusts is the labor supply, reducing production so as to restore market clearing.

[17] The addition of an endogenous interest rate response would strengthen our results if interest rates respond to inflation positively, as in a Taylor rule: current inflation would lead to greater future inflation through the Fisherian channel. Greater interaction would emerge in a model that features nominal frictions.

2.3 Information

We outline the information structure of the economy for households and producers from the first period to the third period. In the first period, households have a prior on the future government, in the second they update their prior based on a public signal and have the option to acquire more information, in the third the government type and spending are revealed.

1. The households start period 1 with a prior about the M vs. F regime and also about the realization of government spending G_3 *conditional* on the F regime;[18] we denote by π_1 the prior of being in regime F.

2. At the beginning of period 2, public signals about the probability of the F regime and about G_3 conditional on being in the F regime are revealed. π_2 is the posterior of the F regime conditional on time-2 information. Although this is not required, in general we expect that the incoming information about the regime and future spending conditional on the F regime are correlated: if $\bar{T}$ is interpreted as being driven by political constraints on taxation, those constraints are more likely to bind when spending needs are high.

3. In period 2, producers have an option to pay a utility cost K and learn further information about the future. To keep algebra simple, we assume that upon paying K they learn perfectly the future realizations of $\{M, F\}$ and G_3, but all of our results would apply if the cost gave them the option of acquiring a (common) signal that is more precise than the freely available signal, but not perfectly revealing.

4. Shoppers learn information by observing prices.

5. In period 3, the realization of the regime and spending become common knowledge.

[18] Agents also have a prior on G_3 conditional on the M regime, but this prior is irrelevant for the determination of an equilibrium.

2.4 Timing and Markets

In each period, nature moves first, then the government, the producers, and finally the shoppers. Specifically:

1. Shocks are realized. In period 1 there are no shocks; in period 2, (public) signals about the future are revealed; and in period 3 all uncertainty is resolved.

2. Interest rates and taxes are set by the government according to the rules described above.

3. In period 2 only, each producer has the option of acquiring extra information as described above. In each period, the producer posts the price for her variety, p_{ijt}, and this choice is made in isolation, based on the information available solely to the producer.

4. After observing prices, the shopper chooses the quantities of different varieties to buy, allocating the residual to bond purchases. Labor supply adjusts so as to meet demand.

3 The Response of Inflation to Fiscal News

We start our analysis by describing the equilibria that arise when the decision to acquire extra information is exogenous: in Subsection 3.1 we assume that no one acquires information, and in Subsection 3.2 we assume that everybody acquires it. In these equilibria, information is symmetric across all agents in the economy, and we can rely on the familiar notion of a (monopolistically) competitive equilibrium. In this case, the determination of an equilibrium prices is a simple application of the FTPL and household Euler equations, yielding expressions (22), (23), and (24). Subsection 3.3 shows how the exogenous equilibrium where no one acquires information and the exogenous equilibrium where everyone acquires information are spliced together under endogenous information. Due to the complementary nature of information, this splicing

leaves a region of multiple equilibria. Subsection 3.4 describes the end result: why an economy may have a limited inflation response to fiscal news over a range of signals until suddenly the inflation response jumps.

In order to highlight how the information channel leads to sudden inflations, we will compare the exogenous information equilibrium where no one acquires information in Subsection 3.1, and the endogenous information equilibrium described in Subsection 3.3. In the exogenous case, inflation responds gradually as consumer beliefs π_2 move from expecting the M regime where all debt is repaid in real terms (at the price level target P_3^*) to expecting the F regime with the exogenous maximum tax level $\bar{T}$. In the endogenous case, inflation responds gradually as π_2 increases, until beliefs about the probability of the F regime are high enough to provoke information acquisition. If, after information acquisition, the F regime and a large enough G_3 are revealed, inflation will suddenly rise.

3.1 Equilibrium with No Information Acquisition

In this subsection, we exogenously assume that no producer acquires extra information beyond the freely available signal, such as would be the case if $K \to \infty$. We will also use this as a building block in studying equilibria with endogenous information acquisition, since the same quantities and prices prevail in that case in regions when producers find it optimal not to acquire the information.

Each household takes as given government policy and the prices charged by all other households, as well as *aggregate* consumption by other households in each period that we denote by C_t. As usual, we break up each household i's optimization problem into two steps:

(i) Given consumption of the composite good c_{it} in each period, we determine the allocation across varieties that minimizes the cost of attaining c_{it};

(ii) Given prices, government policy, the cost of attaining c_{it} computed in the first step, and the demand function by other households for each

variety, we determine the optimal allocation $\{\{\ell_{ijt}\}_{j\in[0,1]}, c_{it}, b_{it}\}_{t=1,2,3}$.

In the first step, the household solves

$$\min_{\{c_{kjt,i}\}_{j,k\in[0,1]}} \int_0^1 \int_0^1 p_{kjt} c_{kjt,i} dj dk,$$

subject to (2). The optimal solution yields the demand function

$$\frac{c_{kjt,i}}{c_{it}} = \left(\frac{p_{kjt}}{P_t}\right)^{-\theta}, \tag{3}$$

with the price index defined by

$$P_t := \left(\int_0^1 \int_0^1 p_{kjt}^{1-\theta} dj dk\right)^{\frac{1}{1-\theta}}. \tag{4}$$

The corresponding cost for the household of attaining c_{it} is $P_t c_{it}$. In period 3, the government solves a similar problem, setting its demand to

$$\frac{G_{kj3}}{G_3} = \left(\frac{p_{kjt}}{P_t}\right)^{-\theta}, \tag{5}$$

with G_3 exogenous.

We can aggregate the household demand functions (3) and obtain

$$\frac{C_{kjt}}{C_t} = \left(\frac{p_{kjt}}{P_t}\right)^{-\theta}, \tag{6}$$

where C_{kjt} is aggregate consumption of the good supplied by producer j of household k in period t.

The remainder of the household problem consists of maximizing (1) with respect to $\{\{\ell_{ijt}, p_{ijt}\}_{j\in[0,1]}, c_{it}, B_{it}\}_{i\in[0,1],t=1,2,3}$ subject to ℓ_{ijt} meeting the demand functions (5) and (6), taking C_t as given, and subject to the budget constraints

$$b_{i,t-1} + \int_0^1 p_{ijt}\ell_{ijt} dj = \frac{b_{it}}{1+i} + P_t(c_{it} + T_t). \tag{7}$$

In (7), $b_{i0} = B_0$, the exogenously given initial debt, and $b_{i3} = 0$: no debt is rolled over in the final period.

The necessary and sufficient first-order conditions of the household problem yield the intratemporal optimality relation

$$u'(c_{it}) = \frac{\theta}{\theta - 1}, \quad j \in [0,1], t = 1,2,3, \tag{8}$$

the Euler equation

$$u'(c_{it}) = \beta(1+i)E_t\left[u'(c_{i\,t+1})\frac{P_t}{P_{t+1}}\right], \quad t = 1,2 \tag{9}$$

and the constraints (5), (6), and (7).

We are thus ready to define an equilibrium:

Definition 1 When no extra information can be acquired, a monopolistically competitive equilibrium is an allocation $\{c_{kjt,i}, C_{kjt}, c_{it}, C_t, \ell_{ijt}, b_{it}, G_{kjt}\}_{i,j,k\in[0,1],t=1,2,3}$, a price system $\{p_{ijt}, P_t\}_{i,j\in[0,1],t=1,2,3}$, fiscal policy $\{T_t, B_t\}_{t=1,2,3}$ and an exogenous interest rate i such that:

- All time-t variables are measurable with respect to the information available at t: that is, period 1 variables only depend on the prior, period 2 variables depend on the prior and the posterior based on the freely available signal, and period 3 variables depend on the entire history including the final realizations of the spending and monetary-fiscal regime (M or F).[19]

- Consumption of individual varieties by each household and the government satisfy the individual static household cost minimization problem, that is, equations (3), (5), and (6) hold.

[19]Since our problem does not feature any backward-looking state variables, it turns out that period 2 variables only depend on the posterior and not on the prior, and period 3 variables only depend on the final realization and G_3 and the monetary-fiscal regime. However, this is a result and not part of the conceptual definition.

- Given aggregate consumption and prices $\{C_t, P_t\}_{t=1,2,3}$, and given government policy and the demand functions (5), and (6), $\{c_{kjt,i}, c_{it}, \ell_{ijt}, p_{ijt}, b_{it}\}_{j,k\in[0,1],t=1,2,3}$ solve household i's optimization problem, that is, equations (7), (8), and (9) hold, with $b_{i3} = 0$.

- The government budget equation holds in each period, and taxes obey the fiscal rules that we set out:

$$\frac{B_t}{1+i} = B_{t-1} + P_t(G_t - T_t), \quad t = 1, 2, 3, \tag{10}$$

with $B_3 = 0$,

$$T_t = \frac{iB_{t-1}}{1+i}, t = 1, 2, \tag{11}$$

$$T_3 = G_3 + \frac{B_2}{P_3^*}, \quad \text{in regime } M, \tag{12}$$

and

$$T_3 = \bar{T}, \quad \text{in regime } F. \tag{13}$$

- Aggregates are consistent with individual choices, that is, (2) and (4) hold, as well as

$$C_{kjt} = \int_0^1 c_{kjt,i} di, \quad k, j \in [0, 1], t = 1, 2, 3, \tag{14}$$

and

$$C_t = \int_0^1 c_{it} di, \quad t = 1, 2, 3. \tag{15}$$

- Markets clear:

$$C_{kjt} + G_{kjt} = \ell_{kjt}, \quad k, j \in [0, 1], t = 1, 2, 3, \tag{16}$$

and

$$B_t = \int_0^1 b_{it} di, \quad t = 1, 2, 3. \tag{17}$$

In period 1, we directly impose $b_{i0} = B_0, i \in [0, 1]$ as the initial condition.

Since all households are identical, the equilibrium takes a simple form, as we now prove.

Proposition 2 *There exists a unique equilibrium, described by the following equations:*

- *Allocation:*

$$c_{kjt,i} = c_{it} = C_{kjt} = C_t = (u')^{-1}\left(\frac{\theta}{\theta - 1}\right), \quad i, j, k \in [0,1], t = 1, 2, 3, \tag{18}$$

$$G_{ij3} = G_3, \quad i, j \in [0,1], \tag{19}$$

$$b_{it} = B_t = B_0, \quad t = 0, 1, 2, \tag{20}$$

  and (16);

- *Prices:*

$$p_{ijt} = P_t, \quad i, j \in [0,1], t = 1, 2, 3, \tag{21}$$

$$P_3 = \begin{cases} P_3^* & \text{in regime } M, \\ \frac{B_2}{\bar{T} - G_3} & \text{in regime } F, \end{cases} \tag{22}$$

$$\frac{1}{P_2} = \pi_2 \frac{\bar{T} - \bar{G}_3}{B_2} + (1 - \pi_2)\frac{1}{P_3^*}, \tag{23}$$

  where $\bar{G}_3 := E_2(G_3|F)$ is expected government spending conditional on the information freely available in period 2 and on being in regime F, and

$$\frac{1}{P_1} = E_1\left(\frac{1}{P_2}\right). \tag{24}$$

- *Taxes are given by equations (11), (12), and (13).*

Proof. Straightforward substitution proves that the allocation, prices and policy in the statement of the theorem meet the definition of an equilibrium. To prove uniqueness, note that, after using equations (5), (6), and (16) to substitute for ℓ_{ijt}, the household problem features a strictly concave objective

function and a convex constraint set, hence its solution is unique.[20] Since all households share the same initial conditions, they must thus make the same choices. Furthermore, the objective function is symmetric in the production of all varieties, therefore charging the same price is optimal for each variety is optimal; equations (5) and (6) imply then that the demand for each variety is the same as well. Having established that the consumption, prices, and production of each variety by each household are the same, equation (8) implies that equation (18) must hold, which uniquely determines consumption. Equations (5) and (6) uniquely determine production and government spending. Since all households choose the same amount of bonds, equations (10) and (11) imply that bonds must satisfy (20). Finally, equations (9), (12), and (13) imply that good prices must be given by the solution to equations (22), (23), and (24). ■

In a finite-horizon model such as ours, the terminal price is necessarily determined by the resources available to repay government debt.[21] In regime M, these resources adjust so as to ensure that the price level is P_3^*, but in regime F, which we interpret as a regime of fiscal distress, the resources are fixed and the price level is forced to adjust in response to government spending. Consistent with the notion that regime F corresponds to tight government finances, we assume that, at least in expected value as of time 2, taxes in regime F are lower than in regime M:[22]

Assumption 3 $\bar{T} < \bar{G}_3 + \frac{B_2}{P_3^*}$.

Equation (23) shows that the sensitivity of the *second period* price to incoming fiscal news is higher when the probability of the regime of fiscal stress is higher. Formally:

[20]Equation (16) is a market clearing condition and would not appear in a household problem in a competitive equilibrium. Under monopolistic competition, a household is a monopolist for the varieties that it produces so this market-clearing condition is taken into account at the optimization stage, when the aggregates C_t, G_t, and P_t are taken as given.

[21]In a model with money, the terminal price would be determined by the resources available to repay both debt and money.

[22]In Assumption 3, B_2 appears as an endogenous object, but the assumption can be equivalently written in terms of the exogenous B_0, since $B_2 = B_0$.

Proposition 4 *In equilibrium,*

$$\frac{\partial^2 p_2}{\partial \pi_2 \partial \bar{G}_3} > 0. \tag{25}$$

Proof. Define $z_2 : 1/P_2$. From equation (23), we have

$$\frac{\partial z_2}{\partial \bar{G}_3} = -\frac{\pi_2}{B_2} < 0,$$

$$\frac{\partial z_2}{\partial \pi_2} = \frac{\bar{T} - \bar{G}_3}{B_2} - \frac{1}{P_3^*} < 0,$$

where the last inequality follows from Assumption 3, and

$$\frac{\partial^2 z_2}{\partial \pi_2 \partial \bar{G}_3} = -\frac{1}{B_2} < 0.$$

It follows that

$$\frac{\partial P_2}{\partial \pi_2} = -P_2^2 \frac{\partial z_2}{\partial \pi_2} > 0$$

and

$$\frac{\partial^2 P_2}{\partial \pi_2 \partial \bar{G}_3} = 2P_2^3 \frac{\partial z_2}{\partial \bar{G}_3} \frac{\partial z_2}{\partial \pi_2} - P_2^2 \frac{\partial^2 z_2}{\partial \pi_2 \partial \bar{G}_3} > 0.$$

■

Since the first period price level P_1 is determined by prior information alone, the properties that we proved for the second period price level P_2 carry over immediately to inflation between periods 1 and 2: incoming news about fiscal spending has little effect on inflation when the probability that the government is against a fiscal limit is low, but inflation will respond more and more as the chance of being in a regime in which taxes are unable to catch up to spending increase.

3.2 Equilibrium with Full Information Acquisition

We next consider the opposite case, in which all producers in period 2 acquire perfect information, as it would endogenously happen if $K = 0$. As in the previous section, this is a building block that we will use when characterizing

the regions in which producers endogenously choose information acquisition in Section 3.3. Producers acquire this information by paying K, and shoppers learn from prices.[23]

This is simply a special case of the equilibrium of the previous subsection, where the posterior information on the regime and G_3 is degenerate. We obtain $P_2 = P_3 = P_3^*$ when regime M is known to prevail and $P_2 = P_3 = B_2/(\hat{T} - G_3)$ when F is known to prevail. Period 2 prices are either completely unresponsive to fiscal news, or maximally responsive. These prices fully reveal the regime and the realization of G_3, thereby verifying that shoppers will be fully informed even without acquiring the underlying information directly.[24]

Our results readily generalize to less-extreme assumptions about the precision of period 2 information. Even if the extra information that agents acquire is not perfect, the posterior probability π_2 would be on average closer to reflecting the future state, so that inflation would on average respond more to fiscal news when regime F is about to be realized than when regime M prevails instead.

3.3 Equilibrium with Endogenous Information Choice

Having described the equilibria that prevail when none of the producers acquire information or all of them do, we now study the conditions under which either choice is an equilibrium. For simplicity, we restrict our attention to pure-strategy equilibria in which all producers take the same action. The monopolistically competitive equilibria that we characterized in the previous two subsections describe how the allocation and prices are determined in the two

[23] The equilibrium that we study here has the feature that the price charged by producers fully reveals the acquired information to the shoppers. There are no equilibria in which all producers choose to acquire extra information, but this information is not revealed through prices. This is because the problem of the producers has a unique solution, so that all producers necessarily charge the same price in equilibrium; furthermore, conditional on this observation, different expectations about P_3 necessarily imply different choices for P_2.

[24] An exception occurs if there is a positive probability that $P_2 = P_3^*$ in regime F. In this case, shoppers would not know whether $P_2 = P_3^*$ as a consequence of being in regime M or because of the specific realization of G_3 in regime F. Nonetheless, they would have full information about the future price $P_3 = P_3^*$, which is all they need to implement the optimal intertemporal choice according to the Euler equation.

cases when, exogenously, everyone or no one knows the government's type. To ascertain when the choice by the producers to acquire information (or not) is optimal we need to describe the consequences of their choice.

As we are looking at pure strategy equilibria, we need to verify their existence by looking at the incentives of a producer to deviate from the actions of the rest of the producers. In studying these incentives, we will identify features of our model that lead to complementarities in the choice of acquiring information. First we look at the situation of a producer who chooses not to acquire information when all other producers acquire information, then at the situation of a producer who chooses to acquire information when all other producers don't acquire information. Having established the two pure strategy equilibria, we describe the regions where each, or both, equilibrium is possible.

The producer problem is simplified by the assumption that producers are infinitesimal both with respect to the aggregate economy and with respect to their household. Furthermore, we assume that shoppers do not learn from the choices of a measure zero set of producers.[25] These assumptions imply that producers take the equilibrium allocation of all goods except their own as given. A producers' choice only affects their cost of production and information acquisition, and accrues an extra infinitesimal amount of resources to the household, that is evaluated at the marginal utility of consumption given by the monopolistically competitive equilibrium. We also assume that a household's shoppers do not shop from producers of the same household, so that they do not observe the prices that they charge, and the infinitesimal extra resources (positive or negative) coming from price deviations by the producers in period 2 are consumed in the final period.[26]

[25]It would be straightforward to provide microfoundations for this assumption by introducing idiosyncratic productivity shocks, which could easily be accommodated within our framework, but we refrain from doing so not to burden the notation further.

[26]By the envelope condition, it does not matter whether the extra resources are used for consumption or leisure in period 3. Whenever shoppers have at least as much information as producers, the envelope condition also implies that it does not matter whether extra resources are consumed in period 2 or period 3. When a single producer chooses to acquire information while everybody else remains uninformed, the envelope condition no longer applies from her perspective, but our results are robust to alternative assumptions about the timing of spending, as we explain in footnote 33.

3.3.1 Existence of pure strategy equilibrium with information acquisition

We study the conditions under which there exists an equilibrium in which all producers acquire information. Consider the problem of a producer when all other producers choose to acquire information. In this case, shoppers are able to learn the information and thus infer the future regime and spending by the producers' prices, and the economy is in the equilibrium of Section 3.2. Suppose producer ij unilaterally chooses not to acquire information, thereby saving K. We analyze the expected revenue and profit for the deviating producer.

Producer ij knows that other producers have acquired information, so that $P_2 = P_3$ according to the equilibrium of Section 3.2, but has to set her price without knowing the aggregate price level. Conditional on P_2, the revenues accruing to producer ij from setting a price p_{ij2} are

$$p_{ij2} C_2 \left(\frac{p_{ij2}}{P_2} \right)^{-\theta}. \tag{26}$$

This revenue is consumed in period 3.[27] In the competitive equilibrium, the household's marginal utility of consumption is $\theta/(\theta - 1)$ and the period-3 price is $P_3 = P_2$. Furthermore, aggregate consumption is $C_2 = (u')^{-1}(\theta/\theta - 1)$. Substituting this information into (26), the revenue evaluated in utility terms is

$$\frac{\frac{\theta}{\theta-1} u'^{-1}\left(\frac{\theta}{\theta-1}\right)}{P_2} \left(\frac{p_{ij2}}{P_2} \right)^{-\theta}. \tag{27}$$

The labor cost incurred by producer ij when setting a price p_{ij2} and when the

[27] Note that in this case the shopper has more information than the producer, so results are the same no matter when the household consumes this revenue, which represents a marginal increment in resources from the perspective of the household as a whole.

aggregate price level is P_2 is[28]

$$C_2 \left(\frac{p_{ij2}}{P_2} \right)^{-\theta}. \tag{28}$$

Producer ij chooses her optimal price by maximizing *expected* revenues minus costs, which yields

$$p_{ij2} = \frac{E_2 \left[P_3^{\theta} \right]}{E_2 \left[P_3^{\theta-1} \right]}, \tag{29}$$

where E_2 is the expectation based on the information freely available in period 2, that is prior information and the free signals alone, and we used the fact that $P_2 = P_3$. Publicly available information is insufficient to know P_2 when other producers acquire information.[29] The expected profits earned by producer ij are given by

$$\Pi_{\text{noinfo}} := u'^{-1} \left(\frac{\theta}{\theta - 1} \right) \frac{1}{\theta - 1} \left[E_2 \left(P_3^{\theta} \right) \right]^{1-\theta} \left[E_2 \left(P_3^{\theta-1} \right) \right]^{\theta}. \tag{30}$$

Producer ij compares the profits in equation (30) with those earned if she acquired information, which are given by[30]

$$\Pi_{\text{eq}} := u'^{-1} \left(\frac{\theta}{\theta - 1} \right) \frac{1}{\theta - 1}. \tag{31}$$

Π_{eq} and Π_{noinfo} differ by the factor $\left[E_2 \left(P_3^{\theta} \right) \right]^{1-\theta} \left[E_2 \left(P_3^{\theta-1} \right) \right]^{\theta}$, which is less than 1 by Jensen's inequality.[31]

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[28] The labor cost is directly expressed in utility terms, since the marginal disutility of labor is 1.

[29] In the degenerate case of no uncertainty, we obtain $p_{ij2} = P_2$. In this case, information has no value, and the "uninformed" producer chooses the same monopolistically competitive equilibrium price as all others.

[30] Equation (33) is obtained by repeating the same steps, but assuming that P_2 is known by the producer.

[31] We have $\left[E_2 \left(P_3^{\theta} \right) \right]^{1-\theta} \left[E_3 \left(P_3^{\theta-1} \right) \right]^{\theta} = \left[\left[E_2 \left(P_3^{\theta} \right) \right]^{\frac{1-\theta}{\theta}} E_2 \left(\left(P_3^{\theta} \right)^{\frac{\theta-1}{\theta}} \right) \right]^{\theta}$, and $\left[E_2 \left(P_3^{\theta} \right) \right]^{\frac{\theta-1}{\theta}} > E_2 \left(\left(P_3^{\theta} \right)^{\frac{\theta-1}{\theta}} \right)$ since $f(x) = x^{\frac{\theta-1}{\theta}}$ is concave.

Definition 5 Under endogenous information, an equilibrium with full information acquisition is a monopolistically competitive equilibrium in which all producers acquire information, shoppers learn the information from prices, and it is optimal for each individual producer to acquire information, that is, $\Pi_{\text{eq}} - \Pi_{\text{noinfo}} > K$.

An equilibrium with full information acquisition exists provided there is enough uncertainty about the future price level P_3. The incentives to acquire information are particularly sensitive to *upward tail risk* on inflation.[32] Intuitively, the most costly scenario for an uninformed producer facing informed competition is to pick a price that is too low and be forced to produce large quantities at a loss in real terms. The opposite situation, in which the uninformed producer charges too high a price, is less costly, since in this case production is low and profits are bounded below by zero.

3.3.2 Existence of pure strategy equilibrium with no information acquisition

We study the conditions under which there exists an equilibrium in which no producers acquire information. Consider the case of a producer when all other producers choose not to acquire information. In this case, the aggregate economy is in the monopolistically competitive equilibrium of Section 3.1. An individual producer can pay the cost K and learn the future price level P_3. As before, we look at the expected revenue and profit of the deviating producer.

The producer's revenues and costs are still described by equations (26) and (28), but now P_2 is given by equation (23) and is not equal to P_3 in general. Since shoppers (at the margin) spend resources in period 3,[33] the revenues of

[32] Mathematically, both expectations in equation (30) involve positive powers of the future price level, and one of them involves a power that is above 1.

[33] If shoppers were to spend some resources in period 2, the optimal price charged by an informed producer would skew closer to that of uninformed producers, and the gains from information acquisition would be smaller. This would expand the region in which an equilibrium with no information acquisition exists and thus the region of equilibrium multiplicity that we discuss below.

the producer converted to utility terms are given by[34]

$$\frac{\frac{\theta}{\theta-1}u'^{-1}\left(\frac{\theta}{\theta-1}\right)}{P_3}\left(\frac{p_{ij2}}{P_2}\right)^{-\theta}. \tag{32}$$

An informed producer maximizes the difference between (32) and (28), which is achieved by setting $p_{ij2} = P_3$. The profits (in utility terms) accruing to the producer are

$$(u')^{-1}\left(\frac{\theta}{\theta-1}\right)\frac{1}{\theta-1}\left(\frac{P_3}{P_2}\right)^{-\theta}.$$

Prior to receiving the extra information, the expected profits of acquiring information when no other producer does are thus given by[35]

$$\Pi_{\text{fullinfo}} := (u')^{-1}\left(\frac{\theta}{\theta-1}\right)\frac{1}{\theta-1}P_2^{\theta}E_2P_3^{-\theta} = (u')^{-1}\left(\frac{\theta}{\theta-1}\right)\frac{1}{\theta-1}\left[E_2P_3^{-1}\right]^{-\theta}E_2P_3^{-\theta}, \tag{33}$$

where the last equality follows from equation (23).

Repeating the same steps, the profits of uninformed producers in this equilibrium are given by equation (31).

Definition 6 Under endogenous information, an equilibrium with no information acquisition is a monopolistically competitive equilibrium in which no producers acquire the information and shoppers remain uninformed, and it is optimal for each individual producer not to acquire information, that is, $\Pi_{\text{fullinfo}} - \Pi_{\text{eq}} < K$.

Jensen's inequality implies that this happens when uncertainty about the future price level is sufficiently low. The decision to acquire information when nobody else does is particularly sensitive to *downside inflation risk*.[36] The

[34]Note that equilibrium consumption and its marginal utility is the same in the equilibria with or without information acquisition, so the corresponding terms in equations (27) and (32) remain the same. Also, equation (32) embeds $\beta(1+i) = 1$, although the same results could be derived in the more general case.

[35]In this case, the equilibrium P_2 is known as of time 2 without acquiring information, since no other producer chooses to acquire information before setting their price.

[36]Mathematically, this occurs because the expectations in equation (33) involve negative powers of the price level.

most favorable scenario for an informed seller facing uninformed competition is to find out that the future price will be low, so she can set a low price, undercut the competition and reap the rewards of a high volume of sales while maintaining the appropriate profit margin. In the reverse case, the best an informed producer can do is to charge a higher price than competitors and produce little, with limited profits.

3.4 Characterizing the sensitivity of inflation to fiscal news

While mathematically we have not ruled out significant downside inflation risk, our economic application is predicated on the idea that this risk is limited.[37] The asymmetry that justifies our exercise lies in the fact that the government will implement the target price P_3^* when fiscal resources are plentiful, and a higher price level will tend to prevail when the fiscally constrained regime F applies, leaving the door open to greater upside inflation risk. In our application, it is thus likely that the threshold for the information cost above which an equilibrium with information acquisition exists is *lower* than the threshold above which an equilibrium with no information acquisition exists; this happens in the quantitative example that we have below. In this case, we have three regions indexed by π_2, the probability of the F regime: one in which only the equilibrium with no information acquisition is possible, an intermediate region where multiple equilibria coexist, and one in which only the equilibrium with full information acquisition survives.

In the exogenous equilibrium of Section 3.1, inflation *gradually* responds more to incoming fiscal news as the probability that taxes will not respond to government spending increases. This gradual increase is present even under endogenous information, additionally we may have a further discrete jump:

- When the probability of regime F is sufficiently low, the only pure-strategy equilibrium is one in which it is not profitable to spend resources

[37] See footnote 6 regarding Roosevelt leaving the gold standard rather than implementing austerity.

to learn more about government finances. As a consequence, changes in π_2 in this region have a small effect on the price level.

- As π_2 increases, we enter the region of multiple equilibria. If, at some point within this region, the full information acquisition equilibrium is sustained, a jump in the sensitivity of the price level to inflation occurs, and the price level starts closely tracking incoming fiscal news.[38]

- As π_2 increases further, only the equilibrium with full information acquisition survives. In this case, regime F is sufficiently likely that producers find it optimal to pay the cost and learn about government finances. Thus, no matter what occurs in the region with multiple equilibria, eventually a jump in the responsiveness of inflation to fiscal news occurs.

Extrapolating our results to an economy where this uncertainty is revealed over time,[39] we can explain why inflation does not respond to bad fiscal news for a long time, and yet at some point it discretely snaps and starts reacting. The region with multiple equilibria adds an additional fear: even an observer with full knowledge of the economy cannot know exactly the tipping point when bad fiscal news will lead to increased inflation responsiveness.

4 A Numerical Example

To better illustrate the message of our paper, we compute a specific parametric example. While a thorough quantitative assessment of our analysis is beyond the scope of our paper, we chose parameter values that deliver reasonable quantitative predictions.

We set the nominal interest rate to $\beta(1+i) = 1.02$ so that inflation from one period to the next would be 2% if the economy were in regime M with probability 1. We set $\theta = 3.5$, so that the producer mark-up is 40%.

[38] Since this region features multiple equilibria, in principle multiple jumps could occur, back and forth. However, a reasonable selection criterion would make such erratic behavior unlikely. Eventually, as we move to the next region, no further jumps can occur, supporting the prediction that at some point inflation starts tracking incoming fiscal news more closely.

[39] We discuss this extension further in Section 5.2.

We assume that G_3 is governed by an underlying truncated normal random variable, and that fiscal policy is set so that taxes adjust one-to-one with the realization of spending up to an upper bound $\bar{T}$.[40] We normalize mean spending to 1 and use the standard deviation σ and the tax threshold to achieve a 10% probability that the price level in period 3 is 2% above its target, normalized to 1, and a 5% probability that it is 6% above its target.

In period 2, households receive a (public) normally distributed signal of G_3, and we choose its precision and the information cost such that endogenous information acquisition is triggered with probability approximately 1/8.[41] To compute this probability, we also need to take a stance on which equilibrium will be played in the (small) region of multiple equilibria; we assume that in this region agents remain uninformed, which is the Pareto-dominant equilibrium. This gives us values of $\sigma_s = .057$ for the standard deviation of the signal conditional on G_3 and a cost of information equal to 0.6% of equilibrium profits evaluated in leisure terms.[42]

Figure 1 plots the price level in the long run (period 3), as a function of the realization of government spending.[43] This captures our notion that government debt has an option-like payoff, in which fiscal and monetary policy will act to prevent deflationary forces, but may be hamstrung by fiscal constraints when faced with upside pressure on prices.

Figure 4 plots second period inflation as a function of the freely available information about future spending when $K = \infty$, that is, when endogenous information acquisition is impossible. When the signal indicates that the M regime is almost certain to prevail, inflation is about 1.3%, below the 2% level that would prevail if regime M were known to prevail as of period 1 as well.[44]

[40] We truncate the distribution of G_3 so that the terminal price level P_3 never exceeds 10 times its target in the M regime, which is normalized to 1. This truncation is numerically irrelevant since the probability of exceeding the truncation threshold is 10^{-23}.

[41] We experimented with different combinations of precision and cost yielding this frequency, and the results are not particularly sensitive to the particular combination used.

[42] Since utility is assumed to be linear in leisure, by using expressing the cost of information in this way, we do not need to specify the utility function for consumption.

[43] The range of the plot corresponds to the mean $\pm$ 4 standard deviations.

[44] This undershoot coming from good news on the fiscal front could of course be undone if the central bank set a correspondingly higher interest rate as of period 1, which would

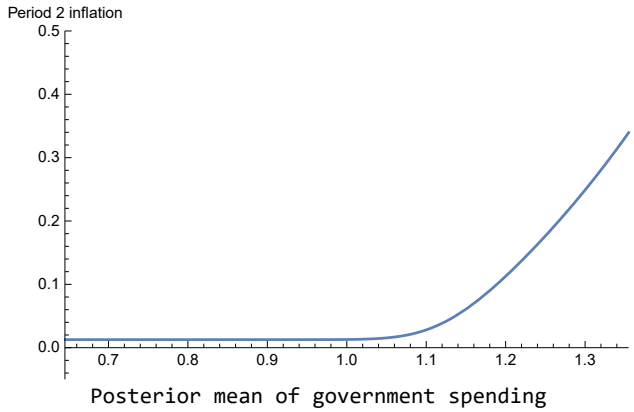

Figure 4: Period-2 inflation under exogenous information.

As expected, second period inflation is insensitive to fiscal news over much of the range. However, as the signal reveals a greater likelihood of the F regime prevailing, inflation in the second period starts responding more and more to the incoming signal. For sufficiently negative fiscal news, when regime F is almost certain to prevail, inflation responds to the signal in period 2 as strongly as it would in period 3 to the actual realization of spending.[45]

Figure 5 plots the cost as a fraction of equilibrium profits for the producer not to acquire extra information when all other producers do, and the benefit of acquiring the information when nobody else does. The two measures look very similar in absolute value, but they are not exactly symmetrical. The two horizontal lines correspond to the information cost K that we set to 0.006, and the two vertical lines denote the critical thresholds at which the cost and the benefit cross this value. The grey area between the two lines is the region where multiple equilibria are possible. To the left of the grey area, the only equilibrium features no information acquisition: the probability that the government will be constrained by its fiscal capacity is negligible and the

cause a parallel increase in inflation in both good states and bad. Whether the central bank is willing to take this risk, or has the information advantage necessary, as in Bauer and Swanson (2021), to be confident in doing so is beyond the scope of this paper.

[45]More precisely, it is inverse inflation that responds in the same way, since in our model inverse inflation is linear in the spending shock as of period 3 and in its expected value as of period 2 conditional on regime F.

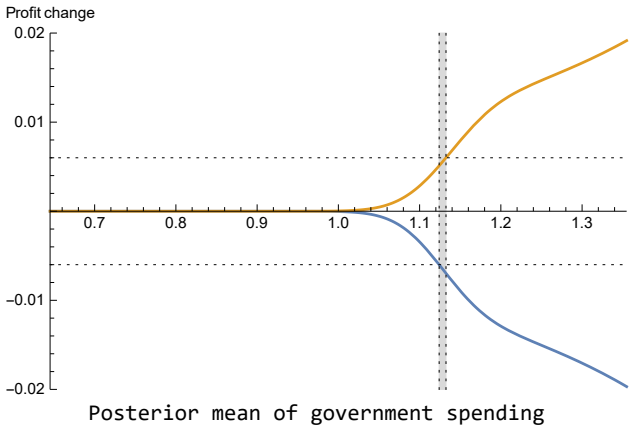

Figure 5: Costs of not acquiring information (lower line) and benefits of acquiring it (upper line) when all other agents take the opposite decision, as a fraction of profits. Horizontal lines represent the cost of information K, and the vertical lines denote the point at which the cost or the benefit exceed the critical threshold. The grey area is where multiple equilibria are possible, as both information acquisition and no information acquisition are optimal if others take the same action.

change in profits arising from the acquisition of information is too small for producers to choose to acquire it, regardless of what others are doing. To the right of the grey area, fiscal sustainability is a sufficient concern that all producers will find it optimal to become informed in equilibrium. In the grey area, both equilibria are possible, depending on expectations about the actions of others. The region of multiple equilibria is small, having a probability of about 1.5%.[46]

Finally, Figure 6 displays inflation as a function of incoming fiscal news, with the region of multiple equilibria shaded in grey once again. To the left of the grey area, inflation behaves exactly as in Figure 4, since all agents have the same information. To the right of the grey area, agents are fully informed in equilibrium, so inflation is no longer responding to the second period signal,

[46]The region of multiple equilibria is small as a result of the distance between the two critical thresholds being small. The limited size of the region can be proven more generally: letting σ_{P_3} be the standard deviation of P_3 conditional on information freely available at time 2, the distance between the two critical thresholds is $O(\sigma_{P_3}^3)$ as $\sigma_{P_3} \to 0$.

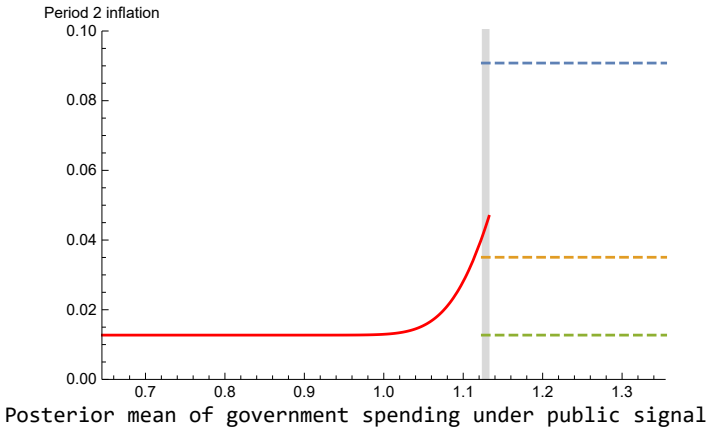

Figure 6: Period-2 inflation under endogenous information. Solid line: inflation in the region where no endogenous information acquisition takes place. Dashed lines: inflation when endogenous acquisition takes place, for different realizations of the spending process. Grey area: region of multiple equilibria, where either option is possible, depending on the expectations of the agents in the economy.

but to the fully anticipated realization of fiscal variables that will prevail in period 3. The horizontal lines correspond to three possible realizations of the spending shock G_3.[47] In the grey area, the equilibrium can either be described by the solid line of no information or by the dotted lines, depending on the coordination of agents' beliefs about the information actions of others.

Comparing this figure with the case of exogenous information in Figure 4, endogenous information gives rise to "inflation scares," a critical tipping point at which economic agents start paying close attention to incoming fiscal news and react to the news. Once this threshold is reached, a discrete jump in inflation will occur. Since agents process available information efficiently, this jump cannot be one-sided: if the endogenously acquired information turns out to be benign, the inflation scare will abate. However, when the bad signal is confirmed by the information agents acquire, a discrete upward jump in

[47] These lines are drawn for a value of the spending shock G_3 equal to the posterior mean at the upper threshold of the region of multiple equilibria, and for the same plus or minus one posterior standard deviation. Thus they represent the central range of what we would expect to happen.

inflation takes place. Since the price level in period 3 is bounded below, inflation will feature frequent downward movements bringing the price level back toward its target, and less frequent, but larger upward jumps.[48]

5 Extensions

5.1 Multiple Deficit Shocks

So far, we have exclusively considered uncertainty about primary surpluses in the final period, where all the action in the interim period comes from fiscal news about the final period. It is straightforward to add an additional fiscal shock to the model that occurs in the interim period. Specifically, we can add a shock to taxes and/or spending in period 2 to the model that affects the amount of debt B_2 that the government inherits at the beginning of period 3.

What really matters for our results is the evolution of the present value of primary surpluses that back the debt. If we retain (for simplicity) the same interest rate peg as in the main model, but allow for more general shocks to taxes and spending in period 2 and 3, in an equilibrium with no information acquisition we would still obtain[49]

$$\frac{B_1}{P_2} = T_2 - G_2 + \beta E_2(T_3 - G_3), \tag{34}$$

where the expectation here is taken across the future realizations of T_3 and G_3, and across the possible fiscal regimes in the terminal period. The key assumption that makes our model work is that bad fiscal news is associated with both lower present values of the surpluses (almost by definition) and more uncertainty about their realized value. To the extent that a bad realization of

[48] At the critical threshold, the probability that the information reveals that spending is sufficiently low that P_3^* can be attained is 1/3, so a significant fraction of downward jumps do not get back all the way to the inflation that would prevail if the regime M had been expected to prevail.

[49] Equation (34) is simplified by the linearity of utility in leisure. Otherwise, equilibrium consumption would vary across periods and the marginal utility of consumption would appear in the expression. This would not change the logic of our argument.

$T_2 - G_2$ pushes the government close to a fiscal limit where future inflation is more uncertain, our analysis of both exogenous and endogenous-information equilibria continues to apply.[50]

5.2 More than Three Periods

Our analysis can also be extended to a longer time horizon. The simplest extension is one in which endogenous learning happens in one shot: once a producer chooses to acquire information, she learns the monetary-fiscal regime that will prevail in the long run, as well as the entire sequence of shocks that will befall the economy up to that time. When an equilibrium of this type exists, the equations that characterize it are quite similar to those included in Section 3, except that there is an option value of waiting before paying the cost. When agents start with a favorable prior but the true regime implies low future primary surpluses (and hence high prices), the agents may learn the truth only gradually. In this case, the economy would feature persistent creeping inflation, until the posterior shifts enough to warrant information acquisition and a big jump in prices occurs.

If there are many periods, learning takes a more prominent role, because an agent may choose to wait to acquire information, trading a miss on profits in a single period against learning for free the sequence of shocks for all subsequent periods from other agents who acquire information. If periods are sufficiently short, an equilibrium will fail to exist for the reasons highlighted by Grossman and Stiglitz (1980).[51] In that case, one could follow their work and introduce noise traders to prevent full information revelation through prices, at the cost of making the model analytically intractable.[52] As mentioned in the introduction, learning in the form of Grossman and Stiglitz (1980) introduces a strategic substitutability in the choice of acquiring information; if this channel

[50]The equivalence between period-2 and period-3 deficits is related to Ricardian equivalence, as discussed in Barro (1974).

[51]Grossman and Stiglitz (1980) can be viewed as a limiting case in which the period is so short that learning takes place immediately.

[52]The CARA-normal paradigm that yields closed-form solutions only works if the underlying security has a linear payoff. Asymmetries are an essential part of our discussion.

is sufficiently strong, it could overcome the complementarities in acquiring information we highlight here. Even in that case, endogenous attention leading to information acquisition would magnify the response of prices to incoming fiscal news compared to the model in which agents learn passively, although discrete jumps may no longer occur.

In our model (extended to multiple periods), a big inflation jump is an isolated event: after fiscal policy is found to be hamstrung, the price level jumps on impact. A simple extension that would generate inflation persistence is the introduction of long-term nominal debt, as in Cochrane (2001). Alternatively, nominal frictions à la Calvo or Rotemberg would deliver both real effects and inflation persistence, at the cost of greater complexity.

5.3 Liquidity

Holmstrom (2015), Gorton (2017) and Caballero and Farhi (2017) show models in which safe assets play a special role in providing liquidity services for the financial intermediation sector. In their story, the high cost to acquire private information about safe assets' underlying value is important in generating this special role by eliminating concerns over asymmetric information. The liquidity services lead to a premium on safe assets that translates into higher prices (and lower returns) for the assets. In our model, government bonds are nominally risk free, but their *real* return becomes riskier and riskier as the prospects of fiscal limits loom. Endogenous learning in the form that we describe here threatens to disrupt the liquidity premium when the fiscal risk becomes sufficiently acute. Papers such as Bassetto and Cui (2018) and Brunnermeier et al. (2020) highlight the possibility that the liquidity role of government bonds serves to fortify government surpluses when using the FTPL to analyze the price level. Thus, learning about future surpluses would offer an additional avenue by which jumps in inflation could occur by hampering liquidity and causing spikes in the real interest rate.

6 Conclusion

It is well known that monetary and fiscal policy are intertwined, yet this connection does not stand out when we look at the experience of advanced economies after World War II. The United States and many other countries responded to the 2008 financial crisis by running unprecedented deficits, yet inflation remained subdued throughout the developed (and even most of the developing) world. This has led many economists and policymakers to take a benign view of the even bigger deficits that followed the COVID pandemic.

In this paper, we argue that there are reasons to expect the connection between deficits and inflation to be subdued, only to resurface suddenly. We identify the endogenous attention that households and firms pay to prospective deficits and their link to monetary policy as an amplifying mechanism that leads to sudden inflation scares. In analogy with Holmstrom (2015) and Gorton's 2017 description of safe assets, we view households as usually poorly informed about the future surpluses that back government bonds; they buy and hold bonds without knowing the government's long-run ability to raise surpluses because they believe the bonds will be repaid, and it's too costly to learn more.

However, when enough bad fiscal news comes in, the risk that the link between inflation and debt may appear leads the private sector to pay greater attention to prospective fiscal policy. When fiscal authorities are revealed to be hamstrung, the idyllic times come to the end, and inflation and debt become linked. We also document the possibility of regions of multiple equilibria, such that pinpointing the exact tipping point may be difficult; in this case, prominent government announcements may act as focal points for regime changes. One such example may be the deficit-financed "mini-budget" announced by Truss's government in the United Kingdom in September 2022.

Our work has taken fiscal policy as given. An interesting avenue of further research is to link the attention choices of the private sector to the response of fiscal authorities. Returning to the United Kingdom example, the abrupt depreciation of the British pound and the large increase in long-term rates

on U.K. bonds that followed the September announcement led to the fall of Truss's government, and to the formation of a government that more than reversed most of the announced measures. This endogenous response offers an additional reason for the private sector to be complacent about deficits in ordinary times: they would expect that, once signals of a confidence crisis emerge, the government would rein in fiscal profligacy and restore calm. Only when the probability is sufficiently high that this sort of austerity may be politically or economically impossible would a confidence crisis emerge with sustained inflation.

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