Online Appendix

C Supplementary Results

C.1 Signal Structure and Conditional Variance

The main framework in the paper models the information technology as reducing the conditional variance of the continuous loss rate δ to a constant $1/\tau'$, independent of the signal realization. This is an assumption that helps us preserve tractability, and holds exactly under Gaussian learning about δ. Since the loss rate δ must live in $[0, 1]$, however, Gaussianity is only an approximation. This extension shows that the same structure can arise exactly with a bounded prior and a suitably parametrized binary signal. To keep the algebra transparent, we work with the simple case of a uniform prior over the loss rate.

To keep the symmetric structure on signals and posterior means, we work with binary signals (H and L) that have a linear likelihood conditional on the state of the world (Kolotilin 2018):

$$Pr\left(sig = H|\delta\right) = \frac{1}{2} + \kappa(\delta - \delta_0) \tag{C.1}$$

where κ controls the informativeness of the signal. For probabilities to remain well-defined for all δ in the support, κ must be small enough that the right-hand side stays in $[0, 1]$. This structure preserves the unconditional symmetry:

$$Pr\left(sig = H\right) = \frac{1}{2} + \kappa(\mathbb{E}[\delta] - \delta_0) = \frac{1}{2} \tag{C.2}$$

The updated (posterior) mean after receiving the high signal is expressed through Bayes' rule:

$$\mathbb{E}[\delta|sig = H] = \frac{\mathbb{E}[\delta Pr(sig = H|\delta)]}{Pr(sig = H)} \tag{C.3}$$

$$\implies \mathbb{E}[\delta|sig = H] = \mathbb{E}\left[\delta + 2\kappa\delta(\delta - \delta_0)\right] \tag{C.4}$$

$$\implies \mathbb{E}[\delta|sig = H] = \delta_0 + 2\kappa\mathbb{E}\left[\delta(\delta - \delta_0)\right] \tag{C.5}$$

$$\implies \mathbb{E}[\delta|sig = H] = \delta_0 + \underbrace{2\kappa \text{Var}(\delta)}_{s} \tag{C.6}$$

We use the notation s as in the main text to characterize the shift between the prior and posterior means. The same applies for the L signal.[1]

---

[1] Note that there is another step ensuring that this is exactly similar to the setup studied in the main text:

Now assume that the prior distribution over the loss rate is uniform on a bounded interval contained in $[0,1]$: $\delta \sim \mathcal{U}[a,b]$, consequently with prior mean $\delta_0 = (a+b)/2$ and variance $\text{Var}(\delta) = \tau^{-1} = (b-a)^2/12$. This bounded prior is convenient because it is symmetric around its mean, which is the key property behind the result.[2] We can now compute the variance of the posterior distribution. Start by deriving the conditional second moment:

$$\mathbb{E}[\delta^2|sig = H] = \frac{\mathbb{E}[\delta^2 \Pr(sig = H|\delta)]}{\Pr(sig = H)} = 2\mathbb{E}\left[\delta^2 \left(\frac{1}{2} + \kappa(\delta - \delta_0)\right)\right] \tag{C.7}$$

$$= \mathbb{E}[\delta^2] + 2\kappa\, \mathbb{E}[\delta^2(\delta - \delta_0)] \tag{C.8}$$

Rewriting in terms of central moments by substituting $\delta = (\delta - \delta_0) + \delta_0$:

$$\mathbb{E}[\delta^2(\delta - \delta_0)] = \mathbb{E}[(\delta - \delta_0)^3] + 2\delta_0\, \mathbb{E}[(\delta - \delta_0)^2] + \delta_0^2\, \mathbb{E}[\delta - \delta_0] \tag{C.9}$$

$$= \mathbb{E}[(\delta - \delta_0)^3] + 2\delta_0\, \text{Var}(\delta) \tag{C.10}$$

Since the uniform distribution is symmetric around its mean, $\mathbb{E}[(\delta - \delta_0)^3] = 0$, and so:

$$\mathbb{E}[\delta^2|sig = H] = \mathbb{E}[\delta^2] + 4\kappa\, \delta_0\, \text{Var}(\delta) \tag{C.11}$$

The conditional variance is then:

$$\text{Var}(\delta|sig = H) = \mathbb{E}[\delta^2|sig = H] - (\mathbb{E}[\delta|sig = H])^2 \tag{C.12}$$

$$= \mathbb{E}[\delta^2] + 4\kappa\, \delta_0\, \text{Var}(\delta) - (\delta_0 + s)^2 \tag{C.13}$$

$$= \left(\text{Var}(\delta) + \delta_0^2\right) + 4\kappa\, \delta_0\, \text{Var}(\delta) - \delta_0^2 - 2\delta_0\, s - s^2 \tag{C.14}$$

$$= \text{Var}(\delta) + 4\kappa\, \delta_0\, \text{Var}(\delta) - 2\delta_0 \cdot 2\kappa\, \text{Var}(\delta) - s^2 \tag{C.15}$$

$$= \text{Var}(\delta) - s^2 \tag{C.16}$$

where we used the notation $s = 2\kappa\, \text{Var}(\delta)$. The same derivation applies for $sig = L$, since

---

previously, the agents were directly computing expected utility knowing that there was a 1/2 chance of getting the positive signal. Now, agents take into account that there is a probability distribution over the signal probability, and so expected utility is computed by integrating over this distribution: $\mathbb{E}[U_I] = \int_\delta U_I(H) Pr\,(sig = H|\delta)\, f(\delta)\, d\delta + \int_\delta U_I(L) Pr\,(sig = L|\delta)\, f(\delta)\, d\delta$. But this goes back exactly to $\mathbb{E}[U_I] = \frac{1}{2}U_I(H) + \frac{1}{2}U_I(L)$ by integrating over probabilities, since $U_I(H)$ and $U_I(L)$ are constant once you fix the signal received.

[2] We show at the end of this appendix section that the necessary condition for this result to hold is that the third moment of the prior distribution is zero.

$(-s)^2 = s^2$. The conditional variance is therefore signal-independent:

$$\frac{1}{\tau'} = \frac{1}{\tau} - s^2 \tag{C.17}$$

which mirrors the constant conditional variance assumed in the main text. Since the bond payoff in the safe zone is linear in the loss rate, $1-\delta$, the same result also delivers signal-invariant payoff variance.

More generally, the same logic applies for any bounded prior over $\delta \in [0,1]$ with mean δ_0, variance $\mathrm{Var}(\delta)$, and third central moment $m_3 \equiv \mathbb{E}[(\delta-\delta_0)^3]$. Under the same signal structure, the conditional second moment is:

$$\begin{aligned}\mathbb{E}[\delta^2|sig=H] &= \mathbb{E}[\delta^2] + 2\kappa\,\mathbb{E}[\delta^2(\delta-\delta_0)] &\text{(C.18)}\\ &= \mathbb{E}[\delta^2] + 2\kappa\,(m_3 + 2\delta_0\mathrm{Var}(\delta)) &\text{(C.19)}\end{aligned}$$

which implies:

$$\begin{aligned}\mathrm{Var}(\delta|sig=H) &= \mathbb{E}[\delta^2|sig=H] - (\delta_0+s)^2 &\text{(C.20)}\\ &= \mathrm{Var}(\delta) - s^2 + 2\kappa m_3 &\text{(C.21)}\end{aligned}$$

By symmetry, after the low signal we obtain:

$$\mathrm{Var}(\delta|sig=L) = \mathrm{Var}(\delta) - s^2 - 2\kappa m_3 \tag{C.22}$$

Hence the posterior variance is signal-invariant if and only if $m_3 = 0$, i.e. if the prior distribution has zero skewness around its mean. The uniform prior used above is one convenient example of such a bounded distribution, but the result is more general.

C.2 Roll-Over Crises at $\psi = 0$

Assumption 1 in the main text ensured that the sovereign would not face self-fulfilling roll-over crises when $\psi = 0$, i.e. when only uninformed traders were buying its bonds. This was necessary to have a trade-off in information acquisition: more information increases the average price by lowering the risk premium, but also increases the volatility of prices and thus the chances to end up in a self-fulfilling roll-over crisis.

When the fundamentals of the country (or equivalently here what the uninformed agents expect the fundamentals to be, δ_0) are sufficiently bad, we can get the opposite of

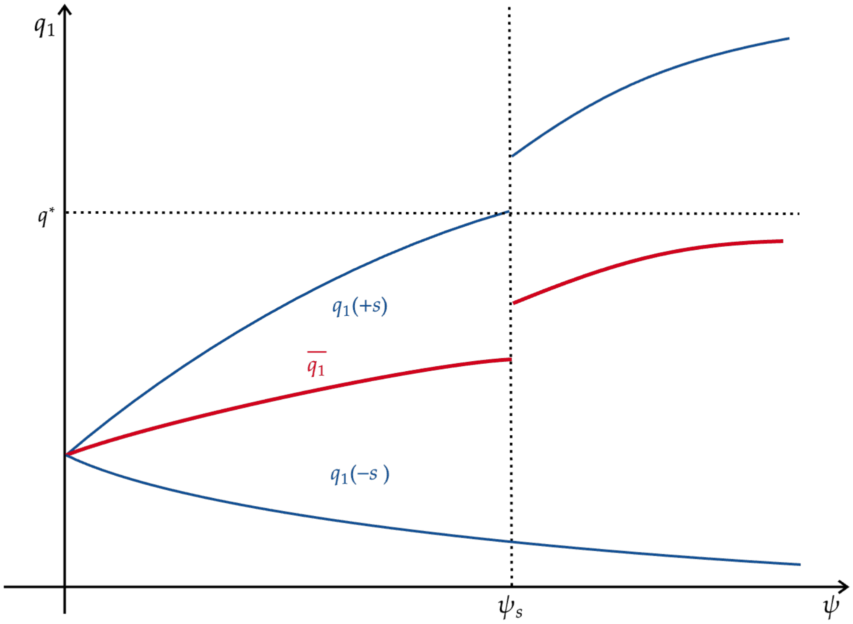


Figure 12: Equilibrium Price of an Asset when Assumption 1 does not hold. This figure plots the equilibrium price on an asset as a function of the number of investors that acquire information. The threshold q^* represents the cutoff at which runs become possible, for example because of roll-over crises as in Cole and Kehoe (2000).

Assumption 1, i.e.:

$$\frac{(1-\delta_0)\tau - \gamma B_1}{\tau - \phi\gamma} < q^* \tag{C.23}$$

In that case, information acquisition becomes unambiguously beneficial, because the two effects are going in the same direction. This is depicted in Figure 12. This highlights that the main insights of the paper only apply in specific conditions. In particular, should the fundamentals or the market expectations be sufficiently low, policymakers should seek to encourage information acquisition rather than discourage it.

C.3 Wallace (1981) Irrelevance

When the central bank decides to purchase a quantity x_1 of sovereign bonds, it exposes itself to losses: recall that we assumed that, even without self-fulfilling default, bonds were never entirely safe because of the fundamental loss rate δ. As such, the central bank can make losses on its balance sheet. In the classic Wallace (1981) result, these losses are passed back to the investors through taxes, making asset purchases irrelevant.

We start by showing how this result can appear in our framework, in the case where there are only uninformed agents (see Section 2.2.1). This can be seen by looking at the expected utility of an uninformed agent, which is given by:

$$U = \mathbb{E}[b\chi] - bq_1 - \frac{\gamma}{2}\mathbb{V}[b\chi] \tag{C.24}$$

If the central bank purchases x_1 units, sophisticated agents should understand that in the event of a default, they will be taxed to cover the losses of the central bank, and will get remittances if there is no default. They should thus understand that they are exposed to an amount $b + x_1$ of default risk:

$$U = \mathbb{E}[b\chi] - bq_1 + x_1(\mathbb{E}[\chi] - q_1) - \frac{\gamma}{2}\mathbb{V}[(b + x_1)\chi] \tag{C.25}$$

which leads to the following demand:

$$b = \tau\frac{(1-\delta_0) - q_1}{\gamma} - x_1 \tag{C.26}$$

and plugging this demand into market clearing leads to the irrelevance of asset purchases, as the equilibrium price is given independent of x_1.

One can interpret the results of the main paper by thinking of uninformed agents as households that do not update their expectations (in the spirit of Iovino and Sergeyev 2023), and informed agents as international hedge funds that are not subject to taxation by the country they are buying sovereign bonds from. Another interpretation could be that the central bank would not tax agents directly but instead indirectly through inflation, and agents do not incorporate fully this inflation tax in their demand.[3]

C.4 Uncertain Scale of Asset Purchases

Should central bankers seek to communicate very clearly the scale of future purchases, or is uncertainty about their actions a desirable feature? We can answer very straightforwardly that question in our main framework. Recall that the expected utility of a prospective informed agent, for a given ψ, was given by equation (A.17) when introducing asset purchases reducing the supply B_1:

$$\mathbb{E}[U_I] = \frac{\tau'}{2\gamma}\cdot\frac{\gamma^2(B_1 - x_1 - \phi(1-\delta_0))^2 + (\tau - \phi\gamma)^2 s^2}{(\tau + \psi\tau' - \phi\gamma)^2} \tag{C.27}$$

---

[3] This is in line with thinking of inflation expectations as being sticky (Mankiw and Reis 2002, Sims 2003, Coibion and Gorodnichenko 2015, Pfäuti 2023). However, a recent paper by Bonaglia, d'Arienzo, Fallico, Gennaioli and Iovino (2025) shows overreaction of inflation expectations, which would imply negative effects of asset purchases, by having agents reduce their demand by more than implied by the Wallace (1981) irrelevance result.

Holding everything else fixed, and assuming that the scale of asset purchases is uncorrelated with the signals, this expression is clearly quadratic in x_1, and thus increasing in the uncertainty over x_1.

To see this analytically, observe that for any random variable x with mean $\bar{x}$ we have:

$$\begin{aligned} \mathbb{E}[(b-x)^2] &= \mathbb{E}[(b-\bar{x}+\bar{x}-x)^2] && \text{(C.28)} \\ &= (b-\bar{x})^2 + \mathbb{E}[(\bar{x}-x)^2] + 2\mathbb{E}[(b-\bar{x})(\bar{x}-x)] && \text{(C.29)} \\ &= (b-\bar{x})^2 + \text{Var}(x) && \text{(C.30)} \end{aligned}$$

which implies that for uncertain purchases:

$$\mathbb{E}[U_I] = \frac{\tau'}{2\gamma} \cdot \frac{\gamma^2(B_1 - \bar{x} - \phi(1-\delta_0))^2 + (\tau - \phi\gamma)^2 s^2}{(\tau + \psi\tau' - \phi\gamma)^2} + \underbrace{\frac{\tau'}{2\gamma} \cdot \frac{\gamma^2 \text{Var}(x)}{(\tau + \psi\tau' - \phi\gamma)^2}}_{\text{Uncertainty term, } > 0} \tag{C.31}$$

Uncertainty thus directly pushes up expected utility, and thus encourages more information acquisition, in a way that is proportional to the size of the uncertainty $\text{Var}(x)$.

C.5 Continuous Signals

The main framework in the paper assumed a binary signal structure for tractability and clarity of expressions, $\tilde{s} \in \{-s, +s\}$. One drawback of the binary assumption is that it can generate a discontinuity in the expected utility of informed investors as a function of ψ (see the details of the calculation in Appendix A.3): when enough investors are uninformed, there is suddenly a $1/2$ chance of getting a price low enough to trigger multiple equilibria at $t = 2$. This section shows that this discontinuity is not a feature of the model, but rather an artifact of the binary signal structure.

Assume that the common signal received by informed investors is drawn from a uniform distribution with support $[-s_M, +s_M]$ and mean zero. We assume that s^M satisfies Assumption 2: this ensures that the price is decreasing in the intensity of information acquisition for some signals. The price function is still linear in the signal, as in the main text, as long as it is below the threshold q^*:

$$q_1(\tilde{s}) = \bar{q}_1 + \Psi\tilde{s} \tag{C.32}$$

with the same expressions for $\bar{q}_1$ and Ψ as in the main text. Figure 13 plots the equivalent of Figure 2 in the continuous signal case. Instead of a continuous threshold ψ_s above

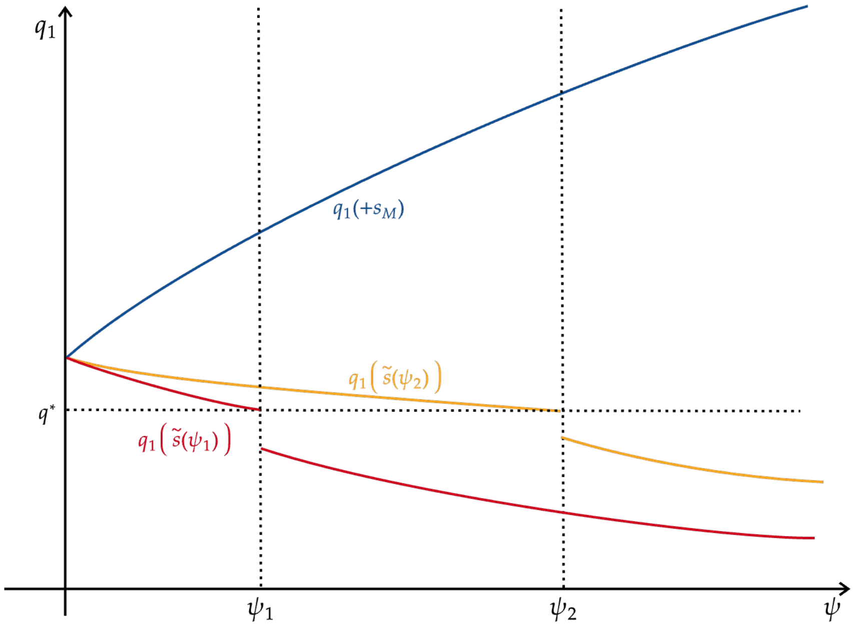


Figure 13: Equilibrium Price with Continuous Signals

which multiple equilibria arise, it is more convenient in this version to work with a continuous threshold *signal* $\tilde{s}^*(\psi) < 0$ such that for any signal realization $\tilde{s} < \tilde{s}^*(\psi)$, the price is low enough to trigger multiple equilibria at $t = 2$. Importantly, this threshold will depend on the number of informed agents: when more agents are informed, it is easier to get in the crisis zone. This threshold is defined by:

$$\bar{q}(\psi) + \Psi(\psi)\tilde{s}^*(\psi) = q^*. \tag{C.33}$$

Turning now to expected utility, we can keep our previous apparatus but now need to integrate over *each pair* of signals $\{-\tilde{s}, \tilde{s}\}$ with $\tilde{s} \in [-s_M, +s_M]$. The case where the price is always above q^* is similar to the one in the main text, so we focus on the case where for a given ψ there is a range of signals $[-s_M, \tilde{s}^*(\psi)]$ that trigger multiple equilibria at $t = 2$ (equivalently, there exists $\tilde{s}^*(\psi)$ in $[-s_M, +s_M]$ such that $q(\tilde{s}^*(\psi)) = q^*$).

We can then use the expected utility expressions in (A.17) and (A.19) to write:

$$\mathbb{E}[U_I] = \frac{1}{s_M}\left[\int_{-s_M}^{\tilde{s}^*(\psi)} \mathbb{E}_\lambda[U_I(\tilde{s})]d\tilde{s} + \int_{\tilde{s}^*(\psi)}^{0} \mathbb{E}[U_I(\tilde{s})]d\tilde{s}\right] \tag{C.34}$$

This is a continuous function of ψ, which ensures that there is at least one equilibrium in information acquisition. The derivative is given by:

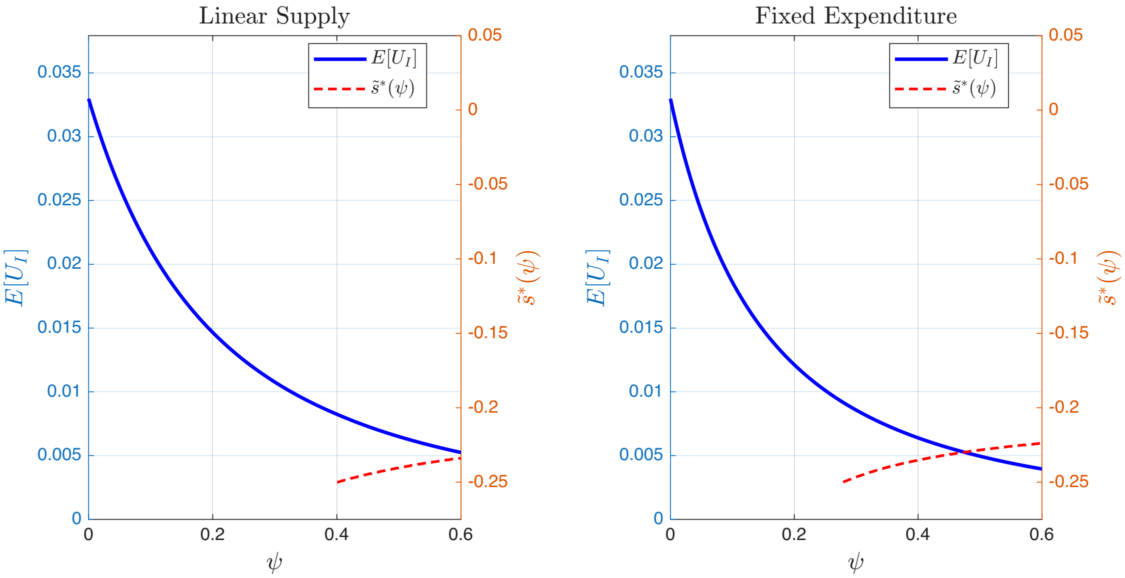


Figure 14: Expected Utility and Threshold Signals with Continuous Signals.

$$\frac{d}{d\psi}\mathbb{E}[U_I] = \frac{1}{s_M}\left[\int_{-s_M}^{\tilde{s}^*(\psi)} \frac{d}{d\psi}\mathbb{E}_\lambda[U_I(\tilde{s})]d\tilde{s} + \int_{\tilde{s}^*(\psi)}^{0} \frac{d}{d\psi}\mathbb{E}[U_I(\tilde{s})]d\tilde{s}\right] + \frac{1}{s_M}\cdot\frac{d\tilde{s}^*(\psi)}{d\psi}\cdot[\mathbb{E}_\lambda[U_I(\tilde{s}^*(\psi))] - \mathbb{E}[U_I(\tilde{s}^*(\psi))]] \quad \text{(C.35)}$$

The first two terms are just the derivatives of the expected utility terms, and are strictly negative. The last term corresponds to the change in expected utility for informed agents when ψ increases marginally because there is an extra interval of signals that switch from being safe to being in the crisis zone. This last term is also negative under the restriction of Proposition 1 for instance.[4]

Figure 14 shows the expected utility of informed investors and the threshold signal ($\tilde{s}^*$) as a function of ψ in the continuous signal case. The right panel also provides the same exercise, but with the fixed expenditure supply assumption (Section 5.1) for additional robustness.

---

[4] See Appendix D.4 for the study of ψ-multiplicity in the continuous signals case. Here again, asset purchases can also be helpful to avoid multiplicity in the information acquisition stage, ultimately preventing roll-over crises in the same way as in our benchmark framework.

D Alternative Frameworks

D.1 Fixed Mass of Investors

This extension studies the case where there is a fixed mass 1 of investors. Investors are by default uninformed, and can decide to acquire information by paying a fixed cost. We denote by ψ the share of informed investors. We start by deriving equilibrium conditions in the case where a single equilibrium is guaranteed at $t = 2$.

With this setup, the market clearing condition becomes:

$$B_1 - \phi q_1(\tilde{s}) = \psi \tau' \frac{1 - \delta_0 + \tilde{s} - q_1(s)}{\gamma} + (1 - \psi) \tau \frac{1 - \delta_0 - q_1(\tilde{s})}{\gamma} \tag{D.1}$$

which leads to the following price :

$$q_1(\tilde{s}) = \frac{(1 - \delta_0)(\psi \tau' + (1 - \psi)\tau) + \psi \tau' \tilde{s} - \gamma B_1}{\psi \tau' + (1 - \psi)\tau - \phi \gamma} \tag{D.2}$$

which also takes the linear form we used in the main text:

$$q_1(\tilde{s}) = \bar{q}_1 + \Psi \tilde{s} \tag{D.3}$$

with:

$$\bar{q} = \frac{(1 - \delta_0)(\psi \tau' + (1 - \psi)\tau) - \gamma B_1}{\psi \tau' + (1 - \psi)\tau - \phi \gamma} \quad ; \quad \Psi = \frac{\psi \tau'}{\psi \tau' + (1 - \psi)\tau - \phi \gamma} \tag{D.4}$$

One feature to notice is that in this setup, $\Psi(1) > 1$. This "over-reaction" is driven by the supply assumption. As one can see in the following equation, the price response to a signal is amplified by the supply response, leading to a more than one-to-one response of prices:

$$\Psi(1) = \frac{\tau'}{\tau' - \phi \gamma} \tag{D.5}$$

For this part, we will thus focus on equilibria where ψ^* is below $1 - \gamma\phi/\tau$ such that $\Psi < 1$. There are various ways to ensure this is the case: first, one could add noise traders (see Appendix D.3.3) to mute the response of prices to signals. Second, one can ensure that the costs of information acquisition are high enough to prevent ψ^* from reaching $1 - \gamma\phi/\tau$.

The equivalent of Assumption 2 is:

$$s > \frac{(\tau' - \tau)\gamma(B_1 - \phi(1 - \delta_0))}{\tau'(\tau - \phi \gamma)} \tag{D.6}$$

The roll-over threshold for information acquisition is derived from:

$$q_1(-s;\psi_s) = q^* \implies \psi_s = \frac{\phi(1-\delta_0) - \tau(B_1 - b^*) - \phi\gamma b^*}{(\tau' - \tau)(B_1 - b^*) - \phi(1-\delta_0)(\tau'-\tau) + \tau' s} > 0 \tag{D.7}$$

The information choice equilibrium is however harder to characterize, because one needs to compare the expected utility of informed traders to the one of uninformed investors, instead of just a fixed number.

For informed traders, our previous formulation still applies since the price takes the same linear form as before:

$$\mathbb{E}[U_I] = \frac{\tau'}{2\gamma}\left[(1-\delta_0-\bar{q})^2 + (1-\Psi)^2 s^2\right] \tag{D.8}$$

Uninformed traders, on the other hand, realize from an ex-ante perspective that they will not be able to change their holdings demand as a function of the signal. Their expected utility for the state where the informed received the signal $\tilde{s}$ is thus given by:

$$\mathbb{E}[U_U|\tilde{s}] = \underbrace{\tau\frac{1-\delta_0-q_1}{\gamma}}_{\text{holdings}}\underbrace{(1-\delta_0+\tilde{s}-q_1)}_{\text{expected payoff}} - \underbrace{\frac{\gamma}{2\tau}\left(\frac{\tau}{\gamma}(1-\delta_0-q_1)\right)^2}_{\text{risk aversion cost}} \tag{D.9}$$

Grouping terms:

$$\mathbb{E}[U_U|\tilde{s}] = \frac{\tau}{2\gamma}(1-\delta_0-q_1)^2 + \frac{\tau}{\gamma}(1-\delta_0-q_1)\tilde{s} \tag{D.10}$$

Using the linear formulation for the price:

$$\mathbb{E}[U_U|\tilde{s}] = \frac{\tau}{2\gamma}(1-\delta_0-\bar{q}-\Psi\tilde{s})^2 + \frac{\tau}{\gamma}(1-\delta_0-\bar{q}-\Psi\tilde{s})\tilde{s} \tag{D.11}$$

$$\implies \mathbb{E}[U_U|\tilde{s}] = \frac{\tau}{\gamma}(1-\delta_0-\bar{q}-\Psi\tilde{s})\left(\frac{1-\delta_0-\bar{q}-\Psi\tilde{s}}{2} + \tilde{s}\right) \tag{D.12}$$

$$\implies \mathbb{E}[U_U|\tilde{s}] = \frac{\tau}{\gamma}(1-\delta_0-\bar{q}-\Psi\tilde{s})\left(\frac{1-\delta_0-\bar{q}}{2} + \tilde{s}\left(1-\frac{\Psi}{2}\right)\right) \tag{D.13}$$

We now isolate the linear terms in $\tilde{s}$ because they will drop out in expectations ($+s$ and $-s$ are equally likely):

$$\begin{aligned}\mathbb{E}[U_U|\tilde{s}] = \frac{\tau}{2\gamma}(1-\delta_0-\bar{q})^2 - \tilde{s}^2\frac{\tau}{\gamma}\Psi\left(1-\frac{\Psi}{2}\right) \\ - \Psi\tilde{s}\frac{\tau}{2\gamma}(1-\delta_0-\bar{q}) + \frac{\tau}{\gamma}(1-\delta_0-\bar{q})\tilde{s}\left(1-\frac{\Psi}{2}\right)\end{aligned} \tag{D.14}$$

The overall expected utility is thus:

$$\mathbb{E}[U_U] = \frac{\tau}{2\gamma}(1-\delta_0-\bar{q})^2 - \frac{\tau}{2\gamma}\Psi\,(2-\Psi)\,s^2 \tag{D.15}$$

Rewrite the last term to make it even more similar to the informed expected utility:

$$\mathbb{E}[U_U] = \frac{\tau}{2\gamma}(1-\delta_0-\bar{q})^2 + \frac{\tau}{2\gamma}\left((1-\Psi)^2-1\right)s^2 \tag{D.16}$$

The difference in expected utility $\Delta[\mathbb{E}] = \mathbb{E}[U_I] - \mathbb{E}[U_U]$ is thus expressed by:

$$\Delta[\mathbb{E}] = \frac{\tau'-\tau}{2\gamma}\left[(1-\delta_0-\bar{q})^2 + (1-\Psi)^2 s^2\right] + \frac{\tau}{2\gamma}s^2 \tag{D.17}$$

Assuming that there is a fixed cost of acquiring information, denoted by ρ, the share ψ of informed investors will be characterized by the following equilibrium condition:

$$\Delta[\mathbb{E}] = \frac{\tau'-\tau}{2\gamma}\left[(1-\delta_0-\bar{q})^2 + (1-\Psi)^2 s^2\right] = \rho - \frac{\tau}{2\gamma}s^2 \tag{D.18}$$

which has exactly the same form as in the main derivations, if you simply replace $\rho - \frac{\tau}{2\gamma}s^2$ by $\bar{U}$. Solving it, however, is not as straightforward as in the main text, which is why we work with the other framework. This is because, even though $\bar{q}$ and Ψ look similar, the term $1-\Psi$ does *not* simplify as much, and ψ stays in the denominator. Indeed:

$$1-\delta_0-\bar{q} = \frac{\gamma\underline{b}}{\psi\tau' + (1-\psi)\tau - \phi\gamma} \quad ; \quad 1-\Psi = \frac{(1-\psi)\tau - \gamma\phi}{\psi\tau' + (1-\psi)\tau - \phi\gamma} \tag{D.19}$$

The term $(1-\psi)\tau$ breaks the tractability of the problem. The equilibrium share of informed investors is thus pinned down by:

$$\frac{\tau'-\tau}{2\gamma(\psi^*\tau' + (1-\psi^*)\tau - \phi\gamma)^2}\left[(\gamma\underline{b})^2 + ((1-\psi^*)\tau - \gamma\phi)^2 s^2\right] = \bar{U} \tag{D.20}$$

While this is technically still solvable (quadratic), the final expression is messy and not as intuitive as in our main framework. For our purposes, what ultimately matters is whether the amount of information acquisition is increasing with the supply B_1. This is unambiguously the case, which can be seen by differentiating with respect to $\underline{b} = B_1 - (1-\delta_0)\phi$:

$$\frac{\tau'-\tau}{2\gamma}\left[2d\underline{b}\gamma^2\underline{b} - \tau d\psi^*((1-\psi^*)\tau - \gamma\phi)s^2\right]$$

$$= 2(\tau' - \tau)d\psi^*(\psi^*\tau' + (1-\psi^*)\tau - \phi\gamma)\bar{U} \quad \text{(D.21)}$$

which clearly implies that $d\psi^*/d\underline{b} > 0$ when, as we assumed, $\psi^* \leq 1 - \gamma\phi/\tau$.

D.2 Learning from Bond Prices

The framework presented in Appendix D.1 assumed that uninformed traders that do not pay the fixed cost are unable to learn the signal received by other informed traders. This extension shows that this assumption is not driving the results. To ensure a tractable structure, assume the following: each trader i receives a signal s_i. Each idiosyncratic signal is a noisy signal of the aggregate signal s as in the main framework, $s_i = s + \epsilon_i$, and we denote by g_l the associated Kalman gain coefficient, relative to the case when traders receive s.[5] As such, an agent whose only information comes from the private signal has expectations: $\mathbb{E}_i[\chi] = (1-\delta_0) + g_l s_i$. We then assume that, in order to be able to learn from prices, investor i must pay a fixed cost i^2/ρ^2.

Because prices are fully revealing, a trader that learns from prices is always able to fully recover the aggregate signal s, and hence trade without the idiosyncratic noise. We can thus define the precision levels τ_l and τ_l' as the ones used by traders when they trade on $s + \epsilon_i$ and when they trade on s. The market clearing condition is thus:

$$B_1 - \phi q_1(s) = \psi\tau_l' \frac{1-\delta_0 + s - q_1(s)}{\gamma} + \int_\psi^1 \tau_l \frac{1-\delta_0 + g_l(s+\epsilon_i) - q_1(s)}{\gamma} di \quad \text{(D.22)}$$

And given the assumption that ϵ_i is idiosyncratic noise, they cancel on the aggregate such that:

$$B_1 - \phi q_1(s) = \psi\tau_l' \frac{1-\delta_0 + s - q_1(s)}{\gamma} + (1-\psi)\tau_l \frac{1-\delta_0 + g_l s - q_1(s)}{\gamma} \quad \text{(D.23)}$$

and the equilibrium price is given by :

$$q_1(s_1;\psi) = \frac{(1-\delta_0)(\psi\tau_l' + (1-\psi)\tau_l) + (\psi\tau' + (1-\psi)g_l\tau_l')s - \gamma B_1}{\psi\tau_l' + (1-\psi)\tau_l - \phi\gamma} \quad \text{(D.24)}$$

---

[5] I am slightly abusing notation here to keep the framework as close as possible to the main one presented in the core of the paper. The signal s is originally defined as how much it moves the posterior relative to the prior (which is not exactly the same thing as what is the information received: going from one to the other requires the Kalman gain). When traders only receive a noisy signal, they update in the direction of the signal but less than in the case where they received the signal without idiosyncratic noise. To keep notation consistent, I thus define the Kalman gain g_l as the scalar that allows me to write the posterior as a function of s_i. g_l is then intuitively less than 1.

The equilibrium is thus similar: the only change is the expression for the price sensitivity to information. It is an increasing function of ψ when:

$$\frac{d}{d\psi}\left(\frac{\psi\tau' + (1-\psi)g_l\tau_l'}{\psi\tau_l' + (1-\psi)\tau_l - \phi\gamma}\right) = \frac{\tau_l'\tau_l(1-g_l) - (\tau_l' - \tau_l g_l)\phi\gamma}{(\psi\tau_l' + (1-\psi)\tau_l - \phi\gamma)^2} > 0 \tag{D.25}$$

where we had that, by definition, $g_l < 1$ and $\tau_l' > \tau_l$. When $g_l = 0$ (as in the benchmark framework) then the stability condition was equivalent to:

$$\tau > \phi\gamma \tag{D.26}$$

Whereas now it can be written:

$$\tau_l\left(\frac{\tau_l' - \tau_l' g_l}{\tau_l' - \tau_l g_l}\right) > \phi\gamma \tag{D.27}$$

which is more restrictive when $g_l > 0$. We assume that this condition holds.

D.3 Market Orders

This section presents an alternative model where private investors can only condition on market prices when they pay the fixed cost associated with information acquisition. When this is the case, uninformed investors maximize instead:[6]

$$\mathbb{E}[U] = \mathbb{E}[b\chi - bq_1] - \frac{\gamma}{2}\mathbb{V}[b\chi] \tag{D.28}$$

This leads to the optimal portfolio choice:

$$b = \tau\frac{\mathbb{E}_1[\chi - q_1]}{\gamma} \tag{D.29}$$

Since investors that purchase information have the same demand function as in the benchmark model, the market clearing condition becomes, for any signal s:

$$B_1 - \phi q_1(s) = \psi\tau'\frac{1-\delta_0+s-q_1(s)}{\gamma} + (1-\psi)\tau\frac{1-\delta_0-\bar{q}_1}{\gamma} \tag{D.30}$$

---

[6] This is implicitly assuming that investors have linear utility over period-1 consumption, and mean-variance preferences over period-2 consumption.

This leads to the following expression:

$$q_1(s)\left(\psi\tau' - \phi\gamma\right) = \psi\tau'(1-\delta_0+s) + (1-\psi)(1-\delta_0-\bar{q}_1) - \gamma B_1 \tag{D.31}$$

Taking the expectation on both sides to find the average price used by uninformed traders:

$$\bar{q}_1\left(\psi\tau' - \phi\gamma\right) = \psi\tau'(1-\delta_0) + (1-\psi)\tau(1-\delta_0-\bar{q}_1) - \gamma B_1 \tag{D.32}$$

which gives:

$$\bar{q}_1 = \frac{(1-\delta_0)(\psi\tau' + (1-\psi)\tau) - \gamma B_1}{\psi\tau' + (1-\psi)\tau - \phi\gamma} \tag{D.33}$$

which has exactly the same expression as in the benchmark model. We can then plug that expression into the market clearing condition for any signal s:

$$\begin{aligned} q_1(s)\left(\psi\tau' - \phi\gamma\right) &= \psi\tau'(1-\delta_0+s) \\ &\quad + (1-\psi)\tau(1-\delta_0 - \frac{(1-\delta_0)(\psi\tau' + (1-\psi)\tau) - \gamma B_1}{\psi\tau' + (1-\psi)\tau - \phi\gamma}) - \gamma B_1 \end{aligned} \tag{D.34}$$

which can be simplified to:

$$q_1(s) = \frac{(1-\delta_0)(\psi\tau' + (1-\psi)\tau) - \gamma B_1}{\psi\tau' + (1-\psi)\tau - \phi\gamma} + s\frac{\psi\tau'}{\psi\tau' - \phi\gamma} \tag{D.35}$$

or for conciseness:

$$q_1(s) = \bar{q}_1 + s\frac{\psi\tau'}{\psi\tau' - \phi\gamma} \tag{D.36}$$

D.3.1 Roll-Over Threshold

Given this equilibrium price, the threshold is found when (as in the benchmark model):

$$B_1 - \phi\frac{(1-\delta_0)(\psi_s\tau' + (1-\psi_s)\tau) - \gamma B_1}{\psi_s\tau' + (1-\psi_s)\tau - \phi\gamma} + \phi\frac{\psi_s\tau' s}{\psi_s\tau' - \phi\gamma} = b^* \tag{D.37}$$

We also assume a condition similar to Assumption 2 in order to get: $\frac{dq_1(-s)}{d\psi} < 0$, such that there is at most one threshold ψ_s.

D.3.2 Information Choice

Since uninformed investors know that they will only be able to submit a demand for bonds that does not condition on equilibrium prices, their expected utility is given by:

$$\mathbb{E}[U|\psi < \psi_s] = \tau \frac{(1-\delta_0-\bar{q}_1)^2}{2\gamma} \tag{D.38}$$

This expression shows why this alternative setup is attractive: uninformed agents know that they will not be able to condition on average prices, so this expression does not contain expectations over prices in different signal realizations, as we had in the main framework. For informed traders, the expression is similar as in the main framework since their demand function is unchanged:

$$\mathbb{E}[U_\rho|\psi < \psi_s] = \frac{\tau'}{4\gamma}\left[(1-\delta_0+s-q_1(+s))^2 + (1-\delta_0-s-q_1(-s))^2\right] - \frac{i^2}{\rho^2} \tag{D.39}$$

Rewrite this as:

$$\mathbb{E}[U_\rho|\psi < \psi_s] = \frac{\tau'}{4\gamma}\left[(1-\delta_0-\bar{q}_1+(1-\Psi)s)^2 + (1-\delta_0-\bar{q}_1-(1-\Psi)s)^2\right] - \frac{i^2}{\rho^2} \tag{D.40}$$

Which can be simplified to:

$$\mathbb{E}[U_\rho|\psi < \psi_s] = \frac{\tau'}{2\gamma}\left[(1-\delta_0-\bar{q}_1)^2 + (1-\Psi)^2 s^2\right] - \frac{i^2}{\rho^2} \tag{D.41}$$

If the equilibrium ψ is indeed below the threshold ψ_s, it thus verifies:

$$(\tau'-\tau)(1-\delta_0-\bar{q}_1)^2 + \tau' s^2 (1-\Psi)^2 = \frac{2\gamma\psi^2}{\rho^2} \tag{D.42}$$

Since both components of the left-hand side of this equality are strictly decreasing (since $\Psi < 1$ and $\bar{q}_1 < 1-\delta_0$ for all ψ) in ψ, while the right-hand side is strictly increasing in ψ, there is at most one solution to this equation. The insights of the main model are then unchanged.

D.3.3 Noise Traders and Price Informativeness

This formulation makes clear that, in this alternative setup, prices are *less sensitive* to information when ψ is higher, an undesirable feature. For this reason, I also assume that there are noise traders with the following demand function:

$$\eta\frac{z-q_1}{\gamma} \tag{D.43}$$

with, on average, $\bar{z}=\bar{q}_1$. This way, the market clearing condition becomes:

$$B_1-\phi q_1(s)=\psi\tau'\frac{1-\delta_0+s-q_1(s)}{\gamma}+(1-\psi)\tau\frac{1-\delta_0-\bar{q}_1}{\gamma}+\eta\frac{z-q_1}{\gamma} \tag{D.44}$$

Taking averages on both sides leads once again to the familiar:

$$\bar{q}_1=\frac{(1-\delta_0)(\psi\tau'+(1-\psi)\tau)-\gamma B_1}{\psi\tau'+(1-\psi)\tau-\phi\gamma} \tag{D.45}$$

Since q_1 is still obviously linear in s and z, we only need to find the coefficient in front of these random variables, thanks to:

$$-\phi\gamma\frac{dq_1}{ds}=-(\psi\tau'+\eta)\frac{dq_1}{ds}+\psi\tau' \tag{D.46}$$

$$-\phi\gamma\frac{dq_1}{dz}=-(\psi\tau'+\eta)\frac{dq_1}{dz}+\eta \tag{D.47}$$

which yields the equilibrium price function:

$$q_1(s,z)=\bar{q}_1+\frac{\psi\tau's}{\psi\tau'+\eta-\phi\gamma}+\frac{\eta(z-\bar{q}_1)}{\psi\tau'+\eta-\phi\gamma} \tag{D.48}$$

And we indeed have, in this case, that prices are more responsive to information when ψ is greater, as long as we assume that $\eta>\phi\gamma$.

D.4 Multiple Equilibria in Information Acquisition

This part analyses the model when parameter values are such that the condition of Proposition 1 is not satisfied, so that the expected utility of informed investors can jump *upward* at ψ_s, generating multiple equilibria in the information acquisition stage. Since this has been studied before (e.g. Hellwig, Kohls and Veldkamp 2012), we keep this contained and in the Appendix. The main lesson is that asset purchases can flip the direction of the jump, restoring uniqueness. The intuition is illustrated in Figure 15.

Recall from the proof of Proposition 1 that the jump direction is determined by comparing the bad-signal contribution to expected utility on each side of the threshold ψ_s. If the jump is upward, for any $\bar{U}$ between the expected utilities just below and just above

ψ_s, two equilibria coexist: a safe one ($\psi_1^* < \psi_s$) and a crisis one ($\psi_2^* > \psi_s$), since $\mathbb{E}[U_I]$ is strictly decreasing on each side of the threshold.

We now show that, provided λ is large enough, asset purchases can make the jump at ψ_s non-positive, restoring unicity, which then comes back to the analysis in the main text.

Proposition 7 (Asset Purchases Restore Unique ψ-Equilibrium)**.** *Suppose the jump in* $\mathbb{E}[U_I]$ *at* ψ_s *is upward and* $\lambda > 1 - \frac{\gamma B_1}{s\tau_\lambda + \phi\gamma p_0}$. *Define:*

$$x_1^0 = B_1 - \frac{(1-\lambda)(s\tau_\lambda + \phi\gamma p_0)}{\gamma} \tag{D.49}$$

Then there exists a unique $x_1^{\text{flip}} \in (0, x_1^0)$ *such that for any* $x_1 \in [x_1^{\text{flip}}, x_1^0]$*, the jump in* $\mathbb{E}[U_I]$ *at* $\psi_s(x_1)$ *is non-positive. Consequently, the information-acquisition equilibrium is unique.*

Proof. Define the crisis-zone bad-signal contribution at $\psi_s(x_1)$:

$$C(x_1) \equiv \frac{\tau'_\lambda}{2\gamma}\left(\frac{N(x_1)}{D_\lambda(x_1)}\right)^2 \tag{D.50}$$

with:

$$N(x_1) \equiv \gamma B_1 - \gamma x_1 - (1-\lambda)\left(s\tau_\lambda + \phi\gamma p_0\right), \qquad D_\lambda(x_1) \equiv \tau_\lambda + \psi_s(x_1)\tau'_\lambda - \phi\gamma \tag{D.51}$$

Recall that the (fixed) safe-zone contribution is $S \equiv \tau'(q^* - p_0)^2/(2\gamma)$. The jump is non-positive if and only if $C(x_1) \le S$.

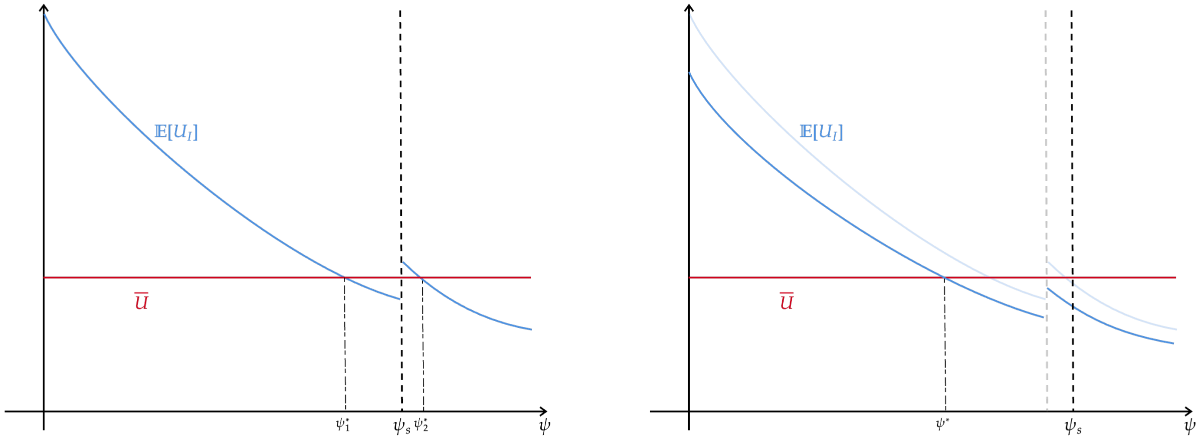
On the interval $[0, x_1^0]$, $N(x_1) \ge 0$ and $D_\lambda(x_1) > 0$. Write $f(x_1) = N(x_1)/D_\lambda(x_1)$. Then:

$$f'(x_1) = \frac{N'(x_1)D_\lambda(x_1) - N(x_1)D'_\lambda(x_1)}{D_\lambda(x_1)^2} \tag{D.52}$$

Since $N' = -\gamma < 0$, $D_\lambda > 0$, $N \ge 0$, and $D'_\lambda > 0$, both terms in the numerator are non-positive, and at least one is strictly negative for $x_1 < x_1^0$. Hence f is strictly decreasing on $[0, x_1^0]$, and so is $C = (\tau'_\lambda/(2\gamma))f^2$.

At the boundary: $C(0) > S$ (by assumption) and $C(x_1^0) = 0 < S$ (since $N(x_1^0) = 0$). By the intermediate value theorem, there exists a unique $x_1^{\text{flip}} \in (0, x_1^0)$ satisfying $C(x_1^{\text{flip}}) = S$. For $x_1 \ge x_1^{\text{flip}}$, we have $C(x_1) \le S$, so the jump is non-positive. Since $\mathbb{E}[U_I]$ is also strictly decreasing on each side of $\psi_s(x_1)$ (by the same argument as in the proof of Proposition 1), a unique information-acquisition equilibrium exists. □

Remark 1. Asset purchases reduce the crisis-zone speculation gains through two reinforcing channels. The *supply channel* operates through $N(x_1)$: fewer bonds on private balance



(a) Without asset purchases

(b) With asset purchases

Figure 15: Expected Utility of Informed Investors with Multiple Equilibria at the Information Acquisition Stage. The left panel shows a case where, given the costs of acquiring information $\bar{U}$, two equilibria are possible for ψ: one below and one above the threshold. The right panel shows that, with large enough purchases, the jump at ψ_s is eliminated and only an equilibrium where $\psi < \psi_s$ is possible.

sheets compress the crisis-zone excess return, reducing trading profits for informed investors at the threshold. The *threshold channel* operates through $D_\lambda(x_1)$: since $\psi_s(x_1)$ is increasing, the relevant evaluation point shifts to a higher mass of informed investors, where competition among them further compresses per-investor profits. Both channels reduce $C(x_1)$ while the safe-zone benchmark S remains unaffected by purchases, since at $\psi_s(x_1)$ the safe-zone bad-signal price is always q^* by construction.

We end this extension by showing that the same lessons apply in the continuous signal case. Figure 16 shows the expected utility of informed investors as a function of ψ in the continuous signal case, for different parameter values. While it is possible to get a set of parameters such that the expected utility of informed agents is non-monotonous, it is much harder to find, since the continuous signals smooth-out the strategic complementarities effect (see Equation C.35). Notice, however, that the insights of the main text regarding the effect of asset purchases stay valid even if we are in the case of the right panel of Figure 16, where expected utility becomes increasing after a point. If multiple equilibria in information acquisition are possible, large enough asset purchases can prevent this by ensuring that only an equilibrium without roll-over crises is possible. This is illustrated in Figure 17.

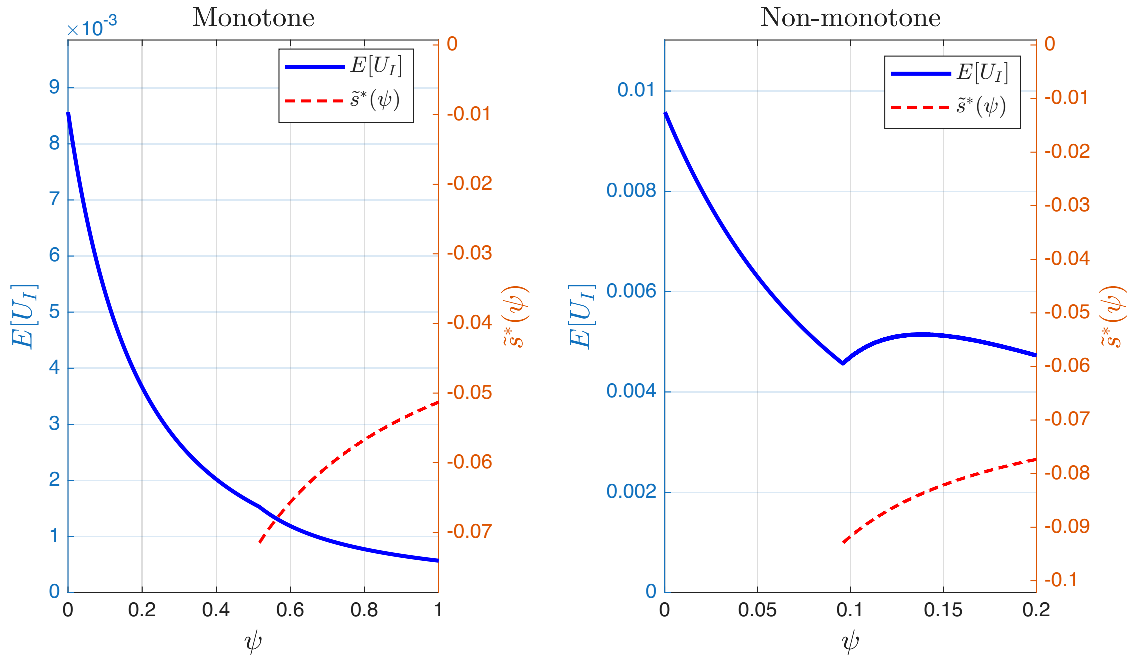


Figure 16: Expected Utility and Threshold Signals with Continuous Signals

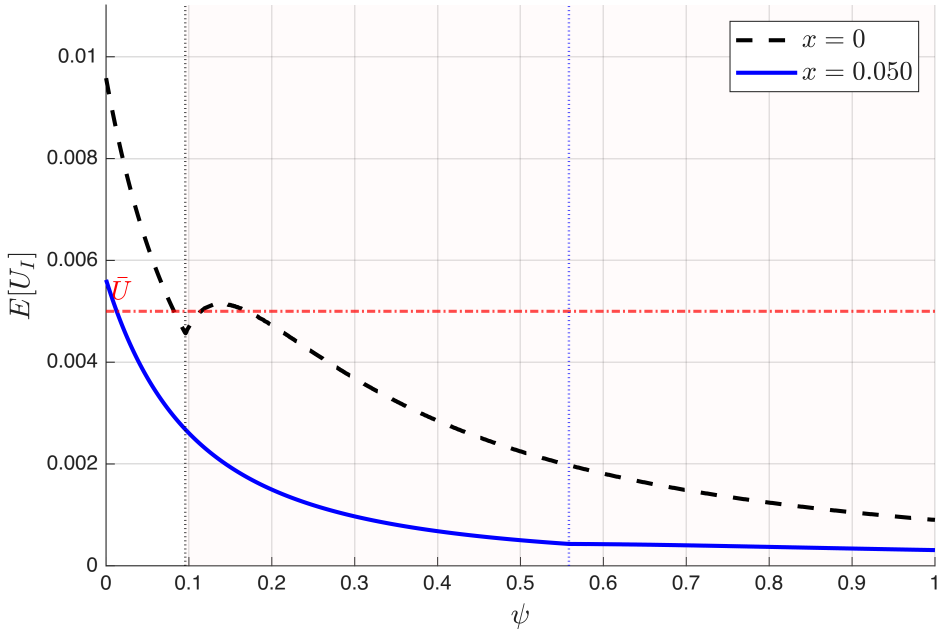


Figure 17: Asset Purchases to Eliminate Multiplicity at the Information Acquisition Stage

E Additional Empirical Results

E.1 Variance of Forecast Errors

The variance of forecast errors is a common indicator of the precision of the information used by private investors (Bae, Stulz and Tan 2008). I thus gather consensus forecasts from analysts on GDP, inflation and industrial production for Italy, from 2010 to 2019. The results are robust to including data up to 2023, and still robust by excluding the covid period, but arguably other factors since 2020 could explain the higher variance of forecast errors. I am thus reporting conservative results.

I then construct the associated forecast errors for each forecast and calculate the variance of these forecast errors before and after the ECB sovereign bond purchase program (in 2015). Macroeconomic forecasts for Italy's GDP, Industrial Production, and inflation are taken from the SmartEconomics survey, accessed through Eikon. This survey is a monthly poll of professional forecasters from Reuters Polls, which is then processed by SmartEconomics to produce a forecast more reliable than the consensus forecast. I restrict the sample to the 2010-2020 period, and divided in two: before the start of asset purchases (2010 to March 2015) and after (until March 2020 to avoid forecasting mistakes due to the pandemic). Forecast errors are then constructed using macroeconomic data release from Eikon. Table 1 shows that the variance is more than twice as large after the ECB starts its purchasing program, suggesting that analysts are making less precise forecasts and thus not investing as much as before into information production.

A potential issue with this argument is that times might have been riskier after 2015, which would explain why forecasts are less accurate. To investigate this possibility, I look at the volatility of Italian bond yields over the same time periods, for three different maturities. Table 1 shows that volatility is moving in the opposite direction as this story suggests: yields are significantly more stable throughout the period 2015-2019 than before.

To further check the robustness of this argument, I also gather forecasts made by the European Commission over the same time period. I collect forecasts made by the European Commission for each year for the following year, for the following variables: GDP, Employment, Trade Balance, GDP Deflator, and Gross Government Debt. The forecasts for Government Debt are very imprecise, but the results are robust to their exclusion. These forecasts are available on the European Commission's website, and are released each Spring in the European Economic Forecast. I use the same methodology as for the analysts' forecasts to construct forecast errors across two samples: 2009-2014 and 2015-2019. In the theory presented above, the incentives to acquire information are linked to the expected utility of private traders, which means that the forecasts made by institutions like the European Commission should be unaffected by the asset purchase program.[7] If anything, these forecasts should be even more precise after the start of the program, as risky bonds are now on the balance sheet of the ECB. Table 1 shows that this is indeed the case: while private sector forecasts are less precise in the second half of the sample, the opposite is true for official forecasts.

Table 1: Variance Analysis, Italy

	2010 - 2014	2015-2019
Analysts FE	0.327	0.855
Yields 3m	0.069	0.002
Yields 3y	0.013	0.008
Yields 5y	0.011	0.006
European Commission FE	1.97	0.16

E.2 Abnormal Returns Around ECB Events

Istrefi, Odendahl and Sestieri (2022) introduce the Euro Area Communication Event-Study Database (EA-CED), which constructs financial market reactions around 4400 ECB inter-meeting communication (IMC). They also identify abnormal returns over these events. I use their data to compute a one-year rolling average of abnormal returns on Italian sovereign yields of different maturities around these events.

Specifically, Istrefi et al. (2022) compute abnormal returns as:

$$Y_{t_1} = X_{t_1} - X_{t_0} \tag{E.53}$$

where X_t is the interest rate, around the window $[t_0, t_1]$. They model X_t following Ait-Sahalia, Mykland and Zhang (2005) as a scaled version of a Brownian motion W:

$$X_t = \iota W_t \tag{E.54}$$

They estimate the variance of the process before the event (adding eventual microstructure noise), and compute the expected variance of the surprise Y. If the surprise is outside the confidence interval, it is recorded as an abnormal return.

For each event, I compute the sum of the squares of the abnormal returns across all maturities (3-month, 6-month, 1-year, 2-year 3-year, 5-year, 7-year and 10-year). I then

---

[7] I thank Julien Alcalin for this suggestion.

take the average of these sums across all events over a one-year rolling window.

Figure 18 shows that abnormal returns are significantly lower after the start of the asset purchase program, and that they increase again when the program is slowed down and stopped. This is consistent, once again, with the theory presented above where new information barely moves market prices when the central bank purchases a significant amount of bonds.

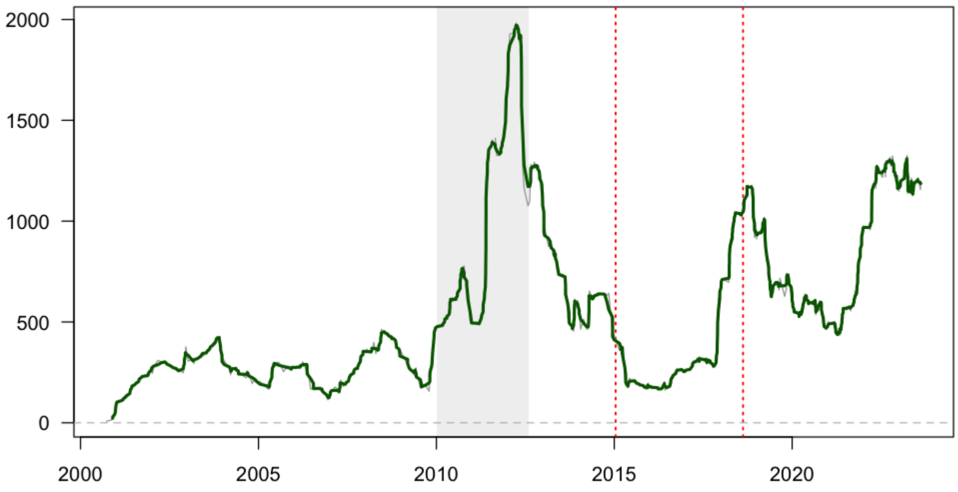


Figure 18: Abnormal Returns for Italian Sovereign Yields Around ECB events. To construct the time series of abnormal returns, I compute the sum of the squares of abnormal returns over different maturities, and take its rolling average over a one-year period. More details are available in Appendix B. The first vertical line indicates the start of the asset purchase program by the ECB, and the second vertical line indicates the slowing down of the program and its halt in 2019 (see Figure 1). The light grey area indicates the Eurozone crisis.

References

Ait-Sahalia, Yacine, Per A Mykland, and Lan Zhang, "How often to sample a continuous-time process in the presence of market microstructure noise," *The review of financial studies*, 2005, *18* (2), 351–416.

Bae, Kee-Hong, René M Stulz, and Hongping Tan, "Do local analysts know more? A cross-country study of the performance of local analysts and foreign analysts," *Journal of financial economics*, 2008, *88* (3), 581–606.

Bonaglia, Edoardo, Daniele d'Arienzo, Nunzio Fallico, Nicola Gennaioli, and Luigi Iovino, "The Volatility of Inflation Expectations and Interest Rates," Technical Report 2025.

Coibion, Olivier and Yuriy Gorodnichenko, "Information rigidity and the expectations formation process: A simple framework and new facts," *American Economic Review*, 2015, *105* (8), 2644–2678.

Cole, Harold L and Timothy J Kehoe, "Self-fulfilling debt crises," *The Review of Economic Studies*, 2000, *67* (1), 91–116.

Hellwig, Christian, Sebastian Kohls, and Laura Veldkamp, "Information choice technologies," *American Economic Review*, 2012, *102* (3), 35–40.

Iovino, Luigi and Dmitriy Sergeyev, "Central bank balance sheet policies without rational expectations," *Review of Economic Studies*, 2023, *90* (6), 3119–3152.

Istrefi, Klodiana, Florens Odendahl, and Giulia Sestieri, "ECB communication and its impact on financial markets," 2022.

Kolotilin, Anton, "Optimal information disclosure: A linear programming approach," *Theoretical Economics*, 2018, *13* (2), 607–635.

Mankiw, N Gregory and Ricardo Reis, "Sticky information versus sticky prices: a proposal to replace the New Keynesian Phillips curve," *The Quarterly Journal of Economics*, 2002, *117* (4), 1295–1328.

Pfäuti, Oliver, "The inflation attention threshold and inflation surges," *arXiv preprint arXiv:2308.09480*, 2023, *2.*

Sims, Christopher A, "Implications of rational inattention," *Journal of monetary Economics*, 2003, *50* (3), 665–690.

Wallace, Neil, "A Modigliani-Miller theorem for open-market operations," *The American Economic Review*, 1981, *71* (3), 267–274.