Stabilizing the Financial Markets through Communication and Informed Trading

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Abstract

We develop a model of government intervention with information disclosure in which a government with two private signals trades directly in financial markets to stabilize asset prices. Government intervention through informed trading stabilizes financial markets and affects market quality (market liquidity and price efficiency) through a noise channel and an information channel. Information disclosure negatively affects financial stability by deteriorating the information advantages of the government, while its final effects on market quality hinge on the relative sizes of the noise effect and the information effect. Under different information disclosure scenarios, there exist potential tradeoffs between financial stability and price efficiency.

Keywords: government intervention; information disclosure; financial stability; price efficiency; market liquidity

JEL Classifications: D8, G1

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1 Introduction

Government intervention through direct trading is becoming a common way to stabilize financial markets, especially during a financial crisis or a stock market meltdown. For example, in August 1998, at the peak of the Asian financial crisis, the Hong Kong government spent HK$118 billion and purchased shares of 33 constituent stocks of the Hang Seng index (HS) to stabilize the stock market. During China's stock market turmoil in 2015-2016, the Chinese government organized a "national team" of securities firms to intervene in the stock market. To combat the financial crisis of 2008-2009 and the COVID-19 pandemic in 2020 and their aftermaths, the United States Federal Reserve (FR), European Central Bank (ECB), Bank of Japan (BOJ) and other central banks purchased large quantities of government securities, mortgage-backed securities, corporate bonds and equities. From 2002 through 2018, the Bank of Japan constantly purchased Japanese stocks through the purchases of exchange-traded funds (ETFs) to stabilize financial markets and stimulate the economy.[1] Although the motives and consequences of these trades continue to be intensely debated, how information disclosure influences the effectiveness of government intervention has received substantially less attention.

In this article, we develop a market microstructure model of government intervention with information disclosure where a large player—the government—has two types of information (a price target signal and a noisy signal about fundamentals). Should the government publicly reveal its own information when making intervention decisions? For example, the government has a price target. Investors are uncertain about the target, and their beliefs are described by a normal distribution. The government's policy decision is to decide whether and how clearly it should communicate this target. Full disclosure is to announce the precise target to the public, and partial disclosure is to announce it with noise. This issue has been hotly debated in relation to regulatory stress tests of financial institutions. In particular, there are different views on whether the results of such stress tests should be publicly disclosed (see Goldstein and Sapra (2013) for a survey). Our model examines this debate in a scenario of government intervention through informed trading and explores the desirability of communications when the government is attempting to stabilize financial markets. For this purpose, we formulate four scenarios of

[1] Cheng et al. (2000) and Su et al. (2002) study the Hong Kong government intervention during the 1998 Asian financial crisis. Huang et al. (2019) and Allen et al. (2020) examine the Chinese government's intervention in the 2015-2016 stock market turmoil. Yang and Zhu (2021) and Caballero and Simsek (2021) briefly review the large asset purchases conducted by major central banks during the 2008-2009 financial crisis and COVID-19 pandemic, respectively. Shirai (2018a, 2018b), Barbon and Gianinazzi (2019), and Charoenwong et al. (2021) review the stock purchases through ETFs conducted by the Bank of Japan.

information disclosure and examine how each of them influences the effectiveness of government intervention, especially in terms of financial stability and market quality.

In the benchmark model without information disclosure, we introduce a stylized government with private information into the standard Kyle (1985) setting in which the insider trades on his precise information to maximize profits, a government with two independent private signals trades alongside other market participants to stabilize financial markets, noise traders provide randomness to the financial market, and the market maker clears the market using the weak rule of market efficiency.[2] We then formulate three scenarios of full information disclosure (releasing the price target, releasing the fundamental signal and releasing both signals), in which the information sets of both the insider and market maker are changed and the equilibrium results are changed accordingly. Finally, in extended models, we consider partial information disclosure and correlated signals as a robustness check.

Our analysis delivers three important messages. First, information disclosure negatively affects financial stability. In particular, no communication is better than releasing either of the two signals, and releasing either signal is better than releasing both signals. The intuition is as follows. The Kyle-type model is well known as a standard setting in which economic agents trade on their private information to achieve respective goals. In our model, by trading on its private information, the government drives asset prices to the price target, shortens the distance between price and the target and stabilizes the financial market from its viewpoint. Once private information is disclosed, the government loses its information advantage, and government intervention is less effective. Releasing one signal implies reducing its information advantages, and releasing both signals is equivalent to abandoning all information advantages. As a result, the performance of government intervention declines. Furthermore, releasing the price target is worse than releasing the noisy signal about the fundamental, since the price target signal is more related to price stability than the fundamental signal. Ultimately, private information is likely to be an important prerequisite for a successful government intervention. Information disclosure reduces the government's information advantages, deteriorates its intervention ability through direct trading and hence negatively affects financial stability.

Second, under different scenarios of government intervention with communications, there may exist potential tradeoffs between price stability and price efficiency. To explain this result,

[2] We use "he/him" to refer to the insider, "she/her" to refer to the market maker, and "it/its" to refer to the government.

we identify two different effects of information disclosure on price efficiency. The first effect is the noise effect, and the second effect is the information effect. In the scenario of releasing the noisy signal about the fundamentals, the noise effect removes informational noise in financial markets and hence directly improves price efficiency, while the information effect reduces private information in financial markets, reveals more of the insider's information and hence indirectly improves price efficiency. Ultimately, both the noise effect and information effect improve price efficiency. Adding the negative effect of information disclosure on price stability, we conclude that the release of the fundamental signal brings about tradeoffs between price stability and price efficiency: it decreases price stability but increases price efficiency.

However, there are no such tradeoffs in the situation where the price target is released, since it simultaneously reduces price stability and price efficiency. The release of the price target deteriorates the information advantage of the government and decreases price stability. Moreover, the release of the price target removes exogenous noise (i.e., the price target as a noise) in financial markets and hence improves price efficiency (noise effect), while it decreases market liquidity, reduces the insider's trading intensity on his precise information and hence decreases price efficiency (information effect). Since the negative information effect on price efficiency dominates the positive noise effect, the release of the price target also reduces price efficiency. Thus, price stability and price efficiency are both reduced, which implies that no tradeoffs between them in this situation.

Third, the release of different signals has different implications for market liquidity. Relative to the benchmark model without information disclosure, releasing the price target removes noise in financial markets and hence decreases market liquidity, while releasing the noisy signal about the fundamentals reduces private information in financial markets and hence raises market liquidity. Releasing both signals has two opposite effects on market liquidity, and the net effects hinge on the extent to which the government cares about financial stability. Specifically, if the government places an equal weight on financial stability and cost minimization, then the positive effect on market liquidity of releasing the fundamental signal dominates the negative effect of releasing the price target and the financial market is deeper. However, if the government cares more about financial stability than cost minimization, the negative effect of releasing the price target dominates the positive effect of releasing the fundamental signal and market liquidity is lower.

Our paper is related to two strands of literature. The first strand consists of the literature on the financial market implications of government intervention through direct trading. Four theoretical studies are most related to our study. Pasquariello et al. (2020) find that government intervention improves the liquidity of financial markets in a static Kyle setting. Yang and Zhu (2021) illustrate that predictable central bank interventions of purchasing assets (or adjusting the interest rates) interact with strategic trading and produce a V-shaped price pattern around central bank interventions. Brunnermeier et al. (2022) develop a noisy rational expectations model and show that by leaning against noise traders, government intervention improves financial stability while negatively affecting price efficiency. Huang et al. (2022) construct a government intervention model and show that the government trades against insider trading and simultaneously improves financial stability and price efficiency. The abovementioned studies examine how government trading influences financial markets but do not discuss how information disclosure affects the effectiveness of government intervention. In our model, we formulate different scenarios of information disclosure and investigate how it affects financial stability and market quality in financial markets.

Some theorists examine the real effects of government intervention through other policy tools. For example, Subrahmanyam (1994) and Chen et al. (2018) show that circuit breakers increase price volatility and exacerbate price movements. Bond and Goldstein (2015) study how government intervention through cash injections or other interventions affect information aggregation by price. Cong et al. (2020) explore the information externalities of government intervention through direct liquidity injections in money market issues.

Other studies empirically investigate the effects of government intervention on financial markets. Cheng et al. (2000) and Su et al. (2002) study the implications of the intervention of the Hong Kong government during the 1998 Asian financial crisis. Pasquariello (2007) explores the impact of central bank interventions on the process of price formation in the U.S. foreign exchange market. Veronesi and Zingles (2010) analyze the costs and benefits of Paulson's plan in the United States. Pasquariello (2017) shows that direct government intervention in a market may induce violations of the law of one price in other arbitrage-related markets. Shirai (2018b), Barbon and Gianinazzi (2019), Katagiri et al. (2022), and Takahashi (2022) study the effects of the ETF purchase program undertaken by the Bank of Japan on domestic equity prices. Allen et al. (2020) and Huang et al. (2019) show that government trading in China's stock market in 2015 both created value and improved liquidity. Bian et al. (2021) show that China's price limit rule led to unintended contagion across stocks during the 2015 market turmoil in China.

The second strand is the literature on the multiple dimensions of information disclosure.[3] Two recent studies—those of Bond and Goldstein (2015) and Goldstein and Yang (2019)—note that in the presence of multiple dimensions of information, the real-efficiency implications of disclosure might differ depending on what dimension of information is disclosed. Bond and Goldstein (2015) establish that if the government discloses information about a variable on which speculators have some additional information, then the government learns less from prices and negatively affects itself because the disclosed information reduces the incentives of speculators to trade on their information; if, instead, the government discloses information about a variable about which speculators know less than does the government, then the government learns more from prices and helps itself because the disclosed information reduces the risk faced by speculators, thus causing them to trade more. Goldstein and Yang (2019) show that if disclosure concerns a variable about which the real decision maker cares to learn, then disclosure negatively affects price informativeness; if disclosure concerns a variable about which the real decision maker already knows much, then disclosure always improves price informativeness and real efficiency. These two studies examine how disclosing different types of information affects price informativeness. Our study complements this stream of literature by investigating how releasing different information affects the financial stability and market quality of financial markets.

The rest of the paper is organized as follows. Section 2 provides the baseline model of government intervention without information disclosure and presents the equilibrium results. Section 3 formulates three scenarios of information disclosure and analyzes their equilibrium results. Section 4 compares the market performance of government intervention under different scenarios of information disclosure and develops the main results. Section 5 considers two model extensions: partial disclosure and correlated signals. Section 6 concludes the paper.

2 Baseline model without information disclosure

In this section, we present a baseline model with government intervention by introducing a stylized government with private information in the static Kyle setting and examine how government intervention through informed trading affects financial markets.

[3] Goldstein and Yang (2017) offer an analytical review of information disclosure in financial markets.

2.1 Kyle model with government intervention

We consider an economy with one trading period. There is a single risky asset traded in the financial market. The final payoff of the risky asset, v, which we refer to as the economic fundamental, follows a normal distribution with mean p_0 and variance σ_v^2.

The economy is populated by four types of traders: a risk-neutral insider (i.e., informed trader), a representative risk-neutral competitive market maker, a large government player ("national team") and noise traders. As usual, the insider submits market orders to maximize profits, noise traders provide randomness to conceal the insider's private information, and the market maker sets the price. The new player is the government, the behavior of which serves regulatory purposes.

Specifically, the government submits a market order, g, to minimize the expected value of the following loss function:

$$\phi(\triangle p)^2 + c, \tag{1}$$

where the parameter $\phi \in [0, \infty)$ represents the relative weight placed by the government on its policy motives. The first term $(\triangle p)^2 \equiv (p - p_T)^2$ captures the government's policy motive, "price stability"[4], where p is the equilibrium price and p_T is the price target. The second component in (1), c, is the cost of intervention, which comes from the trading loss (negative of trading revenue). Specifically, we have $c = (p - v)g$, where g is the government's order flow, and $(p - v)g$ is its trading loss. The specification of the loss function (1) is similar in spirit to that in Stein (1989), Bhattacharya and Weller (1997), Vitale (1999), Pasquariello (2017), and Pasquariello et al. (2020). If $\phi = 0$, then the government trades just as another insider who maximizes the expected profit from trading. When $\phi > 0$, the government cares about its policy goal. The greater the ϕ value is, the more important the government's policy goal (financial stability).

Similar to Kyle (1985), the insider learns liquidity value v at the beginning of the trading period and places market order x. Noise traders do not receive any information, and their net demand u is normally distributed with mean zero and variance σ_u^2. The government is endowed

[4] We use $E(p - p_T)^2$ to measure price/financial stability based on the following reasons. First, it is intuitive. In this setup, by trading on the target, the government injects the information of the price target in the equilibrium price, shortens the distance between price and the target and stabilizes asset prices effectively. Second, a Kyle model with a stylized government who trading on its target and fundamental signals has a regular solution structure and lays a good foundation for discussions on information disclosure. Third, it is in accord with the literature (e.g., Edison, 1993; Vitale, 1999; Sarno and Taylor, 2001; Neely, 2005; Engel, 2014; Pasquariello, 2017; and Pasquariello et al., 2020). The measure for price volatility, $var(p)$, does not possess the above merits all at once, even though it is closely related to the measure for price stability, $E(p - p_T)^2$.

with two private signals. First, the government has a price target signal. Other investors are uncertain about the target, and their beliefs are described by a normal distribution, namely, $p_T \sim N\left(\bar{p}_T, \sigma_T^2\right)$. The following two facts motivate us to introduce the price target signal in the model. In January 2013, the Bank of Japan (BOJ) announced its 2% price stability target and adopted quantitative and qualitative monetary easing (QQE) including purchases of Japanese stocks as the main strategy through which to meet the target. Furthermore, on July 5, 2015, the China Securities Regulatory Commission (CSRC) announced that the People's Bank of China (PBC) would help the China Securities Finance Corporation Limited (CSF) stabilize the stock market by providing multiple types of liquidity support. Second, the government has a noisy signal about the fundamental, $s = v + \varepsilon$, where $\varepsilon \sim N(0, \sigma_\varepsilon^2)$ is independent of v. The government usually has firsthand economic data. In the digital age, the government can exploit low-latency economic data that are already available on Big Tech platforms, such as Amazon, Google, and the Alibaba Group. The government uses real-time economic data to assess economic fundamentals. Because there is no irrefutable evidence to show that the uncertainty about the target is correlated with the uncertainty in the fundamental value, we assume in the baseline model that the government's price target is uninformative about the traded asset's liquidation value (i.e., $cov\,(s, p_T) = cov\,(v, p_T) = 0$).[5] The ownership of the two private signals by the government is identified as an important feature of direct government intervention in financial markets in the literature.[6]

The market maker determines price p at which she trades the quantity to clear the market. The market maker observes the aggregate order flow $y = x + g + u$. The weak-form-efficiency pricing rule of the market maker implies that the market maker sets the price equal to the posterior expectation of v given public information:

$$p = E(v|y). \tag{2}$$

[5] In the model extension section, we relax this assumption and discuss the more complicated case with correlated signals.

[6] The literature identifies several recurring features of direct government intervention in financial markets: (1) governments tend to pursue nonpublic price targets in those markets, (2) governments often intervene in secret in targeted markets, (3) governments are likely to have an information advantage over most market participants about the fundamentals of the traded assets, (4) the observed ex post effectiveness of government intervention is often attributed to that information advantage, (5) those price targets may be related to governments' fundamental information, and (6) governments are sensitive to the potential costs of their interventions (e.g., Edison, 1993; Vitale, 1999; Sarno and Taylor, 2001; Neely, 2005; Engel, 2014; Pasquariello, 2017; and Pasquariello et al., 2020).

2.2 Equilibrium

We characterize the equilibrium of the baseline model in this subsection. A perfect Bayesian equilibrium is a collection of functions $\{x(v), g(s, p_T), p(y)\}$, that satisfies the following: (1) optimization:

$$\begin{aligned} x^* &\in \arg\max_{\{x\}} E\left[(v-p)x|v\right], \qquad (3)\\ g^* &\in \arg\min_{\{g\}} E\left[\phi(p-p_T)^2 + (p-v)g|s, p_T\right]. \qquad (4) \end{aligned}$$

(2) market efficiency: p is determined according to Equation (2).

We are interested in a linear equilibrium in which the trading strategies and pricing function are all linear. Formally, a linear equilibrium is defined as a perfect Bayesian equilibrium in which there exist five constants: $(\beta, \gamma, \alpha, \eta, \lambda) \in \mathbb{R}^5$, such that

$$\begin{aligned} x &= \beta(v-p_0), \qquad (5)\\ g &= \gamma(s-p_0) + \alpha(p_T - \bar{p}_T) + \eta, \qquad (6)\\ p &= p_0 + \lambda(y-\eta), \text{with } y = x+g+u. \qquad (7) \end{aligned}$$

Equations (5) and (6) indicate that both the insider and the government trade on their respective private information.[7] The pricing equation (7) states that price is equal to the expected value of v before trading, adjusted by the information carried by the arriving aggregated order flow. In Appendix A.1, we prove the following:

Theorem 1 *A linear pure strategy equilibrium is defined by five unknowns β, γ, α, η and λ, which are characterized by five equations (26), (29)-(32), together with one SOC (25). The system of equations can be transformed into a polynomial of λ. Specifically, λ solves the following polynomial:*

$$a_6\lambda^6 + a_5\lambda^5 + a_4\lambda^4 + a_3\lambda^3 + a_2\lambda^2 + a_1\lambda + a_0 = 0, \qquad (8)$$

[7] The linear forms are motivated by Bernhardt and Miao (2004) and Yang and Zhu (2020), who specify that the trading strategy of an informed agent is a linear function of each piece of private information.

where the coefficients $a_i's$ are given by

$$\begin{aligned}
a_6 &= 4\phi^4(2-\delta)^2\sigma_u^2, a_5 = 4\phi^3(2-\delta)(8-3\delta)\sigma_u^2,\\
a_4 &= \phi^4\sigma_v^2(4\delta-4) + 4\phi^4\delta^2\sigma_\varepsilon^2 + 4\phi^4(2-\delta)^2\sigma_T^2 + \left[(8-3\delta)^2 + 4(4-\delta)(2-\delta)\right]\phi^2\sigma_u^2,\\
a_3 &= \left(-2\delta^2+14\delta-16\right)\phi^3\sigma_v^2 + 4\phi^3\delta^2\sigma_\varepsilon^2 + 4\phi^3(2-\delta)(4-\delta)\sigma_T^2 + 2\phi\sigma_u^2(8-3\delta)(4-\delta),\\
a_2 &= \left(-4\delta^2+18\delta-24\right)\phi^2\sigma_v^2 - 3\phi^2\delta^2\sigma_\varepsilon^2 + (4-\delta)^2\phi^2\sigma_T^2 + (4-\delta)^2\sigma_u^2,\\
a_1 &= \left(-2\delta^2+10\delta-16\right)\phi\sigma_v^2 - 2\phi\delta^2\sigma_\varepsilon^2, a_0 = (2\delta-4)\sigma_v^2 + \delta^2\sigma_\varepsilon^2.
\end{aligned}$$

All other variables can be solved as expressions of λ as follows:

$$\begin{aligned}
\beta &= \frac{2\phi\lambda+2-\delta}{4\phi\lambda^2+4\lambda-(\lambda+2\phi\lambda^2)\delta}, \alpha = \frac{\phi}{1+\phi\lambda},\\
\gamma &= \frac{(1-2\phi\lambda)\delta}{4\phi\lambda^2+4\lambda-(\lambda+2\phi\lambda^2)\delta}, \eta = 2\phi(\bar{p}_T - p_0),
\end{aligned}$$

where $\delta \equiv \frac{cov(v,s|p_T)}{var(s|p_T)} = \frac{\sigma_v^2}{\sigma_v^2+\sigma_\varepsilon^2}$. Then, the measure of price stability is solved as

$$E[(p-p_T)^2] = \lambda(\beta+\gamma)\sigma_v^2 + (1-2\lambda\alpha)\sigma_T^2 + (p_0-\bar{p}_T)^2.$$

The measure of price discovery/efficiency is

$$var(v|p) = var(v|y) = [1-\lambda(\beta+\gamma)]\sigma_v^2.$$

The expected profit of the insider and expected cost of the government are

$$E(\pi) = [1-\lambda(\beta+\gamma)]\beta\sigma_v^2, E(c) = [\lambda(\beta+\gamma)-1]\gamma\sigma_v^2 + \lambda\gamma^2\sigma_\varepsilon^2 + \lambda\alpha^2\sigma_T^2.$$

The correlation coefficient of the trading positions between the insider and the government is

$$corr(x,g) = \frac{\beta\gamma\sigma_v^2}{\sqrt{\beta^2\sigma_v^2\left[\gamma^2(\sigma_v^2+\sigma_\varepsilon^2)+\alpha^2\sigma_T^2\right]}}.$$

2.3 Numerical results and economic intuitions

In this subsection we simulate the equilibrium of the benchmark model and examine how government intervention without information disclosure affects financial markets. We summarize the numerical results in Figure 1 and develop the associated economic intuitions.

[Insert Figure 1 here.]

Optimal trading (OT). In this model, the government has two goals: one is price stability, measured by $E(p-p_T)^2$, and the other is cost minimization, measured by $(p-v)g$. The government trades on its private information to achieve these two goals and trading on either signal directly and indirectly affects both goals. As shown in Figure 1, so long as the government cares about price stability (i.e., $\phi > 0$), it trades more intensively on the price target than on the fundamental signal (i.e., $\alpha > \gamma$). In other words, the government optimally relates financial stability more with the price target signal and cost minimization more with the fundamental signal when making intervention decisions. Intuitively, by trading on the price target, the government incorporates the information of the target into asset prices, shortens the distance between the price and the target and hence stabilizes asset prices; however, government trading on the fundamental signal indirectly affects price stability through the equilibrium price, the effect of which is relatively small because the two signals are independent.

Furthermore, if the government cares more about the policy goal (i.e., ϕ is larger), then its trading intensity in the price target (α) is larger, while that in the fundamental signal (γ) is smaller. As a result, its intervention costs are higher and the equilibrium price is more stable. Intuitively, the larger values of ϕ, on one hand, indicate further deviations from its motives for profit maximization, which results in more intervention costs, on the other hand, represent greater intervention effort, which leads to more stable prices.

It is also interesting to examine two extreme cases (i.e., $\phi = 3$ and $\phi = 0$). If the government cares more about its policy goals (i.e., $\phi = 3$), then it will trade against the insider (i.e., $corr(x, g) < 0$), and this will induce higher intervention costs. Intuitively, since the insider has precise information about the fundamentals, he trades on his precise information and earns profits in financial markets (i.e., $\beta > 0$ and $E(\pi) > 0$). Although the government trades on the price target and against the fundamental signal (i.e., $\alpha > 0$ and $\gamma < 0$), the latter trading position dominates the former. Hence the government and the insider trade against each other in this situation.[8] Moreover, more policy concerns imply less cost considerations, which leads to more intervention costs. Conversely, if the government does not care about its policy goals (i.e., $\phi = 0$), it trades only on its fundamental signal as another informed trader and ignores

[8] This kind of reversed trading strategy between the government and insider is also derived in Huang et al. (2022), which is a dynamic Kyle-type government intervention model without the price target signal.

the target signal (i.e., $\gamma > 0$ and $\alpha = 0$). With less precise fundamental information than the insider, the government trades less intensively on its fundamental signal and earns less money than the insider (i.e., $\gamma < \beta$, $-E(c) < E(\pi)$).

If the government cares more about its policy goals (i.e., ϕ is larger), the insider trades more intensively on his precise information and earns more profits (i.e., β and $E(\pi)$ are larger). With larger policy motives, the government trades more intensively on the price target and injects more noise into financial markets, which improves market liquidity and decreases price efficiency. Hence, the insider more easily conceals his information and trades more on his precise information. However, if the government does not care about its policy goals (i.e., $\phi = 0$), then the insider trades less intensively and earns less profits than that of the insider in the standard Kyle model. In this situation, the government trades like another informed trader and ignores the price target signal. Facing competition from another informed trader, the insider will trade less and earn less.

Market liquidity (ML). Market liquidity is measured by the inverse of Kyle's lambda ($1/\lambda$), with a lower λ value meaning that the market is deeper and more liquid. Government intervention affects market liquidity through two different channels (noise channel and information channel). On one hand, government trading injects new noise (σ_T^2 and σ_ε^2) into financial markets, which play roles similar to that played by the noisy trading and improve market liquidity. On the other hand, government trading enhances private information (through s) in financial markets, reinforces the degree of adverse selection and lowers market liquidity. As shown by subfigure A7 in Figure 1, the solid blue line, the dashed red line and the dotted dashed green line are all below the dotted black line. That is, relative to the standard Kyle setting, government intervention definitely increases market liquidity, which establishes that the positive noise effects of government intervention always dominate its negative information effects.

Furthermore, market liquidity increases in the policy weight of the government. Intuitively, if the government cares more about its policy goal, it trades more aggressively on the price target, the dominating positive effect through the noise channel is larger and thus deepens financial markets.[9] Additionally, the theoretical results about the improved market liquidity through government intervention are in accord with the empirical findings of Huang et al. (2019), Allen et al. (2020), and Pasquariello et al. (2020).

[9] Numerically, holding other exogenous parameters fixed, increasing σ_T^2 raises $1/\lambda$.

Price stability (PS) and price efficiency (PE). Government intervention through informed trading stabilizes financial markets effectively. Intuitively, government trading on the price target incorporates the information on the target, drives the equilibrium price to its target level and stabilizes asset prices directly. Moreover, trading on the fundamental signal affects financial stability indirectly through the equilibrium price, although its effects are relatively small. As shown in Figure 1, price stability increases in the policy weight of the government. Intuitively, if the government attaches more importance to its policy goals (i.e., ϕ is larger), then it trades more aggressively on the price target, through which the government incorporates more information on the price target into the equilibrium price, shortens the distance between the price and the target, and makes asset prices more stable.

Since price aggregates all information and noise in financial markets, in this baseline model, government intervention affects price efficiency through two different channels: the noise effect and information effect. On one hand, government intervention through direct trading injects two new noises into financial markets: the price target and informational noise (i.e., σ_T^2 and σ_ε^2), which play similar roles to noisy trading and reduce price efficiency. On the other hand, government trading based on the fundamental signal releases more information about the fundamentals and raises price efficiency, moreover due to the increased market liquidity, the insider trades more intensively on his precise information about fundamentals and improves price efficiency. In other words, the noise effect on the price efficiency of government intervention is negative, while the information effect is positive. When it is more concerned with its policy goals, the noise/information effect becomes stronger/weaker and the noise effect increasingly dominates the information effect, resulting in less efficient asset prices. Therefore, price efficiency decreases in the policy weight of the government, as shown in Figure 1.

Combining the above results on price stability and price efficiency, we find that price efficiency decreases while price stability increases in the policy weight of the government, which demonstrates that there are tradeoffs between them in this model. Intuitively, if the government imposes more weight on its policy goals, then it trades more intensively on the price target and more effectively stabilizes the price of the financial asset; moreover, the noise effect of government intervention on price efficiency comes to dominate its information effect, which makes the equilibrium price less efficient. Brunnermeier et al. (2022) derive similar tradeoffs between financial stability and price efficiency in a Grossman-type government intervention model.[10]

[10] In a closely related model, where the government has only the fundamental signal, Huang et al. (2022) show

3 Government intervention with information disclosure

Now, we begin to examine whether information disclosure is helpful for government intervention. Since the government has two private signals, we investigate three scenarios: releasing the price target $\{p_T\}$, releasing the noisy signal about fundamentals $\{s\}$ and releasing both signals $\{p_T, s\}$. Information disclosure changes the information sets of other market participants in financial markets and hence alters the performance of government intervention, although the government's own optimization problem is unchanged. In this section, we formulate three different disclosure scenarios, present their equilibrium results, simulate all four scenarios, and provide the basic features of them. The information structures of these scenarios are summarized in Table 1.

Table 1. Information structures for four scenarios

	Insider's information	MM's information	Government's information
Benchmark	$\{v\}$	$\{y\}$	$\{p_T, s\}$
Release $\{p_T\}$	$\{v, p_T\}$	$\{y, p_T\}$	$\{p_T, s\}$
Release $\{s\}$	$\{v, s\}$	$\{y, s\}$	$\{p_T, s\}$
Release $\{p_T, s\}$	$\{v, p_T, s\}$	$\{y, p_T, s\}$	$\{p_T, s\}$

3.1 Releasing the price target

In this case, we assume that the government releases the realizations of the price target signal before trading. With the enlarged information set $\{v, p_T\}$, the insider's maximization problem is changed as follows:

$$\max_{\{x\}} E[(v - p)x|v, p_T]. \tag{9}$$

Moreover, the market maker also sees the signal released by the government, $\{p_T\}$, and uses her new information set $\{y, p_T\}$ to update the conditional expectations about the fundamentals. Thus, the pricing rule of market efficiency is transformed into

$$p = E(v|y, p_T). \tag{10}$$

We propose the decision rules for the insider and the government and the pricing rule for

that government intervention improves financial stability and price efficiency simultaneously.

the market maker as follows:

$$x = \beta_T(v - p_0) + \xi_T(p_T - \bar{p}_T), \quad (11)$$

$$g = \gamma_T(s - p_0) + \alpha_T(p_T - \bar{p}_T) + \eta_T, \quad (12)$$

$$p = p_0 + \lambda_T[y - E(y|p_T)], \text{ with } y = x + g + u, \quad (13)$$

where

$$E(y|p_T) = (\xi_T + \alpha_T)(p_T - \bar{p}_T) + \eta_T.$$

We solve the model in Appendix A.2 and summarize the equilibrium in the following

Proposition 1 *If the government releases the price target signal* $\{p_T\}$, *then a linear equilibrium is defined by six unknowns* $(\beta_T, \xi_T, \gamma_T, \alpha_T, \eta_T, \lambda_T) \in R^6$, *which are characterized by six equations (37)-(42), together with the SOC,* $\lambda_T > 0$. *The system of equations can be solved as the following fourth-order polynomial of* λ_T:

$$\left(\begin{array}{c} \phi^2(4-2\delta)^2\sigma_u^2\lambda_T^4 + 4\phi(2-\delta)(4-\delta)\sigma_u^2\lambda_T^3 - [4\phi\delta^2\sigma_\varepsilon^2 + (8+2\delta^2-6\delta)\phi\sigma_v^2]\lambda_T \\ +[(4-\delta)^2\sigma_u^2 + 4\phi^2\delta^2\sigma_\varepsilon^2 - 4\phi^2(1-\delta)\sigma_v^2]\lambda_T^2 + \delta^2\sigma_\varepsilon^2 + 2(\delta-2)\sigma_v^2 \end{array} \right) = 0.$$

All other endogenous parameters can be solved as expressions of λ_T *as follows:*

$$\beta_T = \frac{2\phi\lambda_T + 2 - \delta}{4\phi\lambda_T^2 + 4\lambda_T - (\lambda_T + 2\phi\lambda_T^2)\delta}, \xi_T = 0, \alpha_T = 2\phi,$$

$$\gamma_T = \frac{(1 - 2\phi\lambda_T)\delta}{4\phi\lambda_T^2 + 4\lambda_T - (\lambda_T + 2\phi\lambda_T^2)\delta}, \eta_T = 2\phi(\bar{p}_T - p_0),$$

where $\delta \equiv \frac{\sigma_v^2}{\sigma_v^2 + \sigma_\varepsilon^2}$. *The measure of price stability is solved as*

$$E[(p - p_T)^2]_T = \lambda_T(\beta_T + \gamma_T)\sigma_v^2 + \sigma_T^2 + (p_0 - \bar{p}_T)^2.$$

The measure of price discovery/efficiency is

$$var(v|p)_T = [1 - \lambda_T(\beta_T + \gamma_T)]\sigma_v^2.$$

The expected profits of the insider and expected costs of the government are as follows:

$$E(\pi_T) = [1 - \lambda_T(\beta_T + \gamma_T)]\beta_T\sigma_v^2, E(c_T) = [\lambda_T(\beta_T + \gamma_T) - 1]\gamma_T\sigma_v^2 + \lambda_T\gamma_T^2\sigma_\varepsilon^2.$$

The correlation coefficient of the trading positions between the insider and the government is

$$corr\,(x,g)_T = \frac{\beta_T \gamma_T \sigma_v^2 + \xi_T \alpha_T \sigma_T^2}{\sqrt{\beta_T^2 \sigma_v^2 + \xi_T^2 \sigma_T^2}\sqrt{\gamma_T^2\left(\sigma_v^2 + \sigma_\varepsilon^2\right) + \alpha_T^2 \sigma_T^2}}.$$

Compared to the benchmark model, the government now releases the price target signal before trading. As shown in Figure 2 and Figure 3, the government trades more aggressively on the price target signal (i.e., $\alpha_T > \alpha$), which stems from the government's reduced marginal intervention costs and weakened information advantages. On one hand, the release of the price target removes noise in financial markets and decreases market liquidity, which compels the insider and the government to trade less intensively on their respective fundamental signals (i.e., $\beta_T < \beta$, $\gamma_T < \gamma$)[11] and deters price discovery. Then, the marginal trading revenues of the insider (i.e., $(v - p)$) are increased, which implies that the marginal intervention costs of the government (i.e., $(p - v)$) are decreased. With less marginal intervention costs, the government trades more intensively on the price target. On the other hand, with the enlarged information set $\{y, p_T\}$, the market maker uses the filtered order flow (i.e., $y - E\,(y|p_T)$) to evaluate the economic fundamentals, namely, $p = E(v|y, p_T) = E\left[v|y - E\left(y|p_T\right), p_T\right] = E\left[v|y - E\left(y|p_T\right)\right]$.[12] To counteract the market maker's pricing behavior, the government with less information advantages trades more aggressively on the price target, even if it is of no avail.

In this case, the insider trades less intensively on his precise information about the fundamentals and ignores the price target signal (i.e., $\beta_T < \beta$, $\xi_T = 0$). Intuitively, the release of the price target removes noise and hence decreases the liquidity of financial markets. To lessen information leakage, the insider diminishes his trading intensity on his precise information. Moreover, the insider ignores the price target signal and places no position on it. Since the price target signal has no correlation with the fundamentals, the market maker who knows the target perceives the trading positions related to the price target and more effectively evaluates the fundamentals by utilizing the filtered market order (i.e., $y - E\,(y|p_T)$). The pricing decisions of the market maker counteract the government's trading on the price target; hence, the equilibrium price reveals no information about the target. Rationally expecting this, the insider optimally ignores the released price target signal and places zero position on it.[13]

[11] We provide a sufficient condition for $\gamma_T < \gamma$ in Appendix A.3. Numerically, the inequality always holds.

[12] Imagining that the market maker is also optimizing, she trades against the price target signal and offsets the effect on the market price of government trading based on the price target.

[13] Furthermore, if the government cares more about its policy concerns (i.e., $\phi = 3$), the government and the insider still trade against each other (i.e., $corr(x,g) < 0$). Intuitively, ignoring the price target, the insider trades

Compared to the benchmark model, releasing the price target removes noise (i.e., σ_T^2) in financial markets and thus decreases market liquidity (i.e., $1/\lambda_T < 1/\lambda$). The release of the price target has two opposite effects on price efficiency: on one hand, it diminishes exogenous noise (i.e., σ_T^2) in financial markets and directly improves price efficiency (i.e., noise effect); on the other hand, facing lower market liquidity, both the insider and the government trade less intensively on their fundamental information, which decreases price efficiency (i.e., information effect). In other words, the noise effect on price efficiency of releasing the price target is positive while the information effect is negative. Since the information effect dominates the noise effect, the release of the price target reduces price efficiency (i.e., $var(v|p)_T > var(v|p)$).

Releasing the price target increases the expected price instability of financial markets (i.e., $E[(p - p_T)^2]_T > E[(p - p_T)^2]$), as shown in Figures 2 and 3. In the benchmark model, by trading on the price target (and the fundamental signal), the government incorporates the information about the price target into the equilibrium price, drives the equilibrium price to approach the target level and effectively stabilizes asset prices. Once releasing the price target, the government loses its information advantage and has no effective tools to affect the price of the financial asset, because in this situation the market maker's pricing decision effectively offsets the effect on asset prices of government trading based on the price target. Therefore, if the government releases the price target signal, the price becomes more unstable.

We summarize these results in the following Corollary 1 and place its proof in Appendix A.3.

Corollary 1 *Compared to the benchmark model, if the government releases the price target signal, then (i) the insider trades less intensively on his private information and ignores the price target signal; (ii) the government trades more intensively on the price target and trades less on the fundamental signal; and (iii) the equilibrium price is more unstable and less efficient, and the financial market is less deep.*

[Insert Figures 2-3 here.]

3.2 Releasing the noisy signal about the fundamental

Now, let us suppose that the government releases its noisy signal about the fundamental before trading. With the enlarged information set $\{v, s\}$, the insider's maximization problem is

on his precise information (with less trading intensity); meanwhile, the government trades more intensively on the target, but its negative trading on the fundamentals still dominates.

transformed as follows:

$$\max_{\{x\}} E[(v-p)x|v,s]. \tag{14}$$

Moreover, observing the signal released by the government, $\{s\}$, the market maker uses the information set $\{y,s\}$ to update her conditional expectations about the fundamentals. Thus, the pricing rule of market efficiency is transformed into

$$p = E(v|y,s). \tag{15}$$

Let us conjecture, instead, the decision and pricing rules as follows:

$$x = \beta_s(v-p_0)+\xi_s(s-p_0), \tag{16}$$

$$g = \gamma_s(s-p_0)+\alpha_s(p_T-\bar{p}_T)+\eta_s, \tag{17}$$

$$p = p_0+\delta(s-p_0)+\lambda_s[y-E(y|s)], \text{ with } y=x+g+u, \tag{18}$$

where

$$E(y|s)=\eta_s+(\beta_s\delta+\xi_s+\gamma_s)(s-p_0), \delta\equiv\frac{\sigma_v^2}{\sigma_v^2+\sigma_\varepsilon^2}.$$

We solve the model in Appendix A.4 and summarize the equilibrium results in the following:

Proposition 2 *If the government releases the noisy signal about the fundamental $\{s\}$, then a linear equilibrium is defined by six unknowns $(\beta_s,\xi_s,\gamma_s,\alpha_s,\eta_s,\lambda_s)\in R^6$, which are characterized by six equations (44)-(49), together with one SOC, $\lambda_s>0$. The system of equations degenerates to the following fourth-order polynomial of λ_s:*

$$\begin{pmatrix} 4\phi^2\sigma_u^2\lambda_s^4+8\phi\sigma_u^2\lambda_s^3+\left[4\phi^2\sigma_T^2-\phi^2\left((1-\delta)^2\sigma_v^2+\delta^2\sigma_\varepsilon^2\right)+4\sigma_u^2\right]\lambda_s^2 \\ -2\phi\left[(1-\delta)^2\sigma_v^2+\delta^2\sigma_\varepsilon^2\right]\lambda_s-\left[(1-\delta)^2\sigma_v^2+\delta^2\sigma_\varepsilon^2\right] \end{pmatrix}=0.$$

All the other variables can be solved as expressions for λ_s as follows:

$$\beta_s=\frac{1}{2\lambda_s},\ \xi_s=-\frac{\delta}{2\lambda_s},\gamma_s=-2\phi\delta,\alpha_s=\frac{\phi}{1+\phi\lambda_s},\eta_s=2\phi(\bar{p}_T-p_0),$$

where $\delta \equiv \frac{\sigma_v^2}{\sigma_v^2+\sigma_\varepsilon^2}$. *The measure of price stability is then*

$$E[(p-p_T)^2]_s = [\lambda_s\beta_s + (1-\lambda_s\beta_s)\,\delta]^2\,\sigma_v^2 + (1-\lambda_s\beta_s)^2\,\delta^2\sigma_\varepsilon^2 + (\lambda_s\alpha_s - 1)^2\sigma_T^2 + \lambda_s^2\sigma_u^2 + (p_0 - \bar{p}_T)^2.$$

The measure of price discovery/efficiency is

$$var(v|p)_s = \frac{(1-\delta)^2\,\sigma_v^2 + 2\delta^2\sigma_\varepsilon^2}{2\left(1+\delta^2\right)\sigma_v^2 + 2\delta^2\sigma_\varepsilon^2}\sigma_v^2.$$

The expected profit of the insider and expected cost of the government are, respectively,

$$E(\pi) = (1-\delta)\,(1-\lambda_s\beta_s)\,(\beta_s+\xi_s)\sigma_v^2 - (1-\lambda_s\beta_s)\,\delta\xi_s\sigma_\varepsilon^2, E(c) = \lambda_s\alpha_s^2\sigma_T^2.$$

The correlation coefficient of the trading positions between the insider and the government is

$$corr\,(x,g) = \frac{(\beta_s+\xi_s)\,\gamma_s\sigma_v^2 + \xi_s\gamma_s\sigma_\varepsilon^2}{\sqrt{(\beta_s+\xi_s)^2\,\sigma_v^2 + \xi_s^2\sigma_\varepsilon^2}\sqrt{\gamma_s^2\,(\sigma_v^2+\sigma_\varepsilon^2) + \alpha_s^2\sigma_T^2}}.$$

The government now releases the noisy signal about the fundamental before trading. In this situation, the government trades against the fundamental signal (i.e., $\gamma_s < 0 < \gamma$). Intuitively, releasing the fundamental signal improves price efficiency in financial markets and increases the marginal intervention cost (i.e., $p - v$)[14], hence the government trades less intensively on the fundamental signal than in the baseline model (i.e., $\gamma_s < \gamma$). Knowing that the insider's fundamental signal is better than its released one, the government will trade against its released fundamental signal (i.e., $\gamma_s < 0\,(< \gamma)$). Moreover, releasing the fundamental signal erodes the information advantage of the government, and it trades more intensively on the price target (i.e., $\alpha_s > \alpha$) to stabilize asset prices.

From the viewpoint of the insider, releasing the fundamental signal reduces private information in financial markets and increases market liquidity, the insider trades more intensively on his precise fundamental information (i.e., $\beta_s > \beta$). Furthermore, in order to exploit his relative information advantage, the insider trades against the released noisy fundamental information

[14] Seeing the released fundamental signal, the market maker more efficiently evaluates the economic fundamental by using the aggregate order flow. Thus, the equilibrium price approaches the economic fundamental even better, which implies that the marginal trading profit (i.e., $(v-p)$) decreases and the marginal intervention cost increases ((i.e., $p-v$)).

(i.e., $\xi_s < 0$).

Compared to the benchmark model, releasing the noisy signal about the fundamental diminishes private information in financial markets, lowers the degree of adverse selection and thus increases market liquidity (i.e., $1/\lambda_s > 1/\lambda$). The release of the fundamental signal improves price efficiency through the noise effect and information effect. The noise effect removes noise (i.e., σ_ε^2) in financial markets, which directly improves price efficiency. The information effect improves price efficiency through two channels: on one hand, facing deeper financial markets, the insider trades more intensively on his precise information, and the equilibrium price reveals more information about the fundamentals; on the other hand, equipped with enlarged information set $\{y, s\}$, the market maker more easily uncovers the economic fundamentals and the price becomes more informative. Therefore, the release of the fundamental signal improves price efficiency, namely, $var(v|p)_s < var(v|p)$. As shown in Figures 2 and 3, we know that $E[(p - p_T)^2]_s > E[(p - p_T)^2]$ for any values of θ and ϕ, which implies that asset prices become more unstable when the government releases the fundamental signal. Similar to the case of releasing the price target signal, releasing the fundamental signal erodes the information advantage of the government and deteriorates its ability to stabilize the financial markets.

We summarize the above results in the following Corollary 2; the proof is similar to Corollary 1, and we omit it here.

Corollary 2 *Compared to the benchmark model, if the government releases the noisy signal about the fundamental, then (i) the insider trades more intensively on his precise information, trades against the released noisy signal about the fundamental, and earns less profits; (ii) the government trades more intensively on the price target and less intensively on the fundamental signal; and (iii) the equilibrium price is more unstable but more efficient, and the financial market deepens.*

The government releasing its noisy fundamental signal to the insider with precise information about the fundamental is similar to Goldstein et al. (2023) who demonstrate that a less informed investor optimally chooses to share information with a well-informed investor. These two models draw similar conclusions on the trading behavior of the well informed investor and price informativeness of the financial asset. First, both models indicate that the well-informed investor trades against the released noisy signal about the fundamental and earns less profits in equilibrium. The intuition is also similar: relative to the economy without information disclosure in which the well-informed investor obtains the highest profits, any adjustments in the price schedule driven by releasing the noisy fundamental signal will harm the well-informed investor. Second, the price informativeness of the financial asset is improved. Intuitively, in both settings, releasing the noisy signal about the fundamentals injects new information into financial markets, and the equilibrium price aggregates more fundamental information. Moreover, these two models have different equilibrium effects on market liquidity and welfare implications for coarsely informed investors. On one hand, market liquidity is dampened in Goldstein et al. (2023) but improved in our model. In Goldstein et al. (2023), the coarsely informed investor releasing his noisy signal to the well-informed investor (but not to the market maker) increases the informed trading in the total order flow, and the market maker raises the price impact to manage the increasing adverse selection risk, which dampens market liquidity of the financial market. However, in our model, the noisy fundamental signal is released to both the insider and the market maker, which diminishes private information in the financial market, reduces adverse selection risk and improves market liquidity. On the other hand, the welfare implications for the coarsely informed investor are different. In Goldstein et al. (2023), the less informed investor caring only about profit-maximizing benefits from sharing the fundamental information, since information release has the well-informed investor trade against him, offsetting his price impact and making him trade more aggressively. In our model in which the government (as the less informed trader) has multiple signals and multiple goals, the welfare effects on the less informed government of releasing its noisy fundamental signal are more complex. Althrough releasing the fundamental signal negatively affects price stability unambiguously, its effects on trading revenues/costs are ambiguous and hinge on other parameter values.

3.3 Releasing both signals

Let us suppose that the government releases the price target and its noisy signal about the fundamental before trading.[15] With the enlarged information set $\{v, p_T, s\}$, the insider's maxi-

[15]In online Appendix S3, we examine another disclosure scenario that the government discloses its trading plan $\{g\}$ rather than both signals $\{p_T, s\}$ before trading. Relative to the baseline model without communication, both disclosure policies draw similar conclusions for financial stability and price efficiency. Specifically, both disclosure policies negatively affects price stability due to reduced information advantages and improve price efficiency because the market maker with more information (i.e., $\{y, g\}$ or $\{y, p_T, s\}$) uncovers the economic fundamentals more easily. As shown in Section 3.3, the effects on market liquidity of releasing both signals rely on tradeoffs between the noise effect and the information effect. However, disclosing the trading plan decreases market liquidity definitely, since in this case the negative noise effect dominates the positive information effect.

mization problem is transformed as follows:

$$\max_{\{x\}} E[(v-p)x|v, p_T, s]. \tag{19}$$

In this case, the market maker sees both signals released by the government and uses her new information set $\{y, p_T, s\}$ to update her conditional expectations about the fundamentals. Then, the pricing rule of market efficiency is transformed into

$$p = E(v|y, p_T, s). \tag{20}$$

Let us conjecture the decision and pricing rules of the economy:

$$\begin{aligned} x &= \beta_{s,T}(v-p_0) + \xi^{(1)}_{s,T}(s-p_0) + \xi^{(2)}_{s,T}(p_T - \bar{p}_T), & (21)\\ g &= \gamma_{s,T}(s-p_0) + \alpha_{s,T}(p_T - \bar{p}_T) + \eta_{s,T}, & (22)\\ p &= p_0 + \delta(s-p_0) + \lambda_{s,T}[y - E(y|s, p_T)], \text{ with } y = x + g + u, & (23)\end{aligned}$$

where

$$\begin{aligned} E(y|s, p_T) &= \left(\beta_{s,T}\delta + \xi^{(1)}_{s,T} + \gamma_{s,T}\right)(s-p_0) + (\xi^{(2)}_{s,T} + \alpha_{s,T})(p_T - \bar{p}_T) + \eta_{s,T},\\ \delta &\equiv \frac{\sigma_v^2}{\sigma_v^2 + \sigma_\varepsilon^2}. \end{aligned}$$

In Appendix A.5, we derive the model equilibrium which is summarized in the following:

Proposition 3 *If the government releases two private signals $\{p_T, s\}$, then a linear equilibrium is defined by seven unknowns $(\beta_{s,T}, \xi^{(1)}_{s,T}, \xi^{(2)}_{s,T}, \gamma_{s,T}, \alpha_{s,T}, \eta_{s,T}, \lambda_{s,T}) \in R^7$, which are characterized by seven equations (51)-(57), together with one SOC, $\lambda_{s,T} > 0$. The system of equations can be solved explicitly as follows:*

$$\begin{aligned} \beta_{s,T} &= \frac{\sigma_u}{\sqrt{(1-\delta)^2\sigma_v^2 + \delta^2\sigma_\varepsilon^2}}, \xi^{(1)}_{s,T} = -\frac{\delta\sigma_u}{\sqrt{(1-\delta)^2\sigma_v^2 + \delta^2\sigma_\varepsilon^2}}, \xi^{(2)}_{s,T} = 0,\\ \gamma_{s,T} &= -2\phi\delta, \alpha_{s,T} = 2\phi, \eta_{s,T} = 2\phi(\bar{p}_T - p_0), \lambda_{s,T} = \frac{\sqrt{(1-\delta)^2\sigma_v^2 + \delta^2\sigma_\varepsilon^2}}{2\sigma_u}. \end{aligned}$$

The measure of price stability is then

$$E[(p-p_T)^2]_{s,T} = \frac{1}{2}(1+\delta)\sigma_v^2 + \sigma_T^2 + (p_0 - \bar{p}_T)^2.$$

The measure of price discovery/efficiency is

$$var(v|p)_{s,T} = \frac{(1-\delta)^2\sigma_v^2 + 2\delta^2\sigma_\varepsilon^2}{2\left(1+\delta^2\right)\sigma_v^2 + 2\delta^2\sigma_\varepsilon^2}\sigma_v^2.$$

The expected profit of the insider and expected cost of the government are, respectively,

$$E(\pi) = \frac{\sigma_u\sqrt{(1-\delta)^2\sigma_v^2 + \delta^2\sigma_\varepsilon^2}}{2}, E(c) = 0.$$

The correlation coefficient of the trading positions between the insider and the government is

$$corr\,(x, g) = 0.$$

As shown in Proposition 1 and Proposition 2, releasing the price target reduces market liquidity, while releasing the fundamental signal raises the marginal intervention cost, both of which diminish the government's trading intensity on its fundamental signal. Hence, releasing both signals unambiguously reduces its trading intensity in the fundamental signal (i.e., $\gamma_{s,T} < \gamma$). Moreover, since the government loses all of its information advantage in this case, it will trade more intensively on the price target to stabilize asset prices (i.e., $\alpha_{s,T} > \alpha$), even though it is of no avail.

As shown in Proposition 1 and Proposition 2, the insider decreases his trading intensity on his precise information if the government releases the price target but increases it if the government releases the noisy signal about the fundamental. Now, if the government releases both of its signals, compared to the benchmark model, the insider's trading intensity on his precise information will hinge on the relative weight placed by the government on its policy motives. In particular, if the government places an equal weight on both goals (i.e., $\phi = 1$), the insider trades more intensively on his precise information about the fundamental (i.e., $\beta_{s,T} > \beta$), since now the financial market is more liquid than in the baseline setting (i.e., $1/\lambda_{s,T} > 1/\lambda$); conversely, if the government places more weight on its policy goals (i.e., $\phi = 3$), the insider trades less intensively on his precise fundamental information (i.e., $\beta_{s,T} < \beta$), since market liquidity in this case is lower than that of the baseline model (i.e., $1/\lambda_{s,T} < 1/\lambda$). Endowed with two fundamental signals, the insider trades positively on the precise fundamental signal but negatively on the noisy signal (i.e., $\beta_{s,T} > 0$, $\xi^{(1)}_{s,T} < 0$), since the insider's sole goal is to exploit his information advantage to maximize profits, which requires him to trade on precise information and against the error. Similar to the case of releasing the price target, rationally expecting that price does not incorporate any information about the price target, the insider does not trade based on the price target signal (i.e., $\xi^{(2)}_{s,T} = 0$) either.

Releasing the price target removes noises in financial markets and hence reduces market liquidity, while releasing the fundamental signal diminishes private information in the financial market and hence improves market liquidity, as shown in Propositions 1 and 2. The total effects on market liquidity of releasing both signals rely on the relative weights placed by the government on its policy motives. Specifically, if the government places an equal weight on both goals (i.e., $\phi = 1$), the positive effects on market liquidity of releasing the fundamental signal dominate, and the financial market is deeper (i.e., $1/\lambda_{s,T} > 1/\lambda$); conversely, if the government places more weight on its policy goals (i.e., $\phi = 3$), the negative effects on market liquidity of releasing the price target dominate, and market liquidity is less than that of the benchmark setting (i.e., $1/\lambda_{s,T} < 1/\lambda$).

From Proposition 2 and Proposition 3, we know that $var(v|p)_{s,T} = var(v|p)_s < var(v|p)$. The logic for the inequality is given in Corollary 2. The equality shows that once the fundamental signal is released, the marginal effect on price discovery of releasing the price target is trivial. The intuition for this result is as follows. When the fundamental signal has already been released, releasing the price target has two counteracting effects on price efficiency: it diminishes noise and improves price efficiency; moreover, it reduces market liquidity, decreases the insider's trading intensity on his precise information and lowers price efficiency. Since these two opposite effects on price efficiency are cancelled out, the marginal effects on price efficiency become trivial.

For any values of θ and ϕ, we have that $E[(p - p_T)^2]_{s,T} > E[(p - p_T)^2]$, which implies that if the government releases both signals, the financial market is less stable than that of the benchmark setting. Releasing both signals implies that the government abandons its information advantage as a useful tool to stabilize asset prices. Actually, it will be more difficult for the government to stabilize the financial market through direct trading than in the cases of releasing either signal.

We summarize the above results in the following Corollary 3 and omit its proof.

Corollary 3 *Relative to the benchmark model, if the government releases both signals, then (i) the government trades more intensively on the price target and less intensively on its fundamental signal; (ii) when the government places an equal weight on both goals, the financial market is deeper and the insider trades more intensively on his precise information; however, when the government places more weight on its policy goals, the financial market is thinner and the insider trades less intensively on his precise information. The insider trades positively on his precise fundamental information but negatively on the released fundamental signal and ignores the released price target signal; (iii) asset prices are more unstable but more efficient.*

4 To release or not to release and which signal to release

In this section, we compare the market performance of government intervention under four different information disclosure scenarios: the benchmark model without information disclosure, releasing the price target signal, releasing the noisy signal about the fundamentals, and releasing both the price target and the noisy signal about the fundamentals. We discuss how government intervention and information disclosure affect financial stability and market quality. We report the numerical results of two important cases: $\phi = 1$ (the government places an equal weight on its policy goal and profit maximization) in Figure 2 and $\phi = 3$ (the government cares more about its policy goals) in Figure 3. The ranks for all those measures among different cases are also summarized in Table 2.

Table 2. Comparisons for four disclosure scenerios

$\phi = 1$	$\phi = 3$
$E(\Delta p)^2 < E(\Delta p)^2_s < E(\Delta p)^2_T < E(\Delta p)^2_{s,T}$	$E(\Delta p)^2 < E(\Delta p)^2_s < E(\Delta p)^2_T < E(\Delta p)^2_{s,T}$
$\frac{1}{\lambda_s} > \frac{1}{\lambda_{s,T}} > \frac{1}{\lambda} > \frac{1}{\lambda_T}$	$\frac{1}{\lambda_s} > \frac{1}{\lambda} > \frac{1}{\lambda_{s,T}} > \frac{1}{\lambda_T}$
$var\,(v\|p)_{s,T} = var\,(v\|p)_s < var\,(v\|p) < var\,(v\|p)_T$	$var\,(v\|p)_{s,T} = var\,(v\|p)_s < var\,(v\|p) < var\,(v\|p)_T$

Market liquidity (ML). It is shown in Section 3 that relative to the benchmark model without information disclosure, releasing the price target removes noise in financial markets and hence decreases market liquidity, while releasing the noisy signal about the fundamentals reduces private information in financial markets and hence raises market liquidity. Thus, we have $1/\lambda_T < 1/\lambda$ and $1/\lambda_s > 1/\lambda$, respectively. The rank between $1/\lambda$ and $1/\lambda_{s,T}$ hinges on tradeoffs between the two opposite effects, which relate to the policy weights of the government. Specifically, if the government places an equal weight on policy goals and profit maximization (i.e., $\phi = 1$), then the measure of market liquidity of releasing both signals is larger than that of the benchmark model without information disclosure (i.e., $1/\lambda_{s,T} > 1/\lambda$), which establishes that the positive effect on market liquidity of releasing the fundamental signal dominates the negative effect of releasing the price target, and hence the financial market is deeper. However, if the government places larger weights on its policy goals ($\phi = 3$), then the negative effect of releasing the price target dominates the positive effect of releasing the fundamental signal and market liquidity is lower ($1/\lambda > 1/\lambda_{s,T}$). Combining the above results, we conclude that if $\phi = 1$, then the ranks of market liquidity among these four cases are $1/\lambda_s > 1/\lambda_{s,T} > 1/\lambda > 1/\lambda_T$; if $\phi = 3$, then the ranks are $1/\lambda_s > 1/\lambda > 1/\lambda_{s,T} > 1/\lambda_T$, as shown in Figures 2 and 3.

Price stability (PS). For any parameter values of θ and ϕ, as shown in Figures 2-3, we know that $E(\Delta p)^2{}_{s,T} > E(\Delta p)^2{}_T > E(\Delta p)^2{}_s > E(\Delta p)^2$, (note that $\Delta p \equiv p - p_T$), which displays that no information disclosure is better than releasing either of the two signals, and releasing either signal is better than releasing both signals. That is, no information disclosure is the best policy for price stability, releasing both signals is the worst policy, and releasing the fundamental signal is better than releasing the price target. In a word, information disclosure negatively affects financial stability.

The intuition is as follows. The Kyle-type model is well known as a standard setting in which economic agents trade on their private information to achieve respective goals. In our model, by trading on its private information, the government drives asset prices to approach the price target and stabilizes the financial market from its own perspective. Once private information is disclosed, the government loses its information advantage to stabilize the financial market and asset prices become less stable. Releasing one signal implies reducing its information advantages, and releasing both signals implies abandoning all information advantages. As a result, the performance of government intervention declines. The inequality $E(\Delta p)^2{}_T > E(\Delta p)^2{}_s$ shows that releasing the price target is worse than releasing the noisy signal about the fundamental, since the price target signal is more related to price stability than the fundamental signal.

Altogether, private information is likely to be an important prerequisite for a successful government intervention. Information disclosure reduces the government's information advantages, deteriorates its intervention ability through direct trading and hence negatively affects financial stability.[16]

Price efficiency (PE). Combining the above theoretical and numerical results, we find that $var\,(v|p)_{s,T} = var\,(v|p)_s < var\,(v|p) < var\,(v|p)_T$ for any values θ and ϕ. Proposition 1 shows that relative to the benchmark setting, releasing the price target has two opposite effects on price efficiency. The noise effect reduces noise in the financial market and thus improves price efficiency, while the information effect decreases market liquidity, reduces the insider's trading intensity on its precise fundamental information and thus reduces price efficiency. Since the information (and negative) effect dominates the noise (and positive) effect, the release of the price target lowers price efficiency (i.e., $var\,(v|p) < var\,(v|p)_T$). As shown in Proposition 2, releasing the noisy signal about the fundamentals improves price efficiency (i.e., $var\,(v|p)_s < var\,(v|p)$) through the noise effect and information effect. The noise effect of the release of the fundamental signal is to remove noise (i.e., σ_ε^2) in financial markets and improve price efficiency. Moreover, the information effect improves price efficiency through two channels: on one hand, by reducing private information in financial markets, it increases market liquidity, enlarges the insider's trading intensity on his precise information and hence improves price efficiency; on the other hand, it makes the market maker evaluate the economic fundamentals more easily by using the aggregate order flow. The equality $var\,(v|p)_{s,T} = var\,(v|p)_s$ displays that once the fundamental signal is released, the marginal effect on price discovery of releasing the price target becomes trivial. The intuitions is as follows: when the fundamental signal has been released, there exist two counteracting effects on price efficiency of releasing the price target. Specifically, it removes noise in financial markets, which directly improves price efficiency; moreover, it reduces market liquidity, depresses the insider's trading intensity on its precise information and thus indirectly lowers price efficiency. Since these two opposite effects on price efficiency of releasing the price target are cancelled out, the marginal contribution of releasing the price target signal is zero.

Information disclosure may affect price stability and price efficiency in the same direction. In particular, the release of the price target simultaneously decreases price stability and price efficiency. Releasing the price target diminishes the information advantage of the government and hence reduces price stability. Although the noise effect of the release of the price target improves

[16] The literature has identified that governments tend to pursue nonpublic price targets when intervening financial markets. The non-desirability of information disclosure for financial stability may explain why the price target should be nonpublic.

price efficiency while the information effect reduces price efficiency, the latter information effect dominating the former noise effect determines that the net effect is negative. Combining them displays that the release of the price target decreases both price stability and price efficiency. However, information disclosure may bring about possible tradeoffs between price stability and price efficiency. Specifically, releasing the fundamental signal negatively affects price stability due to weakened information advantage. Both the noise effect and information effect of the release of the fundamental signal positively affect price efficiency. Therefore, the release of the fundamental signal decreases price stability but increases price efficiency, leading to tradeoffs between price stability and price efficiency. Furthermore, as shown in Figures 2-3, releasing both signals is the worst approach for price stability but the best approach for price efficiency; releasing nothing is the best approach for financial stability but is not advantageous for price efficiency; and compared to releasing the price target signal, releasing the fundamental signal positively affects both financial stability and price efficiency.

5 Extensions

In this section, we examine two important extensions and variations to demonstrate the robustness of our key results and explore other dimensions that shape government intervention with information disclosure. In the first extension, we extend full information disclosure to partial disclosure. The second extension is that we assume that the government has correlated signals. Both extended models include the baseline model as a special case.

5.1 Partial disclosure

To show our results more clearly, in the baseline model, we assume that the government fully discloses its private information. We here relax this assumption and consider the more general case in which the government releases noisy versions of its two private signals. For this purpose, we also consider three disclosure scenarios: releasing a noisy signal about the price target, $\widetilde{p}_T = p_T + \varepsilon_1$, releasing the noisy signal about its fundamental signal, $\widetilde{s} = s + \varepsilon_2$, and releasing both of them, where $\varepsilon_1 \sim N\left(0, \sigma_{\varepsilon_1}^2\right)$, $\varepsilon_2 \sim N\left(0, \sigma_{\varepsilon_2}^2\right)$, and $\{v, p_T, \varepsilon, u, \varepsilon_1, \varepsilon_2\}$ are mutually independent. Parameters $\sigma_{\varepsilon_1}^2$ and $\sigma_{\varepsilon_2}^2$ controls the qualities of these released signals. The models with full disclosure are nested by assuming that the released information precision is infinity (i.e., $\sigma_{\varepsilon_1}^{-2} = \sigma_{\varepsilon_2}^{-2} = +\infty$). All of our other assumptions remain unchanged from the models with full disclosure.

We use three propositions (Propositions S1-S3) in the online appendix to summarize the equilibrium results in this extended economy. Based on them, we numerically simulate the extended economy and plot Figure 4 (for $\phi = 1$) and Figure 5 (for $\phi = 3$), respectively. Compared to Figures 2 and 3 for the baseline model with full disclosure, we find that the model predictions for full disclosure are robust with partial disclosure. In other words, not only the ranks of the measures of market liquidity, price stability, price efficiency, trading intensities on any signals, and trading profits (or costs) are almost the same as before, but also the numerical changes in a quantitative sense are miniscule.

If paying more attention to comparisons between the baseline model with full disclosure and the setting with partial disclosure, we draw some further conclusions as follows. First, in the extended scenarios with partial disclosure, the relative differences in price stability between partially releasing the price target and partially releasing the fundamental signal are less than that in the baseline model with full disclosure, although their relative ranks remain constant. This is because the informational noises shorten the distances between releasing different signals. Second, different from the baseline model with full disclosure in which releasing the fundamental signal has the same expressions for the posterior variance of v given p as releasing both signals, partially releasing the fundamental signal has a similar expression for price efficiency to releasing both signals but with different endogenous parameter values. However, they are close to each other numerically. Third, there exist some discrepancies on government trading. On one hand, the government trades on two signals in the scenarios with full disclosure (i.e., $\{p_T, s\}$), while it trades on four signals in the scenarios with partial disclosure (i.e., $\{p_T, s, \widetilde{p}_T, \widetilde{s}\}$). On the other hand, it seems that there are large differences in the trading intensities on the two signals $\{p_T, s\}$ between the scenarios with full disclosure and the ones with partial disclosure. If we sum the trading intensities on p_T (or s) and $\widetilde{p}_T$ (or $\widetilde{s}$) in any case with partial disclosure, we find that their sum is very close to the trading intensity on p_T (or s) in the corresponding case with full disclosure.

[Insert Figures 4 and 5 here.]

5.2 Correlated signals

To more clearly develop the insights and intuitions, in the baseline setting, we assume that the government's two signals are uncorrelated. We relax this assumption in this subsection and examine the more general case in which its two signals are correlated. Specifically, we assume that the liquidation value v and price target p_T follow a bivariate normal distribution, namely, $(v, p_T) \sim N(p_0, \bar{p}_T, \sigma_v^2, \sigma_T^2, \rho)$, and thus the government's two private signals follow a bivariate normal random distribution, namely, $(s, p_T) \sim N(p_0, \bar{p}_T, \sigma_v^2 + \sigma_\varepsilon^2, \sigma_T^2, \rho)$. The models with uncorrelated signals are nested by assuming that the correlation coefficient is zero (i.e., $\rho = 0$). All of our other assumptions remain unchanged from the models with uncorrelated signals.

We use four propositions (Propositions S4-S7) in the online appendix to summarize the equilibrium results in this extended setting. Based on them, we numerically simulate the model economies and plot Figure 6 ($\phi = 1, \rho = 0.1$), Figure 7 ($\phi = 1, \rho = 0.5$), Figure 8 ($\phi = 3, \rho = 0.1$), and Figure 9 (($\phi = 3, \rho = 0.5$), respectively. Compared to Figures 2 and 3 for the cases with uncorrelated signals, we find that most of the results for uncorrelated signals are robust with correlated signals. The main changes are discussed as follows.

First, if the government releases the price target in the setting with correlated signals, the insider will trade against the released price target signal (i.e., $\xi_T < 0$, $\xi_{s,T}^{(2)} < 0$)[17], rather than ignoring it (in the setting with uncorrelated signals). The intuition is as follows: if the government releases the price target signal, the market maker not only recognizes the market trading on the price target and uses the market order to infer the fundamentals but also utilizes the price target to deduce the information about the fundamentals and hence decreases the marginal trading benefits of the insider. To hedge this situation, the insider trades against the price target even though it is of no avail.

Second, if the fundamental signal has been released, then the marginal effects on price efficiency of releasing the price target signal are not trivial, namely, $var\,(v|p)_{s,T} \neq var\,(v|p)_s$. Different from the baseline setting with uncorrelated signals, in which the insider ignores the price target signal and the offsetting effects on price efficiency of releasing the price target are cancelled out, in this general case with correlated signals, the insider trades against the released price target signal and breaks the balances between these two opposite effects. As shown in Proposition S6 and Proposition S7 in the online appendix, even though $var\,(v|p)_s$ and $var\,(v|p)_{s,T}$ have similar expressions but with different market liquidity parameters $1/\lambda_s$ and $1/\lambda_{s,T}$, they are not equal generally. Numerically, when the correlation coefficient between the

[17] Using the expressions for ξ_T and $\xi_{s,T}^{(2)}$ in Proposition S5 and Proposition S7 in the online appendix, we can easily prove that $\xi_T < 0$ and $\xi_{s,T}^{(2)} < 0$.

government's two signals is small (i.e., $\rho = 0.1$), they are very close to each other; conversely, when their correlation coefficient is relatively large (i.e., $\rho = 0.5$), the differences between them become larger and their relative size hinges on the policy weight of the government: specifically, if the government places an equal weight on its both goals (i.e., $\phi = 1$), then $var\,(v|p)_{s,T} < var\,(v|p)_s$, and if the government places more weight on its policy goals (i.e., $\phi = 3$), then $var\,(v|p)_{s,T} > var\,(v|p)_s$.

[Insert Figures 6, 7, 8, and 9 here.]

6 Concluding remarks

We develop a theoretical model of government intervention with information disclosure in which a government with two private signals trades directly in the financial market to stabilize asset prices. Government intervention through informed trading stabilizes financial markets and affects market quality (market liquidity and price efficiency) through a noise channel and an information channel. Information disclosure negatively affects financial stability by deteriorating the information advantage of the government, while its final effects on market quality hinge on the relative sizes of the noise effect and the information effect. Under different information disclosure scenarios, there exist potential tradeoffs between financial stability and price efficiency. The theoretical predictions of the baseline model are robust to extended settings with partial disclosure or correlated signals.

Many related questions should be deeply explored in the future research. First, market participants in the simple Kyle (1985) setting are risk neutral. Thus, we cannot examine the risk-sharing effect in financial markets. Combining the risk-sharing effect with the information/noise effect may discuss more dimensions of financial markets and enrich current results. Second, investors in this model have exogenously given information sets. Endogenizing their information sets through information acquisition or other institutional channels may deepen current analyses and provide new insights, especially for the government's target signal. Third, another research line may extend the one-period trading Kyle (1985) setting to multiple-period ones and explore the dynamics of government intervention.

Appendix: Proofs

A.1 Proof of Theorem 1

First, we solve the insider's problem. Let $\pi = (v-p)x$ denote the insider's profit that is directly attributable to his trade. The insider has information $\{v\}$ and chooses x to solve (3). Using Equations (6) and (7) and the projection theorem, we can compute

$$E\left[(v-p)x|v\right] = \left[(1-\lambda\gamma)\left(v-p_0\right) - \lambda x\right]x.$$

Taking the first-order condition (FOC) results in the following solution:

$$x = \frac{1-\lambda\gamma}{2\lambda}(v-p_0). \tag{24}$$

The second-order condition (SOC) is

$$\lambda > 0. \tag{25}$$

Comparing the FOC (24) with the conjectured strategy (5), we have

$$\beta = \frac{1-\lambda\gamma}{2\lambda}. \tag{26}$$

Second, we solve the government's problem. Endowed with information set $\{s, p_T\}$, the government chooses g to solve (4). Using Equations (5) and (7), we can compute

$$E\left[\phi(p-p_T)^2 + (p-v)g|s,p_T\right] = \left\{ \begin{array}{c} 2\phi\lambda\beta(p_0 - p_T - \lambda\eta + \lambda g)E(v-p_0|s,p_T)+ \\ \phi(p_0 - p_T - \lambda\eta + \lambda g)^2 + (\lambda\beta - 1)gE(v-p_0|s,p_T) \\ +\phi\lambda^2\sigma_u^2 + \phi\lambda^2\beta^2 E[(v-p_0)^2|s,p_T] + \lambda g^2 - \lambda\eta g \end{array} \right\}, \tag{27}$$

where

$$E(v-p_0|s,p_T) = E(v-p_0|p_T) + \frac{cov(v-p_0, s|p_T)}{var(s|p_T)}[s - E(s|p_T)] = \delta(s-p_0),$$

$$E[(v-p_0)^2|s,p_T] = [E(v-p_0|s,p_T)]^2 + var(v-p_0|s,p_T) = \delta^2(s-p_0)^2 + (1-\delta)\,\sigma_v^2,$$

$$\delta \equiv \frac{cov(v,s|p_T)}{var(s|p_T)} = \frac{\sigma_v^2}{\sigma_v^2 + \sigma_\varepsilon^2}.$$

The FOC for g yields

$$g = \frac{(1-\lambda\beta-2\phi\lambda^2\beta)\delta(s-p_0)+2\phi\lambda(p_T-\bar{p}_T)+(2\phi\lambda^2+\lambda)\eta+2\phi\lambda(\bar{p}_T-p_0)}{2\phi\lambda^2+2\lambda}. \tag{28}$$

Comparing the FOC (28) with the conjectured trading strategy (6), we have

$$\gamma = \frac{1-\lambda\beta-2\phi\lambda^2\beta}{2\phi\lambda^2+2\lambda}\delta, \tag{29}$$

$$\alpha = \frac{\phi}{1+\phi\lambda}, \tag{30}$$

$$\eta = 2\phi\left(\bar{p}_T - p_0\right). \tag{31}$$

The SOC for the government $2\phi\lambda^2+2\lambda>0$ holds accordingly if the SOC for the insider (25) holds.

Third, we examine the market maker's problem. The market maker observes the aggregate order flow y and sets $p=E[v|y]$. Using Equations (5), (6), and (7) and the projection theorem, we have

$$\lambda = \frac{(\beta+\gamma)\sigma_v^2}{(\beta+\gamma)^2\sigma_v^2+\gamma^2\sigma_\varepsilon^2+\alpha^2\sigma_T^2+\sigma_u^2}. \tag{32}$$

Fourth, we solve the system composed of Equations (26), (29), (30), (31), and (32). Substituting Equation (26) into (29), we have

$$\gamma = \frac{(1-2\phi\lambda)\,\delta}{4\phi\lambda^2+4\lambda-(\lambda+2\phi\lambda^2)\delta}. \tag{33}$$

Plugging Equation (33) into (26) yields

$$\beta = \frac{2\phi\lambda+2-\delta}{4\phi\lambda^2+4\lambda-(\lambda+2\phi\lambda^2)\delta}. \tag{34}$$

Combining Equations (33) and (34) leads to

$$\beta+\gamma = \frac{2+2\phi\lambda-2\phi\lambda\delta}{4\phi\lambda^2+4\lambda-(\lambda+2\phi\lambda^2)\delta}. \tag{35}$$

Substituting Equation (35) into (32) and rearranging them gives rise to the polynomial concerning λ in Proposition 1, (8).

Finally, we compute those moments listed in Proposition 1. The expected price instability can be computed by

$$
\begin{aligned}
E[(p-p_T)^2] &= E\{(p_0+\lambda[\beta(v-p_0)+\gamma(s-p_0)+\alpha(p_T-\bar{p}_T)+u]-p_T)^2\} \\
&= E\{[\lambda(\beta+\gamma)(v-p_0)+\lambda\gamma\varepsilon+(\lambda\alpha-1)(p_T-\bar{p}_T)+\lambda u+p_0-\bar{p}_T]^2\} \\
&= \left(\begin{array}{c} \lambda^2(\beta+\gamma)^2E[(v-p_0)^2]+\lambda^2\gamma^2\sigma_\varepsilon^2+(\lambda\alpha-1)^2E[(p_T-\bar{p}_T)^2]+ \\ \lambda^2\sigma_u^2+2\lambda(\beta+\gamma)(\lambda\alpha-1)E[(v-p_0)(p_T-\bar{p}_T)]+(p_0-\bar{p}_T)^2 \end{array}\right) \\
&= \lambda^2(\beta+\gamma)^2\sigma_v^2+\lambda^2\gamma^2\sigma_\varepsilon^2+(\lambda\alpha-1)^2\sigma_T^2+\lambda^2\sigma_u^2+(p_0-\bar{p}_T)^2 \\
&= \lambda^2[\sigma_u^2+\alpha^2\sigma_T^2+\gamma^2\sigma_\varepsilon^2+(\beta+\gamma)^2\sigma_v^2]+(1-2\lambda\alpha)\sigma_T^2+(p_0-\bar{p}_T)^2 \\
&= \lambda(\beta+\gamma)\sigma_v^2+(1-2\lambda\alpha)\sigma_T^2+(p_0-\bar{p}_T)^2.
\end{aligned}
$$

where the sixth equality comes from plugging in Equation (32). Using the projection theorem and Equation (35), we have that

$$
\begin{aligned}
var(v|p) &= var(v|y)=var(v)-\frac{[cov(v,y)]^2}{var(y)}=\sigma_v^2-\lambda cov(v,y) \\
&= \sigma_v^2-\lambda cov(v,\beta(v-p_0)+\gamma(s-p_0)+\alpha(p_T-\bar{p}_T)+\eta+u) \\
&= \sigma_v^2-\lambda(\beta+\gamma)\sigma_v^2=[1-\lambda(\beta+\gamma)]\sigma_v^2.
\end{aligned}
$$

The expected profit of the insider and the expected cost of the government are

$$
\begin{aligned}
E(\pi) &= E[(v-p)x] \\
&= E\{(v-p_0-\lambda[\beta(v-p_0)+\gamma(v+\varepsilon-p_0)+\alpha(p_T-\bar{p}_T)+u])\beta(v-p_0)\} \\
&= E\{[(1-\lambda\beta-\lambda\gamma)(v-p_0)-\lambda\gamma\varepsilon-\lambda\alpha(p_T-\bar{p}_T)-\lambda u]\beta(v-p_0)\} \\
&= [1-\lambda(\beta+\gamma)]\beta E[(v-p_0)^2]-\lambda\alpha\beta E[(v-p_0)(p_T-\bar{p}_T)] \\
&= [1-\lambda(\beta+\gamma)]\beta\sigma_v^2,
\end{aligned}
$$

$$
\begin{aligned}
E(c) &= E[(p-v)g] \\
&= E\{(p_0+\lambda[\beta(v-p_0)+\gamma(s-p_0)+\alpha(p_T-\bar{p}_T)+u]-v)[\gamma(s-p_0)+\alpha(p_T-\bar{p}_T)+\eta]\} \\
&= E\{[(\lambda\beta+\lambda\gamma-1)(v-p_0)+\lambda\gamma\varepsilon+\lambda\alpha(p_T-\bar{p}_T)+\lambda u][\gamma(s-p_0)+\alpha(p_T-\bar{p}_T)+\eta]\} \\
&= [\lambda(\beta+\gamma)-1]\gamma E[(v-p_0)^2]+\lambda\gamma^2E(\varepsilon^2)+\lambda\alpha^2E[(p_T-\bar{p}_T)^2] \\
&\quad +(\lambda\beta+2\lambda\gamma-1)\alpha E[(v-p_0)(p_T-\bar{p}_T)] \\
&= [\lambda(\beta+\gamma)-1]\gamma\sigma_v^2+\lambda\gamma^2\sigma_\varepsilon^2+\lambda\alpha^2\sigma_T^2.
\end{aligned}
$$

The correlation coefficient between the trading positions of the insider and the government is

$$
\begin{aligned}
corr\,(x,g) &= \frac{cov\,(x,g)}{\sqrt{var\,(x)}\sqrt{var\,(g)}} = \frac{cov\,(\beta(v-p_0),\gamma(s-p_0)+\alpha(p_T-\bar{p}_T)+\eta)}{\sqrt{var\,(\beta(v-p_0))}\sqrt{var\,(\gamma(s-p_0)+\alpha(p_T-\bar{p}_T)+\eta)}} \\
&= \frac{\beta\gamma\sigma_v^2}{\sqrt{\beta^2\sigma_v^2\left[\gamma^2\left(\sigma_v^2+\sigma_\varepsilon^2\right)+\alpha^2\sigma_T^2\right]}}.\square
\end{aligned}
$$

A.2 Proof of Proposition 1

Given his information set $\{v, p_T\}$, the insider solves the problem (9). For this purpose, using Equation (12) and (13), we compute

$$
\begin{aligned}
& E[(v-p)x|v,p_T] \\
=\ & E\left(\left\{\begin{array}{c} v-p_0-\lambda_T[x+\gamma_T(s-p_0)+\alpha_T(p_T-\bar{p}_T) \\ +\eta_T+u-(\xi_T+\alpha_T)(p_T-\bar{p}_T)-\eta_T \end{array}\right\} x|v,p_T\right) \\
=\ & [(1-\lambda_T\gamma_T)(v-p_0)-\lambda_T x+\lambda_T\xi_T(p_T-\bar{p}_T)]\,x.
\end{aligned}
$$

The FOC for x yields

$$
x = \frac{1-\lambda_T\gamma_T}{2\lambda_T}(v-p_0)+\frac{\xi_T}{2}(p_T-\bar{p}_T). \tag{36}
$$

The SOC is $\lambda_T > 0$. Comparing the FOC (36) with the conjectured strategy (11) leads to

$$
\beta_T = \frac{1-\lambda_T\gamma_T}{2\lambda_T}, \tag{37}
$$

$$
\xi_T = 0. \tag{38}
$$

Using Equations (11) and (13), the loss function of the government is derived as

$$\begin{aligned}
&E[\phi(p-p_T)^2+(p-v)g|s,p_T] \\
=&\left(\begin{array}{c}\phi E\left[(p_0+\lambda_T[\beta_T(v-p_0)+\xi_T(p_T-\bar{p}_T)+g+u-(\xi_T+\alpha_T)(p_T-\bar{p}_T)-\eta_T]-p_T)^2|s,p_T\right]+ \\ E\left[p_0+\lambda_T\left(\beta_T(v-p_0)+\xi_T(p_T-\bar{p}_T)+g+u-(\xi_T+\alpha_T)(p_T-\bar{p}_T)-\eta_T\right)-v|s,p_T\right]g\end{array}\right) \\
=&\left(\begin{array}{c}\phi\left[p_0-p_T-\lambda_T\alpha_T(p_T-\bar{p}_T)+\lambda_T g-\lambda_T\eta_T\right]^2+\phi\lambda_T^2\beta_T^2E[(v-p_0)^2|s,p_T] \\ +2\phi\lambda_T\beta_T[p_0-p_T-\lambda_T\alpha_T(p_T-\bar{p}_T)+\lambda_T g-\lambda_T\eta_T]E(v-p_0|s,p_T)+ \\ \phi\lambda_T^2\sigma_u^2+[(\lambda_T\beta_T-1)E(v-p_0|s,p_T)+\lambda_T g-\lambda_T\eta_T-\lambda_T\alpha_T(p_T-\bar{p}_T)]g\end{array}\right),
\end{aligned}$$

where

$$E(v-p_0|s,p_T)=\delta(s-p_0),$$

$$var(v-p_0|s,p_T)=var\left(v-p_0|p_T\right)-\frac{cov\left(v-p_0,s|p_T\right)^2}{var\left(s|p_T\right)}=\frac{\sigma_v^2\sigma_\varepsilon^2}{\sigma_v^2+\sigma_\varepsilon^2},$$

$$E\left[(v-p_0)^2|s,p_T\right]=\left[E(v-p_0|s,p_T)\right]^2+var(v-p_0|s,p_T)=\delta^2(s-p_0)^2+\frac{\sigma_v^2\sigma_\varepsilon^2}{\sigma_v^2+\sigma_\varepsilon^2}.$$

The FOC for g yields

$$g=\frac{\left(\begin{array}{c}(1-\lambda_T\beta_T-2\phi\lambda_T^2\beta_T)\delta(s-p_0)+\left[(1+2\phi\lambda_T)\lambda_T\alpha_T+2\phi\lambda_T\right](p_T-\bar{p}_T) \\ +(2\phi\lambda_T^2+\lambda_T)\eta_T+2\phi\lambda_T(\bar{p}_T-p_0)\end{array}\right)}{2\phi\lambda_T^2+2\lambda_T}.$$

The SOC is $2\phi\lambda_T^2+2\lambda_T>0$, which holds accordingly if $\lambda_T>0$ holds. Comparing the above FOC of the government with its conjectured trading strategy (12), we have

$$\gamma_T=\frac{1-\lambda_T\beta_T-2\phi\lambda_T^2\beta_T}{2\phi\lambda_T^2+2\lambda_T}\delta, \tag{39}$$

$$\alpha_T=\frac{2\phi\lambda_T+\left(1+2\phi\lambda_T\right)\lambda_T\alpha_T}{2\phi\lambda_T^2+2\lambda_T}=2\phi, \tag{40}$$

$$\eta_T=\frac{(2\phi\lambda_T^2+\lambda_T)\eta_T+2\phi\lambda_T(\bar{p}_T-p_0)}{2\phi\lambda_T^2+2\lambda_T}=2\phi(\bar{p}_T-p_0). \tag{41}$$

By the projection theorem, Equation (10) gives rise to

$$\begin{aligned} p &= E(v|p_T) + \frac{cov(v, y|p_T)}{var(y|p_T)}[y - E(y|p_T)] \\ &= E(v) + \frac{cov(v, y|p_T)}{var(y|p_T)}[y - E(y|p_T)] \\ &= p_0 + \frac{cov(v, y|p_T)}{var(y|p_T)}[y - E(y|p_T)]. \end{aligned}$$

Combining the above equation with Equation (39) yields

$$\lambda_T = \frac{cov(v, y|p_T)}{var(y|p_T)} = \frac{(\beta_T + \gamma_T)\sigma_v^2}{(\beta_T + \gamma_T)^2\sigma_v^2 + \gamma_T^2\sigma_\varepsilon^2 + \sigma_u^2}. \tag{42}$$

By a procedure similar to that used to derive the polynomial in Proposition 1, we change the system composed of Equations (37)-(42) into the polynomial about λ_T presented in Proposition 2 and solve other endogenous parameters as functions of λ_T.

The measure of price stability is derived as follows:

$$E[(p - p_T)^2] = E\left[p_0 + \lambda_T\left(\beta_T(v - p_0) + \gamma_T(s - p_0) + u\right) - p_T\right]^2$$
$$= \lambda_T^2\left[(\beta_T + \gamma_T)^2\sigma_v^2 + \gamma_T^2\sigma_\varepsilon^2 + \sigma_u^2\right] + \sigma_T^2 + (p_0 - \bar{p}_T)^2.$$

The measure of price discovery/efficiency is

$$\begin{aligned} var(v|p) &= var(v) - \frac{[cov(v, p)]^2}{var(p)} \\ &= var(v) - \frac{cov\left(v, p_0 + \lambda_T[\beta_T(v - p_0) + \gamma_T(s - p_0) + u]\right)^2}{var\left(p_0 + \lambda_T[\beta_T(v - p_0) + \gamma_T(s - p_0) + u]\right)} \\ &= \sigma_v^2 - \frac{\left[\lambda_T(\beta_T + \gamma_T)\sigma_v^2\right]^2}{\lambda_T^2[(\beta_T + \gamma_T)^2\sigma_v^2 + \gamma_T^2\sigma_\varepsilon^2 + \sigma_u^2]} \\ &= \sigma_v^2 - \frac{[\lambda_T(\beta_T + \gamma_T)\sigma_v^2]^2}{\lambda_T(\beta_T + \gamma_T)\sigma_v^2} = [1 - \lambda_T(\beta_T + \gamma_T)]\sigma_v^2. \end{aligned}$$

The expected profits of the insider are

$$E(\pi) = E\left[E(\pi|v, p_T)\right] = E\left[\frac{(1 - \lambda_T\gamma_T)^2}{4\lambda_T}(v - p_0)^2\right] = \lambda_T\beta_T^2\sigma_v^2.$$

The expected cost of the government is

$$\begin{aligned}
E(c) &= E[(p-v)g] \\
&= E\left([p_0 - v + \lambda_T\left(\beta_T(v-p_0) + \gamma_T(s-p_0) + u\right)\right] \left[\gamma_T(s-p_0) + \alpha_T(p_T - \bar{p}_T) + \eta_T\right]) \\
&= E\{[[\lambda_T(\beta_T + \gamma_T) - 1](v-p_0) + \lambda_T\gamma_T\varepsilon + \lambda_T u] \left[\gamma_T(s-p_0) + \alpha_T(p_T - \bar{p}_T) + \eta_T\right]\} \\
&= [\lambda_T(\beta_T + \gamma_T) - 1]\gamma_T\sigma_v^2 + \lambda_T\gamma_T^2\sigma_\varepsilon^2.
\end{aligned}$$

The correlation coefficient between the trading positions of the insider and the government is

$$\begin{aligned}
corr\,(x,g) &= \frac{cov\,(x,g)}{\sqrt{var\,(x)}\sqrt{var\,(g)}} \\
&= \frac{cov\,(\beta_T(v-p_0) + \xi_T(p_T - \bar{p}_T), \gamma_T(s-p_0) + \alpha_T(p_T - \bar{p}_T) + \eta_T)}{\sqrt{\beta_T(v-p_0) + \xi_T(p_T - \bar{p}_T)}\sqrt{var\,(\gamma_T(s-p_0) + \alpha_T(p_T - \bar{p}_T) + \eta_T)}} \\
&= \frac{\beta_T\gamma_T\sigma_v^2 + \xi_T\alpha_T\sigma_T^2}{\sqrt{\beta_T^2\sigma_v^2 + \xi_T^2\sigma_T^2}\sqrt{\gamma_T^2\left(\sigma_v^2 + \sigma_\varepsilon^2\right) + \alpha_T^2\sigma_T^2}}.\square
\end{aligned}$$

A.3 Proof of Corollary 1

We provide an intuitive proof of Corollary 1. Releasing the price target signal diminishes noise in financial markets and decreases market liquidity (i.e., $1/\lambda > 1/\lambda_T$).[18] As shown in Theorem 1 and Proposition 1, β and β_T have similar expressions, as functions of λ and λ_T, respectively. Define $\beta(\lambda) \equiv \frac{2\phi\lambda + 2 - \delta}{4\phi\lambda^2 + 4\lambda - (\lambda + 2\phi\lambda^2)\delta}$. Due to $0 < \lambda < \lambda_T$, if we can prove $\beta(\lambda)$ is a decreasing function of λ, then the proof will be complete. Taking derivatives w.r.t λ on both sides of $\beta(\lambda)$ leads to

$$\begin{aligned}
\beta'(\lambda) &\equiv \frac{2\phi\left[4\phi\lambda^2 + 4\lambda - (\lambda + 2\phi\lambda^2)\delta\right] - (2\phi\lambda + 2 - \delta)\left[8\phi\lambda + 4 - (1 + 4\phi\lambda)\delta\right]}{\left[4\phi\lambda^2 + 4\lambda - (\lambda + 2\phi\lambda^2)\delta\right]^2} \\
&= \frac{-4\phi^2(2-\delta)\lambda^2 - 4\phi(2-\delta)\lambda - (2-\delta)(4-\delta)}{\left[4\phi\lambda^2 + 4\lambda - (\lambda + 2\phi\lambda^2)\delta\right]^2} < 0,
\end{aligned}$$

in which we use $\delta = \frac{\sigma_v^2}{\sigma_v^2 + \sigma_\varepsilon^2} \in (0,1)$. From Proposition 1, we know that $\xi_T = 0$.

We have $\alpha = \frac{\phi}{1+\phi\lambda}$ in Theorem 1 and $\alpha_T = 2\phi$ in Proposition 1. Since $\alpha_T - \alpha = 2\phi - \frac{\phi}{1+\phi\lambda} = \frac{\phi + 2\phi^2\lambda}{1+\phi\lambda} > 0$, we know that $\alpha_T > \alpha$.

As shown in Theorem 1 and Proposition 1, γ and γ_T have similar expressions, as functions

[18] It is very difficult to provide a formal proof of $\lambda < \lambda_T$, since λ and λ_T are determined by sixth-order and fourth-order polynomials, respectively. Furthermore, the intuitive results can be verified by numerical solutions.

of λ and λ_T, respectively. Define $\gamma(\lambda) \equiv \frac{(1-2\phi\lambda)\delta}{4\phi\lambda^2+4\lambda-(\lambda+2\phi\lambda^2)\delta}$. Taking derivatives w.r.t λ on both sides of $\gamma(\lambda)$ gives rise to

$$\begin{aligned}\gamma'(\lambda) &= \frac{-2\phi\delta\left[4\phi\lambda^2+4\lambda-(\lambda+2\phi\lambda^2)\delta\right]-(1-2\phi\lambda)\,\delta\left[4\phi\lambda+4-(1+4\phi\lambda)\delta\right]}{\left[4\phi\lambda^2+4\lambda-(\lambda+2\phi\lambda^2)\delta\right]^2} \\ &= \frac{\delta(2-\delta)(1-2\phi\lambda)^2-\delta(6-2\delta)}{\left[4\phi\lambda^2+4\lambda-(\lambda+2\phi\lambda^2)\delta\right]^2}.\end{aligned}$$

Then, $\gamma'(\lambda)$ and its numerator $\delta(2-\delta)(1-2\phi\lambda)^2-\delta(6-2\delta)$ have the same signs. It is easy to prove that $\delta(2-\delta)(1-2\phi\lambda)^2-\delta(6-2\delta) < 0$ (or > 0), if and only if $\lambda \in \left(0, \frac{8-3\delta}{2\phi(2-\delta)}\right)\left(\text{ or } \in \left(\frac{8-3\delta}{2\phi(2-\delta)}, +\infty\right)\right)$. Thus, $\gamma'(\lambda) < 0\,(> 0)$, if and only if $\gamma_T < (>)\,\gamma_T$.

Comparing the expression for $E[(p-p_T)^2]$ in Theorem 1 and that of $E[(p-p_T)^2]_T$ in Proposition 1, we find that another negative term (i.e., $-2\lambda\alpha\sigma_T^2$) in the expression for $E[(p-p_T)^2]$. Numerically, the negative term dominates the possible indirect effects brought about by λ and thus, $E[(p-p_T)^2] < E[(p-p_T)^2]_T$.

Note that $var(v|p)$ and $var(v|p)_T$ have similar expressions in Theorem 1 and Proposition 1. If we can prove that $\lambda(\beta+\gamma) > \lambda_T(\beta_T+\gamma_T)$, then we have that $var(v|p) < var(v|p)_T$. Moreover, $\lambda(\beta+\gamma)$ and $\lambda_T(\beta_T+\gamma_T)$ also have similar expressions, as functions of λ and λ_T, respectively. Using (35), we define

$$\lambda(\beta+\gamma) = \frac{2+2\phi\lambda-2\phi\lambda\delta}{(2-\delta)\,2\phi\lambda+(4-\lambda)} \equiv \Lambda(\lambda).$$

Taking derivatives w.r.t λ on both sides of $\Lambda(\lambda)$ yields

$$\Lambda'(\lambda) = \frac{-2\phi\lambda(3-\delta)}{\left[(2-\delta)\,2\phi\lambda+(4-\lambda)\right]^2} < 0.$$

Since $\lambda < \lambda_T$, we know that $\lambda(\beta+\gamma) > \lambda_T(\beta_T+\gamma_T)$ and $var(v|p) < var(v|p)_T$. $\square$

A.4 Proof of Proposition 2

Given his information set $\{v, s\}$, the insider solves the problem (14). Using Equations (17) and (18), we compute

$$
\begin{aligned}
& E[(v-p)x|v,s] \\
= \; & E\left\{\left\{\left[v - p_0 - \delta(s-p_0) - \lambda_s \begin{pmatrix} x + \gamma_s(s-p_0) + \alpha_s(p_T - \bar{p}_T) + \eta_s + \\ u - (\beta_s\delta + \xi_s + \gamma_s)(s-p_0) - \eta_s \end{pmatrix}\right] x|v,s\right\}\right. \\
= \; & [v - p_0 - \lambda_s x + (\lambda_s\beta_s\delta + \lambda_s\xi_s - \delta)(s-p_0)]\, x.
\end{aligned}
$$

The FOC for x yields

$$x = \frac{1}{2\lambda_s}(v-p_0) + \frac{\lambda_s\beta_s\delta + \lambda_s\xi_s - \delta}{2\lambda_s}(s-p_0). \tag{43}$$

The SOC is $\lambda_s > 0$. Comparing Equation (43) with the conjectured strategy (16) leads to

$$\beta_s = \frac{1}{2\lambda_s}, \tag{44}$$

$$\xi_s = \frac{\lambda_s\beta_s\delta + \lambda_s\xi_s - \delta}{2\lambda_s} = -\frac{\delta}{2\lambda_s}, \tag{45}$$

Using Equations (16) and (18), the objective function of the government is derived as

$$
\begin{aligned}
& E[\phi(p-p_T)^2 + (p-v)g|s,p_T] \\
= & \begin{pmatrix} \phi\left[p_0 - p_T - \lambda_s\eta_s + \lambda_s g + (\delta - \lambda_s\beta_s\delta - \lambda_s\gamma_s)(s-p_0)\right]^2 + \\ 2\phi\lambda_s\beta_s\left[p_0 - p_T - \lambda_s\eta_s + \lambda_s g + (\delta - \lambda_s\beta_s\delta - \lambda_s\gamma_s)(s-p_0)\right] E[v-p_0|s,p_T] \\ +\phi\lambda_s^2\sigma_u^2 + \phi\lambda_s^2\beta_s^2 E[(v-p_0)^2|s,p_T] + \lambda_s g^2 - \lambda_s\eta_s g + \\ (\delta - \lambda_s\beta_s\delta - \lambda_s\gamma_s)(s-p_0)g + (\lambda_s\beta_s - 1)E\left(v-p_0|s,p_T\right) g \end{pmatrix},
\end{aligned}
$$

where

$$E[v-p_0|s,p_T] = \delta(s-p_0).$$

The FOC for g yields:

$$g = \frac{1}{2\phi\lambda_s^2 + 2\lambda_s}\begin{pmatrix} [(1 - \lambda_s\beta_s - 2\phi\lambda_s^2\beta_s)\delta + (1+2\phi\lambda_s)(\lambda_s\beta_s\delta + \lambda_s\gamma_s - \delta)](s-p_0) \\ +2\phi\lambda_s(p_T - \bar{p}_T) + (2\phi\lambda_s^2 + \lambda_s)\eta_s + 2\phi\lambda_s(\bar{p}_T - p_0) \end{pmatrix},$$

The SOC is $2\phi\lambda_s^2 + 2\lambda_s > 0$, which holds accordingly if $\lambda_s > 0$ holds. Comparing Equation (17) with the FOC w.r.t g, we obtain

$$\gamma_s = \frac{(1 - \lambda_s\beta_s - 2\phi\lambda_s^2\beta_s)\delta + (1 + 2\phi\lambda_s)(\lambda_s\beta_s\delta + \lambda_s\gamma_s - \delta)}{2\phi\lambda_s^2 + 2\lambda_s}, \tag{46}$$

$$\alpha_s = \frac{2\phi\lambda_s}{2\phi\lambda_s^2 + 2\lambda_s}, \tag{47}$$

$$\eta_s = \frac{2\phi\lambda_s(\bar{p}_T - p_0) + (2\phi\lambda_s^2 + \lambda_s)\eta_s}{2\phi\lambda_s^2 + 2\lambda_s} = 2\phi(\bar{p}_T - p_0), \tag{48}$$

By the projection theorem, Equation (15) gives rise to

$$p = E(v|s) + \frac{cov(v, y|s)}{var(y|s)}[y - E(y|s)] = p_0 + \delta(s - p_0) + \frac{cov(v, y|s)}{var(y|s)}[y - E(y|s)],$$

where

$$\begin{aligned} & \frac{cov(v, y|s)}{var(y|s)} \\ = \; & \frac{cov(v - E(v|s), y - E(y|s))}{var(y - E(y|s))} \\ = \; & \frac{cov(v - p_0 - \delta(s - p_0), \beta_s(v - p_0) + \alpha_s(p_T - \bar{p}_T) + u - \beta_s\delta(s - p_0))}{var(\beta_s(v - p_0) + \alpha_s(p_T - \bar{p}_T) + u - \beta_s\delta(s - p_0))} \\ = \; & \frac{\beta_s(1 - \delta)^2\sigma_v^2 + \beta_s\delta^2\sigma_\varepsilon^2}{\beta_s^2(1 - \delta)^2\sigma_v^2 + \beta_s^2\delta^2\sigma_\varepsilon^2 + \alpha_s^2\sigma_T^2 + \sigma_u^2}. \end{aligned}$$

Combining Equation (18) and the above equation gives us

$$\lambda_s = \frac{cov(v, y|s)}{var(y|s)} = \frac{\beta_s(1 - \delta)^2\sigma_v^2 + \beta_s\delta^2\sigma_\varepsilon^2}{\beta_s^2(1 - \delta)^2\sigma_v^2 + \beta_s^2\delta^2\sigma_\varepsilon^2 + \alpha_s^2\sigma_T^2 + \sigma_u^2}. \tag{49}$$

We change the system composed of Equations (44)-(49) into a polynomial about λ, solve other parameters as functions of λ_s, and compute the associated moments listed in Proposition 2. □

A.5 Proof of Proposition 3

Given his information set $\{v, p_T, s\}$, the insider solves the problem (19). Using Equations (22) and (23), we compute

$$\begin{aligned} & E[(v-p)x|v,p_T,s] \\ = \; & E\left[\left(v-p_0+\left[\lambda_{s,T}\left(\beta_{s,T}\delta+\xi_{s,T}^{(1)}\right)-\delta\right](s-p_0)+\lambda_{s,T}\xi_{s,T}^{(2)}(p_T-\bar{p}_T)-\lambda_{s,T}x-\lambda_{s,T}u\right)x|v,p_T,s\right] \\ = \; & \left(v-p_0+\left[\lambda_{s,T}\left(\beta_{s,T}\delta+\xi_{s,T}^{(1)}\right)-\delta\right](s-p_0)+\lambda_{s,T}\xi_{s,T}^{(2)}(p_T-\bar{p}_T)-\lambda_{s,T}x\right)x. \end{aligned}$$

The FOC for x yields

$$x=\frac{1}{2\lambda_{s,T}}\left(v-p_0+\lambda_{s,T}\xi_{s,T}^{(2)}(p_T-\bar{p}_T)+\left[(\lambda_{s,T}\beta_{s,T}-1)\delta+\lambda_{s,T}\xi_{s,T}^{(1)}\right](s-p_0)\right). \quad (50)$$

The SOC is $\lambda_{s,T}>0$. Comparing Equation (50) with the conjectured strategy (21) leads to

$$\beta_{s,T} = \frac{1}{2\lambda_{s,T}}, \quad (51)$$

$$\xi_{s,T}^{(1)} = \frac{(\lambda_{s,T}\beta_{s,T}-1)\delta+\lambda_{s,T}\xi_{s,T}^{(1)}}{2\lambda_{s,T}} = -\frac{\delta}{2\lambda_{s,T}}, \quad (52)$$

$$\xi_{s,T}^{(2)} = \frac{\lambda_{s,T}\xi_{s,T}^{(2)}}{2\lambda_{s,T}} = 0. \quad (53)$$

Using Equations (21) and (23), the objective function of the government is derived as

$$\begin{aligned} & E[\phi(p-p_T)^2+(p-v)g|s,p_T]= \\ & \phi\left[p_0-\bar{p}_T-\lambda_{s,T}\eta_{s,T}+\lambda_{s,T}g+\left((1-\lambda_{s,T}\beta_{s,T})\delta-\lambda_{s,T}\gamma_{s,T}\right)(s-p_0)-(1+\lambda_{s,T}\alpha_{s,T})(p_T-\bar{p}_T)\right]^2 \\ & +\phi\lambda_{s,T}^2\beta_{s,T}^2E[(v-p_0)^2|s,p_T]+\phi\lambda_{s,T}^2\sigma_u^2+ \\ & 2\phi\lambda_{s,T}\beta_{s,T}\begin{bmatrix} p_0-\bar{p}_T-\lambda_{s,T}\eta_{s,T}-(1+\lambda_{s,T}\alpha_{s,T})(p_T-\bar{p}_T) \\ +\lambda_{s,T}g+\left((1-\lambda_{s,T}\beta_{s,T})\delta-\lambda_{s,T}\gamma_{s,T}\right)(s-p_0) \end{bmatrix}E[v-p_0|s,p_T] \\ & +\begin{pmatrix} (\lambda_{s,T}\beta_{s,T}-1)E(v-p_0|s,p_T)-\lambda_{s,T}\alpha_{s,T}(p_T-\bar{p}_T) \\ +\left((1-\lambda_{s,T}\beta_{s,T})\delta-\lambda_{s,T}\gamma_{s,T}\right)(s-p_0)+\lambda_{s,T}g-\lambda_{s,T}\eta_{s,T} \end{pmatrix}g \end{aligned},$$

where

$$E(v-p_0|s,p_T)=\delta(s-p_0),\delta\equiv\frac{\sigma_v^2}{\sigma_v^2+\sigma_\varepsilon^2}.$$

The FOC for g yields the following:

$$g = \frac{1}{2\phi\lambda_{s,T}^2 + 2\lambda_{s,T}} \begin{pmatrix} \left(-2\phi\lambda_{s,T}\delta + (1+2\phi\lambda_{s,T})\lambda_{s,T}\gamma_{s,T}\right)(s-p_0) \\ +\left(2\phi\lambda_{s,T} + (1+2\phi\lambda_{s,T})\lambda_{s,T}\alpha_{s,T}\right)(p_T - \bar{p}_T) \\ +(2\phi\lambda_{s,T}^2 + \lambda_{s,T})\eta_{s,T} + 2\phi\lambda_{s,T}(\bar{p}_T - p_0) \end{pmatrix},$$

The SOC is $2\phi\lambda_{s,T}^2 + 2\lambda_{s,T} > 0$, which holds accordingly if $\lambda_{s,T} > 0$ holds. Comparing Equation (22) with the FOC w.r.t g, we obtain

$$\gamma_{s,T} = \frac{-2\phi\lambda_{s,T}\delta + (1+2\phi\lambda_{s,T})\lambda_{s,T}\gamma_{s,T}}{2\phi\lambda_{s,T}^2 + 2\lambda_{s,T}} = -2\phi\delta, \tag{54}$$

$$\alpha_{s,T} = \frac{2\phi\lambda_{s,T} + (1+2\phi\lambda_{s,T})\lambda_{s,T}\alpha_{s,T}}{2\phi\lambda_{s,T}^2 + 2\lambda_{s,T}} = 2\phi, \tag{55}$$

$$\eta_{s,T} = \frac{2\phi\lambda_{s,T}(\bar{p}_T - p_0) + (2\phi\lambda_{s,T}^2 + \lambda_{s,T})\eta_{s,T}}{2\phi\lambda_{s,T}^2 + 2\lambda_{s,T}} = 2\phi(\bar{p}_T - p_0), \tag{56}$$

By the projection theorem, Equation (20) gives rise to

$$\begin{aligned} p &= E(v|p_T, s) + \frac{cov(v, y|p_T, s)}{var(y|p_T, s)}[y - E(y|p_T, s)] \\ &= p_0 + \delta(s - p_0) + \frac{cov(v, y|p_T, s)}{var(y|p_T, s)}[y - E(y|p_T, s)], \end{aligned}$$

where

$$\frac{cov(v, y|p_T, s)}{var(y|p_T, s)} = \frac{cov(v - E(v|p_T, s), y - E(y|p_T, s))}{var(y - E(y|p_T, s))} = \frac{\beta_{s,T}\left[(1-\delta)^2\sigma_v^2 + \delta^2\sigma_\varepsilon^2\right]}{\beta_{s,T}^2\left[(1-\delta)^2\sigma_v^2 + \delta^2\sigma_\varepsilon^2\right] + \sigma_u^2}.$$

Combining Equation (23) and the above equation gives rise to

$$\lambda_{s,T} = \frac{cov(v, y|s, p_T)}{var(y|s, p_T)} = \frac{\beta_{s,T}\left[(1-\delta)^2\sigma_v^2 + \delta^2\sigma_\varepsilon^2\right]}{\beta_{s,T}^2\left[(1-\delta)^2\sigma_v^2 + \delta^2\sigma_\varepsilon^2\right] + \sigma_u^2}. \tag{57}$$

Substituting Equation (51) into (57) leads to the expression for $\lambda_{s,T}$ presented in Proposition 4. Through substitutions, we have those expressions for $(\beta_{s,T}, \xi_{s,T}^{(1)}, \xi_{s,T}^{(2)}, \gamma_{s,T}, \alpha_{s,T}, \eta_{s,T})$. We then find those moments listed in Proposition 4. □

Online Appendix

S1 Government intervention with partial information disclosure

In this section of the online appendix, we solve the model economies of three scenarios of partial information disclosure, present the equilibrium results and prove them.

Partially releasing the price target

In this case, we assume that the government releases the price target signal to the financial market partially. Specifically, before trading, the government releases a noisy signal of the price target to the insider and the market maker, namely, $\widetilde{p}_T = p_T + \varepsilon_1$, with $\varepsilon_1 \sim N(0, \sigma^2_{\varepsilon_1})$, where $\{v, p_T, \varepsilon, \varepsilon_1\}$ are mutually independent.

With the enlarged information set $\{v, \widetilde{p}_T\}$, the insider's maximization problem is changed as

$$\max_{\{x\}} E[(v-p)x|v, \widetilde{p}_T]. \tag{E01}$$

Meanwhile, the market maker also sees the signal released by the government, $\{\widetilde{p}_T\}$, and uses her new information set $\{y, \widetilde{p}_T\}$ to update the conditional expectations about the fundamentals. Thus the pricing rule of market efficiency is changed into

$$p = E(v|y, \widetilde{p}_T). \tag{E02}$$

Conjecture the decision rules for the insider and the government and the pricing rule for the market maker as follows:

$$x = \beta_T(v - p_0) + \xi_T(\widetilde{p}_T - \bar{p}_T), \tag{E03}$$

$$g = \gamma_T(s - p_0) + \alpha_T(p_T - \bar{p}_T) + \omega_T(\widetilde{p}_T - \bar{p}_T) + \eta_T, \tag{E04}$$

$$p = p_0 + \lambda_T[y - E(y|\widetilde{p}_T)], \text{ with } y = x + g + u, \tag{E05}$$

where

$$E(y|\widetilde{p}_T) = \left(\xi_T + \omega_T + \alpha_T \frac{\sigma^2_T}{\sigma^2_T + \sigma^2_{\varepsilon_1}}\right)(\widetilde{p}_T - \bar{p}_T) + \eta_T.$$

First, we solve the insider's problem. Using equation (E04) and (E05), we compute

$$
\begin{aligned}
& E[(v-p)x|v,\widetilde{p}_T] \\
= \; & E\left[v-p_0-\lambda_T\left(\begin{array}{c} x+\gamma_T(s-p_0)+\alpha_T(p_T-\bar{p}_T)+\omega_T(\widetilde{p}_T-\bar{p}_T)+ \\ \eta_T+u-\left(\xi_T+\omega_T+\alpha_T\frac{\sigma_T^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}\right)(\widetilde{p}_T-\bar{p}_T)-\eta_T \end{array}\right)|v,\widetilde{p}_T\right]x \\
= \; & [(1-\lambda_T\gamma_T)(v-p_0)-\lambda_T x+\lambda_T\xi_T(\widetilde{p}_T-\bar{p}_T)]\,x.
\end{aligned}
$$

The FOC for x yields

$$x=\frac{1-\lambda_T\gamma_T}{2\lambda_T}(v-p_0)+\frac{\xi_T}{2}(\widetilde{p}_T-\bar{p}_T). \tag{E06}$$

The SOC is $\lambda_T>0$. Comparing the FOC (E06) with the conjectured strategy (E03) leads to

$$\beta_T=\frac{1-\lambda_T\gamma_T}{2\lambda_T}, \tag{E07}$$

$$\xi_T=\frac{\xi_T}{2}=0. \tag{E08}$$

Second, we solve the government's problem. Using (E03) and (E05), the loss function of the government is computed as

$$
\begin{aligned}
& E[\phi(p-p_T)^2+(p-v)g|s,p_T,\widetilde{p}_T] \\
= & \left(\begin{array}{c} \phi E\left[\left(p_0-p_T+\lambda_T\left(\begin{array}{c}\beta_T(v-p_0)+\xi_T(\widetilde{p}_T-\bar{p}_T)+g+u \\ -\left(\xi_T+\omega_T+\alpha_T\frac{\sigma_T^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}\right)(\widetilde{p}_T-\bar{p}_T)-\eta_T\end{array}\right)\right)^2|s,p_T,\widetilde{p}_T\right]+ \\ E\left[p_0-v+\lambda_T\left(\begin{array}{c}\beta_T(v-p_0)+\xi_T(\widetilde{p}_T-\bar{p}_T)+g+u \\ -\left(\xi_T+\omega_T+\alpha_T\frac{\sigma_T^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}\right)(\widetilde{p}_T-\bar{p}_T)-\eta_T\end{array}\right)|s,p_T,\widetilde{p}_T\right]g \end{array}\right) \\
= & \left(\begin{array}{c} \phi\left[p_0-p_T+\lambda_T g-\lambda_T\left(\omega_T+\alpha_T\frac{\sigma_T^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}\right)(\widetilde{p}_T-\bar{p}_T)-\lambda_T\eta_T\right]^2+\phi\lambda_T^2\beta_T^2E[(v-p_0)^2|s,p_T,\widetilde{p}_T] \\ +2\phi\lambda_T\beta_T\left[p_0-p_T+\lambda_T g-\lambda_T\left(\omega_T+\alpha_T\frac{\sigma_T^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}\right)(\widetilde{p}_T-\bar{p}_T)-\lambda_T\eta_T\right]E(v-p_0|s,p_T,\widetilde{p}_T)+ \\ \phi\lambda_T^2\sigma_u^2+\left[(\lambda_T\beta_T-1)E(v-p_0|s,p_T,\widetilde{p}_T)+\lambda_T g-\lambda_T\left(\omega_T+\alpha_T\frac{\sigma_T^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}\right)(\widetilde{p}_T-\bar{p}_T)-\lambda_T\eta_T\right]g \end{array}\right),
\end{aligned}
$$

where

$$E(v-p_0|s,p_T,\widetilde{p}_T)=E(v-p_0|s,p_T,\varepsilon_1)=E(v-p_0|s,p_T)=E(v-p_0|s)=\delta(s-p_0),$$

$$var(v-p_0|s,p_T,\widetilde{p}_T)=var(v-p_0|s,p_T,\varepsilon_1)=var(v-p_0|s,p_T)=var(v-p_0|s)=\frac{\sigma_v^2\sigma_\varepsilon^2}{\sigma_v^2+\sigma_\varepsilon^2},$$

$$E\left[(v-p_0)^2|s,p_T,\widetilde{p}_T\right] = [E(v-p_0|s,p_T,\widetilde{p}_T)]^2 + var(v-p_0|s,p_T,\widetilde{p}_T) = \delta^2(s-p_0)^2 + \frac{\sigma_v^2\sigma_\varepsilon^2}{\sigma_v^2+\sigma_\varepsilon^2},$$

$$\delta \equiv \frac{\sigma_v^2}{\sigma_v^2+\sigma_\varepsilon^2},$$

The FOC for g yields

$$g = \frac{1}{2\phi\lambda_T^2+2\lambda_T}\left(\begin{array}{c}(1-\lambda_T\beta_T-2\phi\lambda_T^2\beta_T)\delta(s-p_0)+2\phi\lambda_T(p_T-\bar{p}_T)+2\phi\lambda_T(\bar{p}_T-p_0)\\ +(2\phi\lambda_T^2+\lambda_T)\left(\omega_T+\alpha_T\frac{\sigma_T^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}\right)(\widetilde{p}_T-\bar{p}_T)+(2\phi\lambda_T^2+\lambda_T)\eta_T\end{array}\right).$$

The SOC is $2\phi\lambda_T^2+2\lambda_T>0$, which holds accordingly if $\lambda_T>0$ holds. Comparing the FOC of the government with the conjectured trading strategy of the government (E04), we have

$$\gamma_T = \frac{1-\lambda_T\beta_T-2\phi\lambda_T^2\beta_T}{2\phi\lambda_T^2+2\lambda_T}\delta, \tag{E09}$$

$$\alpha_T = \frac{2\phi\lambda_T}{2\phi\lambda_T^2+2\lambda_T} = \frac{\phi}{1+\phi\lambda_T}, \tag{E10}$$

$$\omega_T = \frac{2\phi\lambda_T^2+\lambda_T}{2\phi\lambda_T^2+2\lambda_T}\left(\omega_T+\alpha_T\frac{\sigma_T^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}\right) = (1+2\phi\lambda_T)\alpha_T\frac{\sigma_T^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}, \tag{E11}$$

$$\eta_T = \frac{(2\phi\lambda_T^2+\lambda_T)\eta_T+2\phi\lambda_T(\bar{p}_T-p_0)}{2\phi\lambda_T^2+2\lambda_T} = 2\phi(\bar{p}_T-p_0). \tag{E12}$$

Third, we solve the market maker's problem. By the projection theorem, Equation (E02) gives rise to

$$p = E(v|\widetilde{p}_T) + \frac{cov(v,y|\widetilde{p}_T)}{var(y|\widetilde{p}_T)}[y-E(y|\widetilde{p}_T)] = p_0 + \frac{cov(v,y|\widetilde{p}_T)}{var(y|\widetilde{p}_T)}[y-E(y|\widetilde{p}_T)].$$

Combining it with (E05) gives us

$$\lambda_T = \frac{cov(v,y|\widetilde{p}_T)}{var(y|\widetilde{p}_T)} = \frac{(\beta_T+\gamma_T)\sigma_v^2}{(\beta_T+\gamma_T)^2\sigma_v^2+\gamma_T^2\sigma_\varepsilon^2+\alpha_T^2\frac{\sigma_T^2\sigma_{\varepsilon_1}^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}+\sigma_u^2}. \tag{E13}$$

By the similar procedure to derive the polynomial in Theorem 1, we change the equation system composed of (E07)-(E13) into the polynomial about λ_T presented in the following Proposition S1 and solve other endogenous parameters as functions of λ_T.

Finally, we compute the moments listed in Proposition S1. The measure of price stability is solved as

$$
\begin{aligned}
& E[(p-p_T)^2] \\
= \ & E\left[p_0+\lambda_T\left(\beta_T(v-p_0)+\gamma_T(s-p_0)+\alpha_T(p_T-\bar{p}_T)-\alpha_T\frac{\sigma_T^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}(\widetilde{p}_T-\bar{p}_T)+u\right)-p_T\right]^2 \\
= \ & E\left[\left(\begin{array}{c} p_0-\bar{p}_T+\lambda_T(\beta_T+\gamma_T)(v-p_0)+\lambda_T\gamma_T\varepsilon+\lambda_T u \\ +\left(\lambda_T\alpha_T\frac{\sigma_{\varepsilon_1}^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}-1\right)(p_T-\bar{p}_T)-\lambda_T\alpha_T\frac{\sigma_T^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}\varepsilon_1 \end{array}\right)^2\right] \\
= \ & \left(\begin{array}{c} (p_0-\bar{p}_T)^2+\lambda_T^2(\beta_T+\gamma_T)^2\sigma_v^2+\lambda_T^2\gamma_T^2\sigma_\varepsilon^2+\lambda_T^2\sigma_u^2 \\ +\left(\lambda_T\alpha_T\frac{\sigma_{\varepsilon_1}^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}-1\right)^2\sigma_T^2+\lambda_T^2\alpha_T^2\left(\frac{\sigma_T^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}\right)^2\sigma_{\varepsilon_1}^2 \end{array}\right) \\
= \ & \lambda_T^2\left[(\beta_T+\gamma_T)^2\sigma_v^2+\gamma_T^2\sigma_\varepsilon^2+\sigma_u^2+\alpha_T^2\frac{\sigma_T^2\sigma_{\varepsilon_1}^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}\right]+\left(1-2\lambda_T\alpha_T\frac{\sigma_{\varepsilon_1}^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}\right)\sigma_T^2+(p_0-\bar{p}_T)^2 \\
= \ & \lambda_T(\beta_T+\gamma_T)\sigma_v^2+\left(1-2\lambda_T\alpha_T\frac{\sigma_{\varepsilon_1}^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}\right)\sigma_T^2+(p_0-\bar{p}_T)^2.
\end{aligned}
$$

The measure for price discovery/efficiency is

$$
\begin{aligned}
& var(v|p) \\
= \ & var(v)-\frac{[cov(v,p)]^2}{var(p)} \\
= \ & var(v)-\frac{\left[cov\left(v,p_0+\lambda_T\left(\begin{array}{c}\beta_T(v-p_0)+\gamma_T(s-p_0)+ \\ \alpha_T(p_T-\bar{p}_T)-\alpha_T\frac{\sigma_T^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}(s_T-\bar{p}_T)+u\end{array}\right)\right)\right]^2}{var\left(p_0+\lambda_T\left(\begin{array}{c}\beta_T(v-p_0)+\gamma_T(s-p_0)+ \\ \alpha_T(p_T-\bar{p}_T)-\alpha_T\frac{\sigma_T^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}(s_T-\bar{p}_T)+u\end{array}\right)\right)} \\
= \ & \sigma_v^2-\frac{\left[\lambda_T(\beta_T+\gamma_T)\sigma_v^2\right]^2}{\lambda_T^2\left[(\beta_T+\gamma_T)^2\sigma_v^2+\gamma_T^2\sigma_\varepsilon^2+\sigma_u^2+\alpha_T^2\frac{\sigma_T^2\sigma_{\varepsilon_1}^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}\right]} \\
= \ & [1-\lambda_T(\beta_T+\gamma_T)]\sigma_v^2.
\end{aligned}
$$

The expected profit of the insider is

$$
\begin{aligned}
& E(\pi) \\
= \; & E[(v-p)x] \\
= \; & E\left[\left(v - p_0 - \lambda_T \left[\begin{array}{c} \beta_T(v-p_0) + \gamma_T(s-p_0) + \alpha_T(p_T - \bar{p}_T) \\ -\alpha_T \frac{\sigma_T^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}(\widetilde{p}_T - \bar{p}_T) + u \end{array}\right]\right)\left(\begin{array}{c} \beta_T(v-p_0) \\ +\xi_T(\widetilde{p}_T - \bar{p}_T) \end{array}\right)\right] \\
= \; & [1-\lambda_T(\beta_T+\gamma_T)]\beta_T\sigma_v^2 - \lambda_T\alpha_T\xi_T\frac{\sigma_{\varepsilon_1}^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}\sigma_T^2 + \lambda_T\alpha_T\xi_T\frac{\sigma_T^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}\sigma_{\varepsilon_1}^2 \\
= \; & [1-\lambda_T(\beta_T+\gamma_T)]\beta_T\sigma_v^2.
\end{aligned}
$$

The expected cost of the government is

$$
\begin{aligned}
& E(c) \\
= \; & E[(p-v)g] \\
= \; & E\left[\left(p_0 - v + \lambda_T \left[\begin{array}{c} \beta_T(v-p_0) + \gamma_T(s-p_0) + u + \\ \alpha_T(p_T - \bar{p}_T) - \alpha_T \frac{\sigma_T^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}(\widetilde{p}_T - \bar{p}_T) \end{array}\right]\right)\left(\begin{array}{c} \gamma_T(s-p_0) + \alpha_T(p_T - \bar{p}_T) \\ +\omega_T(\widetilde{p}_T - \bar{p}_T) + \eta_T \end{array}\right)\right] \\
= \; & E\left[\left(\begin{array}{c} [\lambda_T(\beta_T+\gamma_T)-1](v-p_0) + \lambda_T\gamma_T\varepsilon + \lambda_T u \\ +\lambda_T\alpha_T\frac{\sigma_{\varepsilon_1}^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}(p_T - \bar{p}_T) - \lambda_T\alpha_T\frac{\sigma_T^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}\varepsilon_1 \end{array}\right)\left(\begin{array}{c} \gamma_T(v-p_0) \; + \gamma_T\varepsilon + \eta_T + \\ (\alpha_T+\omega_T)(p_T - \bar{p}_T) + \omega_T\varepsilon_1 \end{array}\right)\right] \\
= \; & [\lambda_T(\beta_T+\gamma_T)-1]\gamma_T\sigma_v^2 + \lambda_T\gamma_T^2\sigma_\varepsilon^2 + \lambda_T\alpha_T(\alpha_T+\omega_T)\frac{\sigma_{\varepsilon_1}^2\sigma_T^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2} - \lambda_T\alpha_T\omega_T\frac{\sigma_T^2\sigma_{\varepsilon_1}^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2} \\
= \; & [\lambda_T(\beta_T+\gamma_T)-1]\gamma_T\sigma_v^2 + \lambda_T\gamma_T^2\sigma_\varepsilon^2 + \lambda_T\alpha_T^2\frac{\sigma_{\varepsilon_1}^2\sigma_T^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}.
\end{aligned}
$$

The correlation coefficient between the trading position of the insider and the government is

$$
\begin{aligned}
& corr(x,g) \\
= \; & \frac{cov(x,g)}{\sqrt{var(x)}\sqrt{var(g)}} \\
= \; & \frac{cov\left(\beta_T(v-p_0) + \xi_T(\widetilde{p}_T - \bar{p}_T), \gamma_T(s-p_0) + \alpha_T(p_T - \bar{p}_T) + \omega_T(\widetilde{p}_T - \bar{p}_T) + \eta_T\right)}{\sqrt{var(\beta_T(v-p_0) + \xi_T(\widetilde{p}_T - \bar{p}_T))}\sqrt{var\left(\gamma_T(s-p_0) + \alpha_T(p_T - \bar{p}_T) + \omega_T(\widetilde{p}_T - \bar{p}_T) + \eta_T\right)}} \\
= \; & \frac{\beta_T\gamma_T\sigma_v^2}{\sqrt{\beta_T^2\sigma_v^2}\sqrt{\gamma_T^2(\sigma_v^2+\sigma_\varepsilon^2) + (\alpha_T+\omega_T)^2\sigma_T^2 + \omega_T^2\sigma_{\varepsilon_1}^2}}.
\end{aligned}
$$

Thus we have proven the following

Proposition S1 *If the government partially releases a noisy signal about the price target signal, namely, $\widetilde{p}_T \equiv p_T + \varepsilon_T$, then a linear equilibrium is defined by seven unknowns $(\beta_T, \xi_T, \gamma_T, \alpha_T, \omega_T, \eta_T, \lambda_T) \in R^7$, which are characterized by seven equations (E07)-(E13), together with the SOC, $\lambda_T > 0$. The system of equations can be solved as the following six-order polynomial for λ_T:*

$$b_6\lambda_T^6 + b_5\lambda_T^5 + b_4\lambda_T^4 + b_3\lambda_T^3 + b_2\lambda_T^2 + b_1\lambda_T + b_0 = 0,$$

where the coefficients $b_i's$ are

$$\begin{aligned}
b_6 &= 4(2-\delta_1)^2\phi^4\sigma_u^2, b_5 = 4(8-3\delta_1)(2-\delta_1)\phi^3\sigma_u^2, \\
b_4 &= \left(\begin{array}{c} (4\delta-4)\phi^4\sigma_v^2 + 4\phi^4\delta^2\sigma_\varepsilon^2 + 4\phi^4(2-\delta)^2\frac{\sigma_T^2\sigma_{\varepsilon_1}^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2} \\ +\left[(8-3\delta)^2 + 4(2-\delta)(4-\delta)\right]\phi^2\sigma_u^2 \end{array}\right), \\
b_3 &= \left(\begin{array}{c} (-2\delta^2+14\delta-16)\phi^3\sigma_v^2 + 4\phi^3\delta^2\sigma_\varepsilon^2 + \\ 4\phi^3(2-\delta)(4-\delta)\frac{\sigma_T^2\sigma_{\varepsilon_1}^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2} + 2(4-\delta)(8-3\delta)\phi\sigma_u^2 \end{array}\right), \\
b_2 &= (-4\delta^2+18\delta-24)\phi^2\sigma_v^2 - 3\phi^2\delta^2\sigma_\varepsilon^2 + \phi^2(4-\delta)^2\frac{\sigma_T^2\sigma_{\varepsilon_1}^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2} + (4-\delta)^2\sigma_u^2, \\
b_1 &= (-2\delta^2+10\delta-16)\phi\sigma_v^2 - 2\phi\delta^2\sigma_\varepsilon^2, b_0 = (2\delta-4)\sigma_v^2 + \delta^2\sigma_\varepsilon^2,
\end{aligned}$$

where $\delta \equiv \frac{\sigma_v^2}{\sigma_v^2+\sigma_\varepsilon^2}$. All other variables can be solved as expressions of λ_T as follows:

$$\begin{aligned}
\beta_T &= \frac{2\phi\lambda_T + 2 - \delta}{4\phi\lambda_T^2 + 4\lambda_T - (\lambda_T + 2\phi\lambda_T^2)\delta},\ \xi_T = 0, \\
\gamma_T &= \frac{(1-2\phi\lambda_T)\delta}{4\phi\lambda_T^2 + 4\lambda_T - (\lambda_T + 2\phi\lambda_T^2)\delta}, \alpha_T = \frac{\phi}{1+\phi\lambda_T}, \\
\omega_T &= \frac{(1+2\phi\lambda_T)\phi}{1+\phi\lambda_T}\frac{\sigma_T^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}, \eta_T = 2\phi(\bar{p}_T - p_0).
\end{aligned}$$

The measure of price stability is

$$E[(p-p_T)^2] = \lambda_T(\beta_T+\gamma_T)\sigma_v^2 + \left(1 - 2\lambda_T\alpha_T\frac{\sigma_{\varepsilon_1}^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}\right)\sigma_T^2 + (p_0 - \bar{p}_T)^2.$$

The measure of price discovery/efficiency is

$$var(v|p) = [1 - \lambda_T(\beta_T+\gamma_T)]\sigma_v^2.$$

The expected profits of the insider and the expected costs of the government are

$$
\begin{aligned}
E(\pi) &= [1-\lambda_T(\beta_T+\gamma_T)]\beta_T\sigma_v^2, \\
E(c) &= [\lambda_T(\beta_T+\gamma_T)-1]\gamma_T\sigma_v^2+\lambda_T\gamma_T^2\sigma_\varepsilon^2+\lambda_T\alpha_T^2\frac{\sigma_T^2\sigma_{\varepsilon_1}^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}.
\end{aligned}
$$

The correlation coefficient between the trading position of the insider and the government is

$$
corr(x,g)=\frac{\beta_T\gamma_T\sigma_v^2}{\sqrt{\beta_T^2\sigma_v^2}\sqrt{\gamma_T^2(\sigma_v^2+\sigma_\varepsilon^2)+(\alpha_T+\omega_T)^2\sigma_T^2+\omega_T^2\sigma_{\varepsilon_1}^2}}.
$$

Partially releasing the fundamental signal

Now suppose that the government partially releases its fundamental signal to the financial market before trading. Specifically, the government releases a noisy signal, $\widetilde{s}=s+\varepsilon_2$, to the insider and the market maker, with $\varepsilon_2\sim N(0,\sigma_{\varepsilon_2}^2)$, where $\{v,p_T,\varepsilon,\varepsilon_2\}$ are mutually independent.

With the enlarged information set $\{v,\widetilde{s}\}$, the insider's maximization problem is changed as

$$
\max_{\{x\}} E[(v-p)x|v,\widetilde{s}]. \tag{F01}
$$

Meanwhile, observing the signal released by the government, $\{\widetilde{s}\}$, the market maker uses the information set $\{y,\widetilde{s}\}$ to update her conditional expectations about the fundamentals. Thus the pricing rule of market efficiency is transformed into

$$
p=E(v|y,\widetilde{s}). \tag{F02}
$$

Conjecture instead the decision rules and the pricing rule as follows:

$$
\begin{aligned}
x &= \beta_s(v-p_0)+\xi_s(\widetilde{s}-p_0), && \text{(F03)} \\
g &= \gamma_s(s-p_0)+\alpha_s(p_T-\bar{p}_T)+\omega_s(\widetilde{s}-p_0)+\eta_s, && \text{(F04)} \\
p &= p_0+\delta_3(\widetilde{s}-p_0)+\lambda_s[y-E(y|\widetilde{s})],\ \text{with } y=x+g+u, && \text{(F05)}
\end{aligned}
$$

where

$$
\begin{aligned}
E(y|\widetilde{s}) &= \beta_s E(v-p_0|\widetilde{s}) + \gamma_s E(s-p_0|\widetilde{s}) + (\xi_s+\omega_s)(\widetilde{s}-p_0) + \eta_s \\
&= (\beta_s\delta_1 + \gamma_s\delta_2 + \xi_s + \omega_s)(\widetilde{s}-p_0) + \eta_s, \\
\delta_1 &\equiv \frac{\sigma_v^2}{\sigma_v^2+\sigma_\varepsilon^2+\sigma_{\varepsilon_2}^2}, \delta_2 \equiv \frac{\sigma_v^2+\sigma_\varepsilon^2}{\sigma_v^2+\sigma_\varepsilon^2+\sigma_{\varepsilon_2}^2}.
\end{aligned}
$$

First, we solve the insider's problem. Using equation (F04) and (F05), we compute

$$
\begin{aligned}
& E[(v-p)x|v,\widetilde{s}] \\
= \; & E\left\{\left[v-p_0-\delta_1(\widetilde{s}-p_0)-\lambda_s\left(\begin{array}{c} x+\gamma_s(s-p_0)+\alpha_s(p_T-\bar{p}_T)+\omega_s(\widetilde{s}-p_0)+\eta_s \\ +u-(\beta_s\delta_1+\gamma_s\delta_2+\xi_s+\omega_s)(\widetilde{s}-p_0)-\eta_s \end{array}\right)\right]x|v,\widetilde{s}\right\} \\
= \; & [v-p_0-\delta_1(\widetilde{s}-p_0)-\lambda_s x - \lambda_s\gamma_s E(s-p_0|v,\widetilde{s}) + \lambda_s(\beta_s\delta_1+\gamma_s\delta_2+\xi_s)(\widetilde{s}-p_0)]\, x \\
= \; & \{[1-\lambda_s\gamma_s(1-\delta_3)](v-p_0) - \lambda_s x - [\delta_1+\lambda_s\gamma_s\delta_3 - \lambda_s(\beta_s\delta_1+\gamma_s\delta_2+\xi_s)](\widetilde{s}-p_0)\}x,
\end{aligned}
$$

where

$$
E(s-p_0|v,\widetilde{s}) = v-p_0+\delta_3(\widetilde{s}-v), \delta_3 \equiv \frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2+\sigma_{\varepsilon_2}^2}.
$$

The FOC for x yields

$$
x = \frac{1-\lambda_s\gamma_s(1-\delta_3)}{2\lambda_s}(v-p_0) - \frac{\delta_1+\lambda_s\gamma_s\delta_3-\lambda_s(\beta_s\delta_1+\gamma_s\delta_2+\xi_s)}{2\lambda_s}(\widetilde{s}-p_0). \tag{F06}
$$

The SOC is $\lambda_s > 0$. Comparing Equation (F06) with the conjectured strategy (F03) leads to

$$
\beta_s = \frac{1-\lambda_s\gamma_s(1-\delta_3)}{2\lambda_s}, \tag{F07}
$$

$$
\xi_s = -\frac{\delta_1}{2\lambda_s} + \gamma_s\left[\delta_2 - \delta_3 - \frac{\delta_1}{2}(1-\delta_3)\right]. \tag{F08}
$$

Second, we solve the government's problem. Using (F03) and (F05), the objective function of the government is derived as

$$
\begin{aligned}
& E[\phi(p-p_T)^2+(p-v)g|s,p_T,\widetilde{s}] \\
= & \left(\begin{array}{c}
\phi\{p_0-p_T-\lambda_s\eta_s+\lambda_s g+[\delta_1-\lambda_s(\beta_s\delta_1+\gamma_s\delta_2+\omega_s)](\widetilde{s}-p_0)\}^2+ \\
2\phi\lambda_s\beta_s\{p_0-p_T-\lambda_s\eta_s+\lambda_s g+[\delta_1-\lambda_s(\beta_s\delta_1+\gamma_s\delta_2+\omega_s)](\widetilde{s}-p_0)\}E(v-p_0|s,p_T,\widetilde{s}) \\
+\phi\lambda_s^2\sigma_u^2+\phi\lambda_s^2\beta_s^2E[(v-p_0)^2|s,p_T,\widetilde{s}]+\lambda_s g^2-\lambda_s\eta_s g+ \\
[\delta_1-\lambda_s(\beta_s\delta_1+\gamma_s\delta_2+\omega_s)](\widetilde{s}-p_0)g+(\lambda_s\beta_s-1)E(v-p_0|s,p_T,\widetilde{s})g
\end{array}\right),
\end{aligned}
$$

where

$$E(v-p_0|s,p_T,\widetilde{s})=E(v-p_0|s,\varepsilon_2)=E(v-p_0|s)=\delta(s-p_0),\delta\equiv\frac{\sigma_v^2}{\sigma_v^2+\sigma_\varepsilon^2}.$$

The FOC for g yields:

$$g=\frac{1}{2\phi\lambda_s^2+2\lambda_s}\left(\begin{array}{c}
(1-\lambda_s\beta_s-2\phi\lambda_s^2\beta_s)\delta_1(s-p_0)+2\phi\lambda_s(p_T-\bar{p}_T) \\
-(1+2\phi\lambda_s)[\delta_1-\lambda_s(\beta_s\delta_1+\gamma_s\delta_2+\omega_s)](\widetilde{s}-p_0) \\
+(2\phi\lambda_s^2+\lambda_s)\eta_s+2\phi\lambda_s(\bar{p}_T-p_0)
\end{array}\right),$$

The SOC is $2\phi\lambda_s^2+2\lambda_s>0$, which holds accordingly if $\lambda_s>0$ holds. Comparing (F04) with the FOC w.r.t g, we obtain

$$\gamma_s=\frac{(1-\lambda_s\beta_s-2\phi\lambda_s^2\beta_s)\delta}{2\phi\lambda_s^2+2\lambda_s}, \tag{F09}$$

$$\alpha_s=\frac{\phi}{1+\phi\lambda_s}, \tag{F10}$$

$$\omega_s=(1+2\phi\lambda_s)\left(\beta_s\delta_1+\gamma_s\delta_2-\frac{\delta_1}{\lambda_s}\right), \tag{F11}$$

$$\eta_s=2\phi(\bar{p}_T-p_0). \tag{F12}$$

Third, by the projection theorem, Equation (F02) gives rise to

$$p=E(v|\widetilde{s})+\frac{cov(v,y|\widetilde{s})}{var(y|\widetilde{s})}[y-E(y|\widetilde{s})]=p_0+\delta_1(\widetilde{s}-p_0)+\frac{cov(v,y|\widetilde{s})}{var(y|\widetilde{s})}[y-E(y|\widetilde{s})],$$

where

$$
\begin{aligned}
& \frac{cov(v, y|\widetilde{s})}{var(y|\widetilde{s})} = \frac{cov(v - E(v|\widetilde{s}), y - E(y|\widetilde{s}))}{var(y - E(y|\widetilde{s}))} \\
= \quad & \frac{cov(v - p_0 - \delta_1(\widetilde{s} - p_0), \beta_s(v - p_0) + \gamma_s(s - p_0) + \alpha_s(p_T - \bar{p}_T) + u - (\beta_s\delta_1 + \gamma_s\delta_2)(\widetilde{s} - p_0))}{var(\beta_s(v - p_0) + \gamma_s(s - p_0) + \alpha_s(p_T - \bar{p}_T) + u - (\beta_s\delta_1 + \gamma_s\delta_2)(\widetilde{s} - p_0))} \\
= \quad & \frac{(1 - \delta_1)(\beta_s + \gamma_s - \beta_s\delta_1 - \gamma_s\delta_2)\sigma_v^2 - \delta_1(\gamma_s - \beta_s\delta_1 - \gamma_s\delta_2)\sigma_\varepsilon^2 + \delta_1(\beta_s\delta_1 + \gamma_s\delta_2)\sigma_{\varepsilon_2}^2}{(\beta_s + \gamma_s - \beta_s\delta_1 - \gamma_s\delta_2)^2\sigma_v^2 + (\gamma_s - \beta_s\delta_1 - \gamma_s\delta_2)^2\sigma_\varepsilon^2 + (\beta_s\delta_1 + \gamma_s\delta_2)^2\sigma_{\varepsilon_2}^2 + \alpha_s^2\sigma_T^2 + \sigma_u^2}.
\end{aligned}
$$

Combining Equation (F05) and the above equation gives us

$$
\lambda_s = \frac{(1 - \delta_1)(\beta_s + \gamma_s - \beta_s\delta_1 - \gamma_s\delta_2)\sigma_v^2 - \delta_1(\gamma_s - \beta_s\delta_1 - \gamma_s\delta_2)\sigma_\varepsilon^2 + \delta_1(\beta_s\delta_1 + \gamma_s\delta_2)\sigma_{\varepsilon_2}^2}{(\beta_s + \gamma_s - \beta_s\delta_1 - \gamma_s\delta_2)^2\sigma_v^2 + (\gamma_s - \beta_s\delta_1 - \gamma_s\delta_2)^2\sigma_\varepsilon^2 + (\beta_s\delta_1 + \gamma_s\delta_2)^2\sigma_{\varepsilon_2}^2 + \alpha_s^2\sigma_T^2 + \sigma_u^2}. \tag{F13}
$$

We solve the equation system composed of (F07)-(F13) as a polynomial about λ_s presented in the following Proposition S2, where the coefficients are as follows:

$$
\begin{aligned}
c_6 &= 4[2-(1-\delta_3)\delta]^2\phi^4\sigma_u^2, c_5 = 4[2-(1-\delta_3)\delta][8-3(1-\delta_3)\delta]\phi^3\sigma_u^2, \\
c_4 &= \left(\begin{array}{c}
4\left[((1-\delta_3)\delta-1)(1-\delta_1)^2+\delta^2(1-\delta_2)^2-\delta^2(1-\delta_3)(1-\delta_2)(1-\delta_1)\right]\phi^4\sigma_v^2 \\
+4\left[((1-\delta_3)\delta-1)\delta_1^2+\delta^2(1-\delta_2)^2+\delta^2(1-\delta_3)(1-\delta_2)\delta_1\right]\phi^4\sigma_\varepsilon^2 \\
+4\left[((1-\delta_3)\delta-1)\delta_1^2+\delta^2\delta_2^2-\delta^2(1-\delta_3)\delta_2\delta_1\right]\phi^4\sigma_{\varepsilon_2}^2+4[2-(1-\delta_3)\delta]^2\phi^4\sigma_T^2 \\
+[(8-3(1-\delta_3)\delta)^2+4(2-(1-\delta_3)\delta)(4-(1-\delta_3)\delta)]\phi^2\sigma_u^2
\end{array}\right), \\
c_3 &= \left(\begin{array}{c}
2\left(\begin{array}{c}\left[7(1-\delta_3)\delta-(1-\delta_3)^2\delta^2-8\right](1-\delta_1)^2+ \\ 2\delta^2(1-\delta_2)^2-2\delta^2(1-\delta_3)(1-\delta_2)(1-\delta_1)\end{array}\right)\phi^3\sigma_v^2 \\
+2\left(\begin{array}{c}\left[7(1-\delta_3)\delta-(1-\delta_3)^2\delta^2-8\right]\delta_1^2+ \\ 2\delta^2(1-\delta_2)^2+2\delta^2(1-\delta_3)(1-\delta_2)\delta_1\end{array}\right)\phi^3\sigma_\varepsilon^2 \\
+2\left(\left[7(1-\delta_3)\delta-(1-\delta_3)^2\delta^2-8\right]\delta_1^2+2\delta^2\delta_2^2-2\delta^2(1-\delta_3)\delta_2\delta_1\right)\phi^3\sigma_{\varepsilon_2}^2 \\
+4\left[8-6(1-\delta_3)\delta+(1-\delta_3)^2\delta^2\right]\phi^3\sigma_T^2+2[4-(1-\delta_3)\delta][8-3(1-\delta_3)\delta]\phi\sigma_u^2
\end{array}\right), \\
c_2 &= \left(\begin{array}{c}
\left(\begin{array}{c}\left[18(1-\delta_3)\delta-4(1-\delta_3)^2\delta^2-24\right](1-\delta_1)^2 \\ -3\delta^2(1-\delta_2)^2+3\delta^2(1-\delta_3)(1-\delta_2)(1-\delta_1)\end{array}\right)\phi^2\sigma_v^2+ \\
\left(\left[18(1-\delta_3)\delta-4(1-\delta_3)^2\delta^2-24\right]\delta_1^2-3\delta^2(1-\delta_2)^2-3\delta^2(1-\delta_3)(1-\delta_2)\delta_1\right)\phi^2\sigma_\varepsilon^2 \\
+\left(\left[18(1-\delta_3)\delta-4(1-\delta_3)^2\delta^2-24\right]\delta_1^2-3\delta^2\delta_2^2+3\delta^2(1-\delta_3)\delta_2\delta_1\right)\phi^2\sigma_{\varepsilon_2}^2 \\
+[4-(1-\delta_3)\delta]^2\phi^2\sigma_T^2+[4-(1-\delta_3)\delta]^2\sigma_u^2
\end{array}\right), \\
c_1 &= \left(\begin{array}{c}
2\left(\begin{array}{c}\left[5(1-\delta_3)\delta-(1-\delta_3)^2\delta^2-8\right](1-\delta_1)^2 \\ -\delta^2(1-\delta_2)^2+\delta^2(1-\delta_3)(1-\delta_2)(1-\delta_1)\end{array}\right)\phi\sigma_v^2 \\
+2\left(\left[5(1-\delta_3)\delta-(1-\delta_3)^2\delta^2-8\right]\delta_1^2-\delta^2(1-\delta_2)^2-\delta^2(1-\delta_3)(1-\delta_2)\delta_1\right)\phi\sigma_\varepsilon^2 \\
+2\left(\left[5(1-\delta_3)\delta-(1-\delta_3)^2\delta^2-8\right]\delta_1^2-\delta^2\delta_2^2+\delta^2(1-\delta_3)\delta_2\delta_1\right)\phi\sigma_{\varepsilon_2}^2
\end{array}\right), \\
c_0 &= \left(\begin{array}{c}
\left[(2(1-\delta_3)\delta-4)(1-\delta_1)^2+\delta^2(1-\delta_2)^2-\delta^2(1-\delta_3)(1-\delta_2)(1-\delta_1)\right]\sigma_v^2 \\
+\left[(2(1-\delta_3)\delta-4)\delta_1^2+\delta^2(1-\delta_2)^2+\delta^2(1-\delta_3)(1-\delta_2)\delta_1\right]\sigma_\varepsilon^2 \\
+\left[(2(1-\delta_3)\delta-4)\delta_1^2+\delta^2\delta_2^2-\delta^2(1-\delta_3)\delta_2\delta_1\right]\sigma_{\varepsilon_2}^2
\end{array}\right).
\end{aligned}
$$

By substitions, we solve other parameters as functions of λ_s as follows. The measure for price stability is computed as:

$$
\begin{aligned}
& E[(p-p_T)^2] \\
= \; & E\left[\left(\begin{array}{c} p_0+\delta_1(\widetilde{s}-p_0)+\lambda_s\beta_s(v-p_0)+\lambda_s\gamma_s(s-p_0)+\lambda_s\alpha_s(p_T-\bar{p}_T) \\ +\lambda_s u-\lambda_s(\beta_s\delta_1+\gamma_s\delta_2)(\widetilde{s}-p_0)-p_T \end{array}\right)^2\right] \\
= \; & E\left[\left(\begin{array}{c} [\delta_1+\lambda_s(\beta_s+\gamma_s-\beta_s\delta_1-\gamma_s\delta_2)](v-p_0)+[\delta_1+\lambda_s(\gamma_s-\beta_s\delta_1-\gamma_s\delta_2)]\varepsilon \\ +[\delta_1-\lambda_s(\beta_s\delta_1+\gamma_s\delta_2)]\varepsilon_2+(\lambda_s\alpha_s-1)(p_T-\bar{p}_T)+\lambda_s u+(p_0-\bar{p}_T) \end{array}\right)^2\right] \\
= \; & \left(\begin{array}{c} [\delta_1+\lambda_s(\beta_s+\gamma_s-\beta_s\delta_1-\gamma_s\delta_2)]^2\sigma_v^2+[\delta_1+\lambda_s(\gamma_s-\beta_s\delta_1-\gamma_s\delta_2)]^2\sigma_\varepsilon^2 \\ +[\delta_1-\lambda_s(\beta_s\delta_1+\gamma_s\delta_2)]^2\sigma_{\varepsilon_2}^2+(\lambda_s\alpha_s-1)^2\sigma_T^2+\lambda_s^2\sigma_u^2+(p_0-\bar{p}_T)^2 \end{array}\right) \\
= \; & \left(\begin{array}{c} \lambda_s^2\left[(\beta_s+\gamma_s-\beta_s\delta_1-\gamma_s\delta_2)^2\sigma_v^2+(\gamma_s-\beta_s\delta_1-\gamma_s\delta_2)^2\sigma_\varepsilon^2+(\beta_s\delta_1+\gamma_s\delta_2)^2\sigma_{\varepsilon_2}^2+\alpha_s^2\sigma_T^2+\sigma_u^2\right] \\ +[\delta_1^2+2\lambda_s(\beta_s+\gamma_s-\beta_s\delta_1-\gamma_s\delta_2)\delta_1]\sigma_v^2+[\delta_1^2+2\lambda_s(\gamma_s-\beta_s\delta_1-\gamma_s\delta_2)\delta_1]\sigma_\varepsilon^2 \\ +[\delta_1^2-2\lambda_s(\beta_s\delta_1+\gamma_s\delta_2)\delta_2]\sigma_{\varepsilon_2}^2+(1-2\lambda_s\alpha_s)\sigma_T^2+(p_0-\bar{p}_T)^2 \end{array}\right) \\
= \; & \left(\begin{array}{c} \left[\delta_1^2+\lambda_s(1+\delta_1)(\beta_s+\gamma_s-\beta_s\delta_1-\gamma_s\delta_2)\right]\sigma_v^2+[\delta_1^2+\lambda_s\delta_1(\gamma_s-\beta_s\delta_1-\gamma_s\delta_2)]\sigma_\varepsilon^2 \\ +[\delta_1^2-\lambda_s(\beta_s\delta_1+\gamma_s\delta_2)\delta_1]\sigma_{\varepsilon_2}^2+(1-2\lambda_s\alpha_s)\sigma_T^2+(p_0-\bar{p}_T)^2 \end{array}\right).
\end{aligned}
$$

Using the projection theorem, we have that

$$
\begin{aligned}
var(v|p) &= var(v)-\frac{[cov(v,p)]^2}{var(p)} \\
&= var(v)-\frac{\left[cov\left(v,p_0+\delta_1(\widetilde{s}-p_0)+\lambda_s\left(\begin{array}{c} \beta_s(v-p_0)+\gamma_s(s-p_0)+\alpha_s(p_T-\bar{p}_T) \\ +u-(\beta_s\delta_1+\gamma_s\delta_2)(\widetilde{s}-p_0) \end{array}\right)\right)\right]^2}{var\left(p_0+\delta_1(\widetilde{s}-p_0)+\lambda_s\left(\begin{array}{c} \beta_s(v-p_0)+\gamma_s(s-p_0)+\alpha_s(p_T-\bar{p}_T) \\ +u-(\beta_s\delta_1+\gamma_s\delta_2)(\widetilde{s}-p_0) \end{array}\right)\right)} \\
&= \sigma_v^2-\frac{[\delta_1+\lambda_s(\beta_s+\gamma_s-\beta_s\delta_1-\gamma_s\delta_2)]^2\sigma_v^4}{\left(\begin{array}{c} [\delta_1+\lambda_s(\beta_s+\gamma_s-\beta_s\delta_1-\gamma_s\delta_2)]^2\sigma_v^2+[\delta_1+\lambda_s(\gamma_s-\beta_s\delta_1-\gamma_s\delta_2)]^2\sigma_\varepsilon^2 \\ +[\delta_1-\lambda_s(\beta_s\delta_1+\gamma_s\delta_2)]^2\sigma_{\varepsilon_2}^2+\lambda_s^2\alpha_s^2\sigma_T^2+\lambda_s^2\sigma_u^2 \end{array}\right)} \\
&= \sigma_v^2-\frac{[\delta_1+\lambda_s(\beta_s+\gamma_s-\beta_s\delta_1-\gamma_s\delta_2)]^2\sigma_v^4}{\left(\begin{array}{c} \left[\delta_1^2+\lambda_s(1+\delta_1)(\beta_s+\gamma_s-\beta_s\delta_1-\gamma_s\delta_2)\right]\sigma_v^2 \\ +[\delta_1^2+\lambda_s\delta_1(\gamma_s-\beta_s\delta_1-\gamma_s\delta_2)]\sigma_\varepsilon^2+[\delta_1^2-\lambda_s(\beta_s\delta_1+\gamma_s\delta_2)\delta_1]\sigma_{\varepsilon_2}^2 \end{array}\right)}.
\end{aligned}
$$

The expected profits of the insider and the expected costs of the government are

$$\begin{aligned}
E(\pi) &= E[(v-p)x] \\
&= E\left[\left(v-p_0-\delta_1(\widetilde{s}-p_0)-\lambda_s\left[\begin{array}{c}\beta_s(v-p_0)+\gamma_s(s-p_0)+\alpha_s(p_T-\bar{p}_T)\\ +u-(\beta_s\delta_1+\gamma_s\delta_2)(\widetilde{s}-p_0)\end{array}\right]\right)\left(\begin{array}{c}\beta_s(v-p_0)\\ +\xi_s(\widetilde{s}-p_0)\end{array}\right)\right] \\
&= E\left[\left(\begin{array}{c}[1-\delta_1-\lambda_s(\beta_s+\gamma_s-\beta_s\delta_1-\gamma_s\delta_2)]\,(v-p_0)\\ -[\delta_1+\lambda_s(\gamma_s-\beta_s\delta_1-\gamma_s\delta_2)]\,\varepsilon-\lambda_s\alpha_s(p_T-\bar{p}_T)\\ -[\delta_1-\lambda_s(\beta_s\delta_1+\gamma_s\delta_2)]\,\varepsilon_2-\lambda_s u\end{array}\right)\left(\begin{array}{c}(\beta_s+\xi_s)(v-p_0)\\ +\xi_s(\varepsilon+\varepsilon_2)\end{array}\right)\right] \\
&= \left(\begin{array}{c}[1-\delta_1-\lambda_s(\beta_s+\gamma_s-\beta_s\delta_1-\gamma_s\delta_2)]\,(\beta_s+\xi_s)\sigma_v^2\\ -[\delta_1+\lambda_s(\gamma_s-\beta_s\delta_1-\gamma_s\delta_2)]\,\xi_s\sigma_\varepsilon^2-[\delta_1-\lambda_s(\beta_s\delta_1+\gamma_s\delta_2)]\,\xi_s\sigma_{\varepsilon_2}^2\end{array}\right).
\end{aligned}$$

The expression for the expected cost of the government is found as follows:

$$\begin{aligned}
&E(c)=E[(p-v)g] \\
&= E\left[\left(p_0+\delta_1(\widetilde{s}-p_0)+\lambda_s\left(\begin{array}{c}\beta_s(v-p_0)+\gamma_s(s-p_0)+\alpha_s(p_T-\bar{p}_T)\\ +u-(\beta_s\delta_1+\gamma_s\delta_2)(\widetilde{s}-p_0)\end{array}\right)-v\right)\left(\begin{array}{c}\gamma_s(s-p_0)\;+\\ \alpha_s(p_T-\bar{p}_T)+\\ \omega_s(\widetilde{s}-p_0)+\eta_s\end{array}\right)\right] \\
&= \left(\begin{array}{c}[\lambda_s(\beta_s+\gamma_s-\beta_s\delta_1-\gamma_s\delta_2)+\delta_1-1](\gamma_s+\omega_s)\sigma_v^2+\lambda_s\alpha_s^2\sigma_T^2\\ +[\lambda_s(\gamma_s-\beta_s\delta_1-\gamma_s\delta_2)+\delta_1](\gamma_s+\omega_s)\sigma_\varepsilon^2+[\delta_1-\lambda_s(\beta_s\delta_1+\gamma_s\delta_2)]\omega_s\sigma_{\varepsilon_2}^2\end{array}\right).
\end{aligned}$$

The correlation coefficient between the trading position of the insider and the government is

$$\begin{aligned}
corr(x,g) &= \frac{cov(x,g)}{\sqrt{var(x)}\sqrt{var(g)}} \\
&= \frac{cov\left(\beta_s(v-p_0)+\xi_s(\widetilde{s}-p_0),\gamma_s(s-p_0)+\alpha_s(p_T-\bar{p}_T)+\omega_s(\widetilde{s}-p_0)+\eta_s\right)}{\sqrt{var(\beta_s(v-p_0)+\xi_s(\widetilde{s}-p_0))}\sqrt{var(\gamma_s(s-p_0)+\alpha_s(p_T-\bar{p}_T)+\omega_s(\widetilde{s}-p_0)+\eta_s)}} \\
&= \frac{(\beta_s+\xi_s)(\gamma_s+\omega_s)\sigma_v^2+\xi_s(\gamma_s+\omega_s)\sigma_\varepsilon^2+\xi_s\omega_s\sigma_{\varepsilon_2}^2}{\sqrt{(\beta_s+\xi_s)^2\sigma_v^2+\xi_s^2(\sigma_\varepsilon^2+\sigma_{\varepsilon_2}^2)}\sqrt{(\gamma_s+\omega_s)^2(\sigma_v^2+\sigma_\varepsilon^2)+\omega_s^2\sigma_{\varepsilon_2}^2+\alpha_s^2\sigma_T^2}}.
\end{aligned}$$

We summarize the above equilibrium results in the following

Proposition S2 *If the government releases a noisy signal about its fundamental signal, namely,* $\widetilde{s}\equiv s+\varepsilon_2$*, a linear equilibrium is defined by seven unknowns* $(\beta_s,\xi_s,\gamma_s,\alpha_s,\omega_s,\eta_s,\lambda_s)\in R^7$*, which are characterized by seven equations (F07)-(F13), together with one SOC,* $\lambda_s>0$*.*

The system of equations can be changed as a six-order polynomial of λ_s*:*

$$c_6\lambda_s^6 + c_5\lambda_s^5 + c_4\lambda_s^4 + c_3\lambda_s^3 + c_2\lambda_s^2 + c_1\lambda_s + c_0 = 0,$$

where the coefficients $c_i's$ *are listed above. All the other variables can be solved as expressions for* λ_s *as follows:*

$$\begin{aligned}
\beta_s &= \frac{2\phi\lambda_s + 2 - (1-\delta_3)\delta}{4\phi\lambda_s^2 + 4\lambda_s - (\lambda_s + 2\phi\lambda_s^2)(1-\delta_3)\delta}, \\
\xi_s &= -\frac{\delta_1}{2\lambda_s} + \frac{(1-2\phi\lambda_s)\delta}{4\phi\lambda_s^2 + 4\lambda_s - (\lambda_s + 2\phi\lambda_s^2)(1-\delta_3)\delta}\left[\delta_2 - \delta_3 - \frac{\delta_1}{2}(1-\delta_3)\right], \\
\gamma_s &= \frac{(1-2\phi\lambda_s)\delta}{4\phi\lambda_s^2 + 4\lambda_s - (\lambda_s + 2\phi\lambda_s^2)(1-\delta_3)\delta}, \alpha_s = \frac{\phi}{1+\phi\lambda_s}, \eta_s = 2\phi(\bar{p}_T - p_0), \\
\omega_s &= (1+2\phi\lambda_s)\left(\frac{[2\phi\lambda_s + 2 - (1-\delta_3)\delta]\delta_1 + (1-2\phi\lambda_s)\delta\delta_2}{4\phi\lambda_s^2 + 4\lambda_s - (\lambda_s + 2\phi\lambda_s^2)(1-\delta_3)\delta} - \frac{\delta_1}{\lambda_s}\right),
\end{aligned}$$

where $\delta \equiv \frac{\sigma_v^2}{\sigma_v^2+\sigma_\varepsilon^2}$ and $\delta_3 \equiv \frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2+\sigma_{\varepsilon_2}^2}$.*The measure of price stability is then*

$$E[(p-p_T)^2] = \begin{pmatrix} [\delta_1^2 + \lambda_s(1+\delta_1)(\beta_s + \gamma_s - \beta_s\delta_1 - \gamma_s\delta_2)]\sigma_v^2 + [\delta_1^2 - \lambda_s\delta_1(\beta_s\delta_1 + \gamma_s\delta_2)]\sigma_{\varepsilon_2}^2 \\ +[\delta_1^2 + \lambda_s\delta_1(\gamma_s - \beta_s\delta_1 - \gamma_s\delta_2)]\sigma_\varepsilon^2 + (1-2\lambda_s\alpha_s)\sigma_T^2 + (p_0 - \bar{p}_T)^2 \end{pmatrix}.$$

The measure of price discovery/efficiency is

$$var(v|p) = \sigma_v^2 - \frac{[\delta_1 + \lambda_s(\beta_s + \gamma_s - \beta_s\delta_1 - \gamma_s\delta_2)]^2\sigma_v^4}{\begin{pmatrix} [\delta_1^2 + \lambda_s(1+\delta_1)(\beta_s + \gamma_s - \beta_s\delta_1 - \gamma_s\delta_2)]\sigma_v^2 + [\delta_1^2 - \lambda_s\delta_1(\beta_s\delta_1 + \gamma_s\delta_2)]\sigma_{\varepsilon_2}^2 \\ +[\delta_1^2 + \lambda_s\delta_1(\gamma_s - \beta_s\delta_1 - \gamma_s\delta_2)]\sigma_\varepsilon^2 \end{pmatrix}}.$$

The expected profit of the insider and expected cost of the government are

$$E(\pi) = \begin{pmatrix} [1 - \delta_1 - \lambda_s(\beta_s + \gamma_s - \beta_s\delta_1 - \gamma_s\delta_2)](\beta_s + \xi_s)\sigma_v^2 \\ -[\lambda_s(\gamma_s - \beta_s\delta_1 - \gamma_s\delta_2) + \delta_1]\xi_s\sigma_\varepsilon^2 - [\delta_1 - \lambda_s(\beta_s\delta_1 + \gamma_s\delta_2)]\xi_s\sigma_{\varepsilon_2}^2 \end{pmatrix},$$

$$E(c) = \begin{pmatrix} [\lambda_s(\beta_s + \gamma_s - \beta_s\delta_1 - \gamma_s\delta_2) + \delta_1 - 1](\gamma_s + \omega_s)\sigma_v^2 + \lambda_s\alpha_s^2\sigma_T^2 \\ +[\lambda_s(\gamma_s - \beta_s\delta_1 - \gamma_s\delta_2) + \delta_1](\gamma_s + \omega_s)\sigma_\varepsilon^2 + [\delta_1 - \lambda_s(\beta_s\delta_1 + \gamma_s\delta_2)]\omega_s\sigma_{\varepsilon_2}^2 \end{pmatrix}.$$

The correlation coefficient between the trading position of the insider and the government

is

$$corr(x,g) = \frac{(\beta_s+\xi_s)(\gamma_s+\omega_s)\sigma_v^2+\xi_s(\gamma_s+\omega_s)\sigma_\varepsilon^2+\xi_s\omega_s\sigma_{\varepsilon_2}^2}{\sqrt{(\beta_s+\xi_s)^2\sigma_v^2+\xi_s^2(\sigma_\varepsilon^2+\sigma_{\varepsilon_2}^2)}\sqrt{(\gamma_s+\omega_s)^2(\sigma_v^2+\sigma_\varepsilon^2)+\omega_s^2\sigma_{\varepsilon_2}^2+\alpha_s^2\sigma_T^2}}.$$

Partially releasing both signals

Suppose instead that the government releases its both signals partially. Specifically, the government releases two noisy signals, $\widetilde{p}_T = p_T + \varepsilon_1$ and $\widetilde{s} = s + \varepsilon_2$ with $\varepsilon_1 \sim N(0, \sigma_{\varepsilon_1}^2)$, $\varepsilon_2 \sim N(0, \sigma_{\varepsilon_2}^2)$, in the financial market, where $\{v, p_T, \varepsilon, \varepsilon_1, \varepsilon_2\}$ are mutually independent.

With the enlarged information set $\{v, \widetilde{p}_T, \widetilde{s}\}$, the insider's maximization problem is changed as

$$\max_{\{x\}} E[(v-p)x|v, \widetilde{p}_T, \widetilde{s}]. \tag{G01}$$

In this case, the market maker sees both signals released by the government, and uses her new information set $\{y, \widetilde{p}_T, \widetilde{s}\}$ to update her conditional expectations about the fundamentals. Then the pricing rule of market efficiency is transformed into

$$p = E(v|y, \widetilde{p}_T, \widetilde{s}). \tag{G02}$$

Conjecture the decision rules and the pricing rule of the economy:

$$\begin{aligned}
x &= \beta_{s,T}(v-p_0) + \xi_{s,T}^{(1)}(\widetilde{s}-p_0) + \xi_{s,T}^{(2)}(\widetilde{p}_T - \bar{p}_T), && \text{(G03)}\\
g &= \gamma_{s,T}(s-p_0) + \alpha_{s,T}(p_T-\bar{p}_T) + \omega_{s,T}^{(1)}(\widetilde{s}-p_0) + \omega_{s,T}^{(2)}(\widetilde{p}_T-\bar{p}_T) + \eta_{s,T}, && \text{(G04)}\\
p &= p_0 + \delta_1(\widetilde{s}-p_0) + \lambda_{s,T}[y - E(y|\widetilde{p}_T, \widetilde{s})], \text{ with } y = x+g+u, && \text{(G05)}
\end{aligned}$$

where

$$\begin{aligned}
E(y|\widetilde{p}_T,\widetilde{s}) &= \begin{pmatrix} \beta_{s,T}E(v-p_0|\widetilde{p}_T,\widetilde{s}) + \gamma_{s,T}E(s-p_0|\widetilde{p}_T,\widetilde{s}) + \alpha_{s,T}E(p_T-\bar{p}_T|\widetilde{p}_T,\widetilde{s}) \\ +(\xi_{s,T}^{(1)}+\omega_{s,T}^{(1)})(\widetilde{s}-p_0) + (\xi_{s,T}^{(2)}+\omega_{s,T}^{(2)})(\widetilde{p}_T-\bar{p}_T) + \eta_{s,T} \end{pmatrix} \\
&= \left(\beta_{s,T}\delta_1 + \gamma_{s,T}\delta_2 + \xi_{s,T}^{(1)} + \omega_{s,T}^{(1)}\right)(\widetilde{s}-p_0) + (\alpha_{s,T}\delta_4 + \xi_{s,T}^{(2)} + \omega_{s,T}^{(2)})(\widetilde{p}_T-\bar{p}_T) + \eta_{s,T}, \\
\delta_1 &\equiv \frac{\sigma_v^2}{\sigma_v^2+\sigma_\varepsilon^2+\sigma_{\varepsilon_2}^2}, \delta_2 \equiv \frac{\sigma_v^2+\sigma_\varepsilon^2}{\sigma_v^2+\sigma_\varepsilon^2+\sigma_{\varepsilon_2}^2}, \delta_4 \equiv \frac{\sigma_T^2}{\sigma_T^2+\sigma_{\varepsilon_1}^2}.
\end{aligned}$$

First, we solve the insider's problem. Given his information set $\{v, \widetilde{p}_T, \widetilde{s}\}$, the insider solves the problem (G01). Using Equations (G04) and (G05), we compute

$$
\begin{aligned}
& E[(v-p)x|v,\widetilde{p}_T,\widetilde{s}] \\
= \; & E\left[\left(\begin{array}{c} v-p_0-\delta_1(\widetilde{s}-p_0) \\ -\lambda_{s,T}\left(\begin{array}{c} x+\gamma_{s,T}(s-p_0)+\alpha_{s,T}(p_T-\bar{p}_T)+u \\ -(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2+\xi^{(1)}_{s,T})(\widetilde{s}-p_0)-(\xi^{(2)}_{s,T}+\alpha_{s,T}\delta_4)(\widetilde{p}_T-\bar{p}_T) \end{array}\right) \end{array}\right) x|v,\widetilde{p}_T,\widetilde{s}\right] \\
= \; & \left(\begin{array}{c} [1-\lambda_{s,T}\gamma_{s,T}(1-\delta_3)](v-p_0)-\lambda_{s,T}x+\lambda_{s,T}\xi^{(2)}_{s,T}(\widetilde{p}_T-\bar{p}_T) \\ -[\delta_1+\lambda_{s,T}\gamma_{s,T}\delta_3-\lambda_{s,T}(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2+\xi^{(1)}_{s,T})](\widetilde{s}-p_0) \end{array}\right) x.
\end{aligned}
$$

The FOC for x yields

$$
x=\frac{1}{2\lambda_{s,T}}\left(\begin{array}{c} [1-\lambda_{s,T}\gamma_{s,T}(1-\delta_3)](v-p_0)+\lambda_{s,T}\xi^{(2)}_{s,T}(\widetilde{p}_T-\bar{p}_T) \\ -[\delta_1+\lambda_{s,T}\gamma_{s,T}\delta_3-\lambda_{s,T}(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2+\xi^{(1)}_{s,T})](\widetilde{s}-p_0) \end{array}\right). \tag{G06}
$$

The SOC is $\lambda_{s,T}>0$. Comparing equation (G06) with the conjectured strategy (G03) leads to

$$
\beta_{s,T} = \frac{1-\lambda_{s,T}\gamma_{s,T}(1-\delta_3)}{2\lambda_{s,T}}, \tag{G07}
$$

$$
\xi^{(1)}_{s,T} = -\frac{\delta_1}{2\lambda_{s,T}}+\gamma_{s,T}\left[\delta_2-\delta_3-\frac{\delta_1}{2}(1-\delta_3)\right], \tag{G08}
$$

$$
\xi^{(2)}_{s,T} = 0. \tag{G09}
$$

Second, we solve the government's problem. Using (G03) and (G05), the objective function of the government is computed as

$$
\begin{aligned}
& E[\phi(p-p_T)^2+(p-v)g|s,p_T,\widetilde{p}_T,\widetilde{s}] \\
= \; & \left(\begin{array}{c}
\phi\left(\begin{array}{c} p_0-p_T+[\delta_1-\lambda_{s,T}(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2+\omega^{(1)}_{s,T})](\widetilde{s}-p_0) \\ -\lambda_{s,T}(\alpha_{s,T}\delta_4+\omega^{(2)}_{s,T})(\widetilde{p}_T-\bar{p}_T)-\lambda_{s,T}\eta_{s,T}+\lambda_{s,T}g \end{array}\right)^2 \\
+\phi\lambda^2_{s,T}\beta^2_{s,T}E[(v-p_0)^2|s,p_T,\widetilde{p}_T,\widetilde{s}]+\phi\lambda^2_{s,T}\sigma^2_u \\
+2\phi\lambda_{s,T}\beta_{s,T}\left(\begin{array}{c} p_0-p_T+[\delta_1-\lambda_{s,T}(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2+\omega^{(1)}_{s,T})](\widetilde{s}-p_0) \\ -\lambda_{s,T}(\alpha_{s,T}\delta_4+\omega^{(2)}_{s,T})(\widetilde{p}_T-\bar{p}_T)-\lambda_{s,T}\eta_{s,T}+\lambda_{s,T}g \end{array}\right)E(v-p_0|s,p_T,\widetilde{p}_T,\widetilde{s}) \\
+\left(\begin{array}{c} (\lambda_{s,T}\beta_{s,T}-1)E(v-p_0|s,p_T,\widetilde{p}_T,\widetilde{s})-\lambda_{s,T}(\alpha_{s,T}\delta_4+\omega^{(2)}_{s,T})(\widetilde{p}_T-\bar{p}_T) \\ +[\delta_1-\lambda_{s,T}(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2+\omega^{(1)}_{s,T})](\widetilde{s}-p_0)+\lambda_{s,T}g-\lambda_{s,T}\eta_{s,T} \end{array}\right)g
\end{array}\right),
\end{aligned}
$$

where

$$E(v - p_0|s, p_T, \widetilde{p}_T, \widetilde{s}) = E(v - p_0|s, p_T, \varepsilon_1, \varepsilon_2) = E(v - p_0|s) = \delta(s - p_0), \delta \equiv \frac{\sigma_v^2}{\sigma_v^2 + \sigma_\varepsilon^2}.$$

The first-order-condition (FOC) for g gives:

$$g = \frac{1}{2\phi\lambda_{s,T}^2 + 2\lambda_{s,T}} \left(\begin{array}{c} (1 - \lambda_{s,T}\beta_{s,T} - 2\phi\lambda_{s,T}^2\beta_{s,T})\delta(s - p_0) + 2\phi\lambda_{s,T}(p_T - \bar{p}_T) + 2\phi\lambda_{s,T}(\bar{p}_T - p_0) \\ -(1 + 2\phi\lambda_{s,T})[\delta_1 - \lambda_{s,T}(\beta_{s,T}\delta_1 + \gamma_{s,T}\delta_2 + \omega_{s,T}^{(1)})](\widetilde{s} - p_0) \\ +(1 + 2\phi\lambda_{s,T})\lambda_{s,T}(\alpha_{s,T}\delta_4 + \omega_{s,T}^{(2)})(\widetilde{p}_T - \bar{p}_T) + (2\phi\lambda_{s,T}^2 + \lambda_{s,T})\eta_{s,T} \end{array} \right),$$

The SOC is $2\phi\lambda_{s,T}^2 + 2\lambda_{s,T} > 0$, which holds accordingly if $\lambda_{s,T} > 0$ holds. Comparing the above equation with the conjectured decision rule of the government (G04), we obtain

$$\gamma_{s,T} = \frac{(1 - \lambda_{s,T}\beta_{s,T} - 2\phi\lambda_{s,T}^2\beta_{s,T})\delta}{2\phi\lambda_{s,T}^2 + 2\lambda_{s,T}}, \tag{G10}$$

$$\alpha_{s,T} = \frac{\phi}{1 + \phi\lambda_{s,T}}, \tag{G11}$$

$$\omega_{s,T}^{(1)} = (1 + 2\phi\lambda_{s,T}) \left(\beta_{s,T}\delta_1 + \gamma_{s,T}\delta_2 - \frac{\delta_1}{\lambda_{s,T}} \right), \tag{G12}$$

$$\omega_{s,T}^{(2)} = (1 + 2\phi\lambda_{s,T})\alpha_{s,T}\delta_4, \tag{G13}$$

$$\eta_{s,T} = 2\phi(\bar{p}_T - p_0). \tag{G14}$$

Third, we consider the market maker's problem. By the projection theorem, Equation (G02) gives rise to

$$\begin{aligned} p &= E(v|\widetilde{p}_T, \widetilde{s}) + \frac{cov(v, y|\widetilde{p}_T, \widetilde{s})}{var(y|\widetilde{p}_T, \widetilde{s})}[y - E(y|\widetilde{p}_T, \widetilde{s})] \\ &= p_0 + \delta_1(\widetilde{s} - p_0) + \frac{cov(v, y|\widetilde{p}_T, \widetilde{s})}{var(y|\widetilde{p}_T, \widetilde{s})}[y - E(y|\widetilde{p}_T, \widetilde{s})], \end{aligned}$$

where

$$\frac{cov(v,y|\widetilde{p}_T,\widetilde{s})}{var(y|\widetilde{p}_T,\widetilde{s})}=\frac{cov(v-E(v|\widetilde{p}_T,\widetilde{s}),y-E(y|\widetilde{p}_T,\widetilde{s}))}{var(y-E(y|\widetilde{p}_T,\widetilde{s}))}$$

$$=\frac{cov\left(v-p_0-\delta_1(\widetilde{s}-p_0),\left(\begin{array}{c}\beta_{s,T}(v-p_0)+\gamma_{s,T}(s-p_0)+\alpha_{s,T}(p_T-\bar{p}_T)+u\\-(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)(\widetilde{s}-p_0)-\alpha_{s,T}\delta_4(\widetilde{p}_T-\bar{p}_T)\end{array}\right)\right)}{var\left(\begin{array}{c}\beta_{s,T}(v-p_0)+\gamma_{s,T}(s-p_0)+\alpha_{s,T}(p_T-\bar{p}_T)+u\\-(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)(\widetilde{s}-p_0)-\alpha_{s,T}\delta_4(\widetilde{p}_T-\bar{p}_T)\end{array}\right)}$$

$$=\frac{\left(\begin{array}{c}(1-\delta_1)(\beta_{s,T}+\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)\sigma_v^2\\-\delta_1(\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)\sigma_\varepsilon^2+\delta_1(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)\sigma_{\varepsilon_2}^2\end{array}\right)}{\left(\begin{array}{c}(\beta_{s,T}+\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)^2\sigma_v^2+(\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)^2\sigma_\varepsilon^2\\+(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)^2\sigma_{\varepsilon_2}^2+\alpha_{s,T}^2(1-\delta_4)^2\sigma_T^2+\alpha_{s,T}^2\delta_4^2\sigma_{\varepsilon_1}^2+\sigma_u^2\end{array}\right)}.$$

Combining (G05) and the above equation gives rise to

$$\lambda_{s,T}=\frac{\left(\begin{array}{c}(1-\delta_1)(\beta_{s,T}+\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)\sigma_v^2\\-\delta_1(\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)\sigma_\varepsilon^2+\delta_1(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)\sigma_{\varepsilon_2}^2\end{array}\right)}{\left(\begin{array}{c}(\beta_{s,T}+\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)^2\sigma_v^2+(\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)^2\sigma_\varepsilon^2\\+(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)^2\sigma_{\varepsilon_2}^2+\alpha_{s,T}^2(1-\delta_4)^2\sigma_T^2+\alpha_{s,T}^2\delta_4^2\sigma_{\varepsilon_1}^2+\sigma_u^2\end{array}\right)}. \tag{G15}$$

We solve the equation system composed of (G07)-(G15) as a polynomial about $\lambda_{s,T}$ presented in the following Proposition S3, where the coefficients are as follows:

$$d_6 = 4[2-(1-\delta_3)\delta]^2\phi^4\sigma_u^2, d_5 = 4[2-(1-\delta_3)\delta][8-3(1-\delta_3)\delta]\phi^3\sigma_u^2,$$

$$d_4 = \left(\begin{array}{c} 4\left[((1-\delta_3)\delta-1)(1-\delta_1)^2+\delta^2(1-\delta_2)^2-\delta^2(1-\delta_3)(1-\delta_2)(1-\delta_1)\right]\phi^4\sigma_v^2 \\ +4\left[((1-\delta_3)\delta-1)\delta_1^2+\delta^2(1-\delta_2)^2+\delta^2(1-\delta_3)(1-\delta_2)\delta_1\right]\phi^4\sigma_\varepsilon^2 \\ +4\left[((1-\delta_3)\delta-1)\delta_1^2+\delta^2\delta_2^2-\delta^2(1-\delta_3)\delta_2\delta_1\right]\phi^4\sigma_{\varepsilon_2}^2+4[2-(1-\delta_3)\delta]^2(1-\delta_4)\phi^4\sigma_T^2 \\ +[(8-3(1-\delta_3)\delta)^2+4(2-(1-\delta_3)\delta)(4-(1-\delta_3)\delta)]\phi^2\sigma_u^2 \end{array}\right),$$

$$d_3 = \left(\begin{array}{c} 2\left(\begin{array}{c}\left[7(1-\delta_3)\delta-(1-\delta_3)^2\delta^2-8\right](1-\delta_1)^2+ \\ 2\delta^2(1-\delta_2)^2-2\delta^2(1-\delta_3)(1-\delta_2)(1-\delta_1)\end{array}\right)\phi^3\sigma_v^2 \\ +2\left(\begin{array}{c}\left[7(1-\delta_3)\delta-(1-\delta_3)^2\delta^2-8\right]\delta_1^2+ \\ 2\delta^2(1-\delta_2)^2+2\delta^2(1-\delta_3)(1-\delta_2)\delta_1\end{array}\right)\phi^3\sigma_\varepsilon^2 \\ +2\left(\left[7(1-\delta_3)\delta-(1-\delta_3)^2\delta^2-8\right]\delta_1^2+2\delta^2\delta_2^2-2\delta^2(1-\delta_3)\delta_2\delta_1\right)\phi^3\sigma_{\varepsilon_2}^2 \\ +4\left[8-6(1-\delta_3)\delta+(1-\delta_3)^2\delta^2\right](1-\delta_4)\phi^3\sigma_T^2+2[4-(1-\delta_3)\delta][8-3(1-\delta_3)\delta]\phi\sigma_u^2 \end{array}\right),$$

$$d_2 = \left(\begin{array}{c} \left(\begin{array}{c}\left[18(1-\delta_3)\delta-4(1-\delta_3)^2\delta^2-24\right](1-\delta_1)^2 \\ -3\delta^2(1-\delta_2)^2+3\delta^2(1-\delta_3)(1-\delta_2)(1-\delta_1)\end{array}\right)\phi^2\sigma_v^2+ \\ \left(\left[18(1-\delta_3)\delta-4(1-\delta_3)^2\delta^2-24\right]\delta_1^2-3\delta^2(1-\delta_2)^2-3\delta^2(1-\delta_3)(1-\delta_2)\delta_1\right)\phi^2\sigma_\varepsilon^2 \\ +\left(\left[18(1-\delta_3)\delta-4(1-\delta_3)^2\delta^2-24\right]\delta_1^2-3\delta^2\delta_2^2+3\delta^2(1-\delta_3)\delta_2\delta_1\right)\phi^2\sigma_{\varepsilon_2}^2 \\ +[4-(1-\delta_3)\delta]^2(1-\delta_4)\phi^2\sigma_T^2+[4-(1-\delta_3)\delta]^2\sigma_u^2 \end{array}\right),$$

$$d_1 = \left(\begin{array}{c} 2\left(\begin{array}{c}\left[5(1-\delta_3)\delta-(1-\delta_3)^2\delta^2-8\right](1-\delta_1)^2 \\ -\delta^2(1-\delta_2)^2+\delta^2(1-\delta_3)(1-\delta_2)(1-\delta_1)\end{array}\right)\phi\sigma_v^2 \\ +2\left(\left[5(1-\delta_3)\delta-(1-\delta_3)^2\delta^2-8\right]\delta_1^2-\delta^2(1-\delta_2)^2-\delta^2(1-\delta_3)(1-\delta_2)\delta_1\right)\phi\sigma_\varepsilon^2 \\ +2\left(\left[5(1-\delta_3)\delta-(1-\delta_3)^2\delta^2-8\right]\delta_1^2-\delta^2\delta_2^2+\delta^2(1-\delta_3)\delta_2\delta_1\right)\phi\sigma_{\varepsilon_2}^2 \end{array}\right),$$

$$d_0 = \left(\begin{array}{c} \left[(2(1-\delta_3)\delta-4)(1-\delta_1)^2+\delta^2(1-\delta_2)^2-\delta^2(1-\delta_3)(1-\delta_2)(1-\delta_1)\right]\sigma_v^2 \\ +\left[(2(1-\delta_3)\delta-4)\delta_1^2+\delta^2(1-\delta_2)^2+\delta^2(1-\delta_3)(1-\delta_2)\delta_1\right]\sigma_\varepsilon^2 \\ +\left[(2(1-\delta_3)\delta-4)\delta_1^2+\delta^2\delta_2^2-\delta^2(1-\delta_3)\delta_2\delta_1\right]\sigma_{\varepsilon_2}^2 \end{array}\right).$$

By substitutions, we have those expressions for $(\beta_{s,T}, \xi_{s,T}^{(1)}, \xi_{s,T}^{(2)}, \gamma_{s,T}, \alpha_{s,T}, \omega_{s,T}^{(1)}, \omega_{s,T}^{(2)}, \eta_{s,T})$ listed in Proposition S3. The measure for price stability can be computed by

$$
\begin{aligned}
& E[(p-p_T)^2] \\
= \;& E\left[\left(\begin{array}{c} p_0+\delta_1(\widetilde{s}-p_0)+\lambda_{s,T}\beta_{s,T}(v-p_0)+\lambda_{s,T}\gamma_{s,T}(s-p_0)+\lambda_{s,T}\alpha_{s,T}(p_T-\bar{p}_T) \\ +\lambda_{s,T}u-\lambda_{s,T}(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)(\widetilde{s}-p_0)-\lambda_{s,T}\alpha_{s,T}\delta_4(\widetilde{p}_T-\bar{p}_T)-p_T \end{array}\right)^2\right] \\
= \;& E\left[\left(\begin{array}{c} p_0-\bar{p}_T+[\delta_1+\lambda_{s,T}(\beta_{s,T}+\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)](v-p_0) \\ +[\delta_1+\lambda_{s,T}(\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)]\varepsilon+[\delta_1-\lambda_{s,T}(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)]\varepsilon_2 \\ +[\lambda_{s,T}\alpha_{s,T}(1-\delta_4)-1](p_T-\bar{p}_T)-\lambda_{s,T}\alpha_{s,T}\delta_4\varepsilon_1+\lambda_{s,T}u \end{array}\right)^2\right] \\
= \;& \left(\begin{array}{c} \lambda_{s,T}^2\left(\begin{array}{c} (\beta_{s,T}+\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)^2\sigma_v^2+(\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)^2\sigma_\varepsilon^2 \\ +(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)^2\sigma_{\varepsilon_2}^2+\alpha_{s,T}^2(1-\delta_4)^2\sigma_T^2+\alpha_{s,T}^2\delta_4^2\sigma_{\varepsilon_1}^2+\sigma_u^2 \end{array}\right) \\ +[\delta_1^2+2\lambda_{s,T}(\beta_{s,T}+\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)\delta_1]\sigma_v^2+[\delta_1^2-2\lambda_{s,T}(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)\delta_1]\sigma_{\varepsilon_2}^2 \\ +[\delta_1^2+2\lambda_{s,T}(\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)\delta_1]\sigma_\varepsilon^2+[1-2\lambda_{s,T}\alpha_{s,T}(1-\delta_4)]\sigma_T^2+(p_0-\bar{p}_T)^2 \end{array}\right) \\
= \;& \left(\begin{array}{c} [\delta_1^2+\lambda_{s,T}(1+\delta_1)(\beta_{s,T}+\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)]\sigma_v^2 \\ +[\delta_1^2-\lambda_{s,T}\delta_1(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)]\sigma_{\varepsilon_2}^2+[\delta_1^2+\lambda_{s,T}\delta_1(\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)]\sigma_\varepsilon^2 \\ +[1-2\lambda_{s,T}\alpha_{s,T}(1-\delta_4)]\sigma_T^2+(p_0-\bar{p}_T)^2 \end{array}\right).
\end{aligned}
$$

By the projection theorem, we have that

$$
\begin{aligned}
var(v|p) &= var(v)-\frac{[cov(v,p)]^2}{var(p)} \\
&= var(v)-\frac{\left[cov\left(v, p_0+\delta_1(\widetilde{s}-p_0)+\lambda_{s,T}\left(\begin{array}{c} \beta_{s,T}(v-p_0)+\gamma_{s,T}(s-p_0) \\ +\alpha_{s,T}(p_T-\bar{p}_T)+u-\alpha_{s,T}\delta_4(\widetilde{p}_T-\bar{p}_T) \\ -(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)(\widetilde{s}-p_0) \end{array}\right)\right)\right]^2}{var\left(p_0+\delta_1(\widetilde{s}-p_0)+\lambda_{s,T}\left(\begin{array}{c} \beta_{s,T}(v-p_0)+\gamma_{s,T}(s-p_0) \\ +\alpha_{s,T}(p_T-\bar{p}_T)+u-\alpha_{s,T}\delta_4(\widetilde{p}_T-\bar{p}_T) \\ -(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)(\widetilde{s}-p_0) \end{array}\right)\right)} \\
&= \sigma_v^2-\frac{[\delta_1+\lambda_{s,T}(\beta_{s,T}+\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)]^2\sigma_v^4}{\left(\begin{array}{c} [\delta_1^2+\lambda_{s,T}(1+\delta_1)(\beta_{s,T}+\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)]\sigma_v^2 \\ +[\delta_1^2-\lambda_{s,T}\delta_1(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)]\sigma_{\varepsilon_2}^2+[\delta_1^2+\lambda_{s,T}\delta_1(\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)]\sigma_\varepsilon^2 \end{array}\right)}.
\end{aligned}
$$

The expected profits of the insider and the expected costs of the government are computed as

follows:

$$
\begin{aligned}
E(\pi) &= E[(v-p)x] \\
&= E\left[\left(\begin{array}{c} v-p_0-\delta_1(\widetilde{s}-p_0)-\lambda_{s,T}u-\lambda_{s,T}\beta_{s,T}(v-p_0) \\ -\lambda_{s,T}\gamma_{s,T}(s-p_0)-\lambda_{s,T}\alpha_{s,T}(p_T-\bar{p}_T) \\ +\lambda_{s,T}(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)(\widetilde{s}-p_0)+\lambda_{s,T}\alpha_{s,T}\delta_4(\widetilde{p}_T-\bar{p}_T) \end{array}\right)\left(\begin{array}{c} \beta_{s,T}(v-p_0) \\ +\xi^{(1)}_{s,T}(\widetilde{s}-p_0) \\ +\xi^{(2)}_{s,T}(\widetilde{p}_T-\bar{p}_T) \end{array}\right)\right] \\
&= E\left[\left(\begin{array}{c} \left[1-\delta_1-\lambda_{s,T}(\beta_{s,T}+\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)\right](v-p_0) \\ -\left[\delta_1+\lambda_{s,T}(\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)\right]\varepsilon \\ -\left[\delta_1-\lambda_{s,T}(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)\right]\varepsilon_2-\lambda_{s,T}u \\ -\lambda_{s,T}\alpha_{s,T}(1-\delta_4)(p_T-\bar{p}_T)+\lambda_{s,T}\alpha_{s,T}\delta_4\varepsilon_1 \end{array}\right)\left(\begin{array}{c} (\beta_{s,T}+\xi^{(1)}_{s,T})(v-p_0) \\ +\xi^{(2)}_{s,T}(p_T-\bar{p}_T) \\ +\xi^{(1)}_{s,T}(\varepsilon+\varepsilon_2)+\xi^{(2)}_{s,T}\varepsilon_1 \end{array}\right)\right] \\
&= \left(\begin{array}{c} [1-\delta_1-\lambda_{s,T}(\beta_{s,T}+\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)](\beta_{s.T}+\xi^{(1)}_{s,T})\sigma_v^2 \\ -[\delta_1+\lambda_{s,T}(\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)]\xi^{(1)}_{s,T}\sigma_\varepsilon^2-[\delta_1-\lambda_{s,T}(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)]\xi^{(1)}_{s,T}\sigma_{\varepsilon_2}^2 \end{array}\right).
\end{aligned}
$$

$$
\begin{aligned}
&E(c) = E[(p-v)g] \\
&= E\left[\left(p_0+\delta_1(\widetilde{s}-p_0)+\lambda_{s,T}\left(\begin{array}{c} \beta_{s,T}(v-p_0)+\gamma_{s,T}(s-p_0) \\ +\alpha_{s,T}(p_T-\bar{p}_T)+u \\ -(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)(\widetilde{s}-p_0) \\ -\alpha_{s,T}\delta_4(\widetilde{p}_T-\bar{p}_T) \end{array}\right)-v\right)\left(\begin{array}{c} \gamma_{s,T}(s-p_0) \\ +\alpha_{s,T}(p_T-\bar{p}_T) \\ +\omega^{(1)}_{s,T}(\widetilde{s}-p_0) \\ +\omega^{(2)}_{s,T}(\widetilde{p}_T-\bar{p}_T)+\eta_{s,T} \end{array}\right)\right] \\
&= E\left[\left(\begin{array}{c} [\lambda_{s,T}(\beta_{s,T}+\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)+\delta_1-1](v-p_0) \\ +[\lambda_{s,T}(\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)+\delta_1]\varepsilon \\ +[\delta_1-\lambda_{s,T}(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)]\varepsilon_2+\lambda_{s,T}u \\ +\lambda_{s,T}\alpha_{s,T}(1-\delta_4)(p_T-\bar{p}_T)-\lambda_{s,T}\alpha_{s,T}\delta_4\varepsilon_1 \end{array}\right)\left(\begin{array}{c} (\gamma_{s,T}+\omega^{(1)}_{s,T})(v-p_0) \\ +(\gamma_{s,T}+\omega^{(1)}_{s,T})\varepsilon+\omega^{(1)}_{s,T}\varepsilon_2 \\ +(\alpha_{s,T}+\omega^{(2)}_{s,T})(p_T-\bar{p}_T) \\ +\omega^{(2)}_{s,T}\varepsilon_1+\eta_{s,T} \end{array}\right)\right] \\
&= \left(\begin{array}{c} [\lambda_{s,T}(\beta_{s,T}+\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)+\delta_1-1](\gamma_{s,T}+\omega^{(1)}_{s,T})\sigma_v^2+\lambda_{s,T}\alpha^2_{s,T}(1-\delta_4)\sigma_T^2+ \\ [\lambda_{s,T}(\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)+\delta_1](\gamma_{s,T}+\omega^{(1)}_{s,T})\sigma_\varepsilon^2+[\delta_1-\lambda_{s,T}(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)]\omega^{(1)}_{s,T}\sigma_{\varepsilon_2}^2 \end{array}\right).
\end{aligned}
$$

The correlation coefficient between the trading position of the insider and the government is

$$
\begin{aligned}
corr(x,g) &= \frac{cov(x,g)}{\sqrt{var(x)}\sqrt{var(g)}} \\
&= \frac{cov\left(\left(\begin{array}{c} \beta_{s,T}(v-p_0)+\xi_{s,T}^{(1)}(\widetilde{s}-p_0) \\ +\xi_{s,T}^{(2)}(\widetilde{p}_T-\bar{p}_T) \end{array}\right),\left(\begin{array}{c} \gamma_{s,T}(s-p_0) \quad +\alpha_{s,T}(p_T-\bar{p}_T) \\ +\omega_{s,T}^{(1)}(\widetilde{s}-p_0)+\omega_{s,T}^{(2)}(\widetilde{p}_T-\bar{p}_T)+\eta_{s,T} \end{array}\right)\right)}{\sqrt{var\left(\begin{array}{c} \beta_{s,T}(v-p_0)+\xi_{s,T}^{(1)}(\widetilde{s}-p_0) \\ +\xi_{s,T}^{(2)}(\widetilde{p}_T-\bar{p}_T) \end{array}\right)}\sqrt{var\left(\begin{array}{c} \gamma_{s,T}(s-p_0) \quad +\alpha_{s,T}(p_T-\bar{p}_T) \\ +\omega_{s,T}^{(1)}(\widetilde{s}-p_0)+\omega_{s,T}^{(2)}(\widetilde{p}_T-\bar{p}_T)+\eta_{s,T} \end{array}\right)}} \\
&= \frac{(\beta_{s,T}+\xi_{s,T}^{(1)})(\gamma_{s,T}+\omega_{s,T}^{(1)})\sigma_v^2+\xi_{s,T}^{(1)}(\gamma_{s,T}+\omega_{s,T}^{(1)})\sigma_\varepsilon^2+\xi_{s,T}^{(1)}\omega_{s,T}^{(1)}\sigma_{\varepsilon_2}^2}{\sqrt{(\beta_{s,T}+\xi_{s,T}^{(1)})^2\sigma_v^2+(\xi_{s,T}^{(1)})^2(\sigma_\varepsilon^2+\sigma_{\varepsilon_2}^2)}\sqrt{\left(\begin{array}{c} (\gamma_{s,T}+\omega_{s,T}^{(1)})^2(\sigma_v^2+\sigma_\varepsilon^2)+(\omega_{s,T}^{(1)})^2\sigma_{\varepsilon_2}^2 \\ +(\alpha_{s,T}+\omega_{s,T}^{(2)})^2\sigma_T^2+(\omega_{s,T}^{(2)})^2\sigma_{\varepsilon_1}^2 \end{array}\right)}}.
\end{aligned}
$$

Then we summarize the above results in the following

Proposition S3 *If the government partially releases two private signals $\{\widetilde{p}_T,\widetilde{s}\}$, a linear equilibrium is defined by nine unknowns $(\beta_{s,T},\xi_{s,T}^{(1)},\xi_{s,T}^{(2)},\gamma_{s,T},\alpha_{s,T},\omega_{s,T}^{(1)},\omega_{s,T}^{(2)},\eta_{s,T},\lambda_{s,T})\in R^9$, which are characterized by nine equations (G07)-(G15), together with one SOC, $\lambda_{s,T}>0$. The system of equations can be solved as a six-order polynomial for $\lambda_{s,T}$:*

$$
d_6\lambda_{s,T}^6+d_5\lambda_{s,T}^5+d_4\lambda_{s,T}^4+d_3\lambda_{s,T}^3+d_2\lambda_{s,T}^2+d_1\lambda_{s,T}+d_0=0,
$$

where the coefficients $d_i's$ are listed above. All the other variables can be solved as expres-

sions of $\lambda_{s,T}$ as follows:

$$\begin{aligned}
\beta_{s,T} &= \frac{2\phi\lambda_{s,T}+2-(1-\delta_3)\delta}{4\phi\lambda_{s,T}^2+4\lambda_{s,T}-(\lambda_{s,T}+2\phi\lambda_{s,T}^2)(1-\delta_3)\delta}, \\
\xi_{s,T}^{(1)} &= -\frac{\delta_1}{2\lambda_{s,T}}+\frac{(1-2\phi\lambda_{s,T})\delta}{4\phi\lambda_{s,T}^2+4\lambda_{s,T}-(\lambda_{s,T}+2\phi\lambda_{s,T}^2)(1-\delta_3)\delta}\left[\delta_2-\delta_3-\frac{\delta_1}{2}(1-\delta_3)\right], \\
\xi_{s,T}^{(2)} &= 0, \\
\gamma_{s,T} &= \frac{(1-2\phi\lambda_{s,T})\delta}{4\phi\lambda_{s,T}^2+4\lambda_{s,T}-(\lambda_{s,T}+2\phi\lambda_{s,T}^2)(1-\delta_3)\delta}, \\
\alpha_{s,T} &= \frac{\phi}{1+\phi\lambda_{s,T}}, \\
\omega_{s,T}^{(1)} &= (1+2\phi\lambda_{s,T})\left(\frac{[2\phi\lambda_{s,T}+2-(1-\delta_3)\delta]\delta_1+(1-2\phi\lambda_{s,T})\delta\delta_2}{4\phi\lambda_{s,T}^2+4\lambda_{s,T}-(\lambda_{s,T}+2\phi\lambda_{s,T}^2)(1-\delta_3)\delta}-\frac{\delta_1}{\lambda_{s,T}}\right), \\
\omega_{s,T}^{(2)} &= \frac{\phi(1+2\phi\lambda_{s,T})\delta_4}{1+\phi\lambda_{s,T}}, \\
\eta_{s,T} &= 2\phi(\bar{p}_T-p_0),
\end{aligned}$$

where $\delta \equiv \frac{\sigma_v^2}{\sigma_v^2+\sigma_\varepsilon^2}$ and $\delta_3 \equiv \frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2+\sigma_{\varepsilon_2}^2}$. *The measure of price stability is then*

$$E[(p-p_T)^2] = \begin{pmatrix} [\delta_1^2+\lambda_{s,T}(1+\delta_1)(\beta_{s,T}+\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)]\sigma_v^2 \\ +[\delta_1^2-\lambda_{s,T}\delta_1(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)]\sigma_{\varepsilon_2}^2+[\delta_1^2+\lambda_{s,T}\delta_1(\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)]\sigma_\varepsilon^2 \\ +[1-2\lambda_{s,T}\alpha_{s,T}(1-\delta_4)]\sigma_T^2+(p_0-\bar{p}_T)^2 \end{pmatrix}.$$

The measure of price discovery/efficiency is

$$var(v|p) = \sigma_v^2 - \frac{[\delta_1+\lambda_{s,T}(\beta_{s,T}+\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)]^2\sigma_v^4}{\begin{pmatrix} [\delta_1^2+\lambda_{s,T}(1+\delta_1)(\beta_{s,T}+\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)]\sigma_v^2 \\ +[\delta_1^2-\lambda_{s,T}\delta_1(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)]\sigma_{\varepsilon_2}^2+[\delta_1^2+\lambda_{s,T}\delta_1(\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)]\sigma_\varepsilon^2 \end{pmatrix}}.$$

The expected profit of the insider and expected cost of the government are

$$E(\pi) = \begin{pmatrix} [1-\delta_1-\lambda_{s,T}(\beta_{s,T}+\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)](\beta_{s.T}+\xi_{s,T}^{(1)})\sigma_v^2 \\ -[\lambda_{s,T}(\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)+\delta_1]\xi_{s,T}^{(1)}\sigma_\varepsilon^2-[\delta_1-\lambda_{s,T}(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)]\xi_{s,T}^{(1)}\sigma_{\varepsilon_2}^2 \end{pmatrix},$$

$$E(c) = \begin{pmatrix} [\lambda_{s,T}(\beta_{s,T}+\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)+\delta_1-1](\gamma_{s,T}+\omega_{s,T}^{(1)})\sigma_v^2+\lambda_{s,T}\alpha_{s,T}^2(1-\delta_4)\sigma_T^2+ \\ [\lambda_{s,T}(\gamma_{s,T}-\beta_{s,T}\delta_1-\gamma_{s,T}\delta_2)+\delta_1](\gamma_{s,T}+\omega_{s,T}^{(1)})\sigma_\varepsilon^2+[\delta_1-\lambda_{s,T}(\beta_{s,T}\delta_1+\gamma_{s,T}\delta_2)]\omega_{s,T}^{(1)}\sigma_{\varepsilon_2}^2 \end{pmatrix}.$$

The correlation coefficient between the trading position of the insider and the government

is

$$corr(x,g)=\frac{(\beta_{s,T}+\xi^{(1)}_{s,T})(\gamma_{s,T}+\omega^{(1)}_{s,T})\sigma_v^2+\xi^{(1)}_{s,T}(\gamma_{s,T}+\omega^{(1)}_{s,T})\sigma_\varepsilon^2+\xi^{(1)}_{s,T}\omega^{(1)}_{s,T}\sigma^2_{\varepsilon 2}}{\sqrt{(\beta_{s,T}+\xi^{(1)}_{s,T})^2\sigma_v^2+(\xi^{(1)}_{s,T})^2(\sigma_\varepsilon^2+\sigma^2_{\varepsilon_2})}\sqrt{\begin{pmatrix}(\gamma_{s,T}+\omega^{(1)}_{s,T})^2(\sigma_v^2+\sigma_\varepsilon^2)+(\omega^{(1)}_{s,T})^2\sigma^2_{\varepsilon 2}\\+(\alpha_{s,T}+\omega^{(2)}_{s,T})^2\sigma_T^2+(\omega^{(2)}_{s,T})^2\sigma^2_{\varepsilon_1}\end{pmatrix}}}.$$

S2 Government intervention with correlated signals

In this section of online appendix, we solve the model economies with correlated signals. We extend the baseline model to the case with correlated government signals. Then we solve the three scenerios with full information disclosure.

The baseline model with correlated signals

We extend the baseline model of government intervention to the case with correlated signals. For this purpose, we assume that the liquidation value v and price target p_T follow a bivariate normal distribution, namely, $(v,p_T)\sim N\left(p_0,\overline{p}_T,\sigma_v^2,\sigma_T^2,\rho\right)$. Thus the government's two private signals follow a bivariate normal distribution, namely, $(s,p_T)\sim N\left(p_0,\overline{p}_T,\sigma_v^2+\sigma_\varepsilon^2,\sigma_T^2,\rho\right)$.

In this case, we conjecture the decision rules for the insider and the government and the pricing rule for the market maker as follows:

$$x = \beta(v-p_0), \tag{I01}$$

$$g = \gamma(s-p_0)+\alpha(p_T-\bar{p}_T)+\eta, \tag{I02}$$

$$p = p_0+\lambda(y-\eta), \text{with } y=x+g+u. \tag{I03}$$

First, we solve the insider's problem. Using Equations (I02), (I03) and the projection theorem, we can compute

$$E\left[(v-p)x|v\right]=[\left(1-\lambda\gamma-\lambda\alpha\rho\frac{\sigma_T}{\sigma_v}\right)(v-p_0)-\lambda x]x.$$

Taking the FOC results in the following solution:

$$x=\frac{1-\lambda\gamma-\lambda\alpha\rho\frac{\sigma_T}{\sigma_v}}{2\lambda}(v-p_0). \tag{I04}$$

The SOC is $\lambda > 0$. Comparing the FOC (I04) with the conjectured strategy (I01), we have

$$\beta = \frac{1 - \lambda\gamma - \lambda\alpha\rho\frac{\sigma_T}{\sigma_v}}{2\lambda}. \tag{I05}$$

Second, we solve the government's problem. Using Equations (I01) and (I03), we can compute

$$E\left[\phi(p-p_T)^2 + (p-v)g|s,p_T\right] = \left\{ \begin{array}{c} 2\phi\lambda\beta(p_0 - p_T - \lambda\eta + \lambda g)E(v-p_0|s,p_T) + \\ \phi(p_0 - p_T - \lambda\eta + \lambda g)^2 + (\lambda\beta - 1)gE(v-p_0|s,p_T) \\ +\phi\lambda^2\sigma_u^2 + \phi\lambda^2\beta^2 E[(v-p_0)^2|s,p_T] + \lambda g^2 - \lambda\eta g \end{array} \right\},$$

where

$$\begin{aligned} E(v-p_0|s,p_T) &= E(v-p_0|p_T) + \frac{cov(v-p_0,s|p_T)}{var(s|p_T)}[s - E(s|p_T)] \\ &= (1-\delta)\frac{\rho\sigma_v}{\sigma_T}(p_T - \bar{p}_T) + \delta(s-p_0), \end{aligned}$$

$$\begin{aligned} E[(v-p_0)^2|s,p_T] &= [E(v-p_0|s,p_T)]^2 + var(v-p_0|s,p_T) \\ &= \left\{ \begin{array}{c} \left[(1-\delta)\frac{\rho\sigma_v}{\sigma_T}(p_T-\bar{p}_T) + \delta(s-p_0)\right]^2 \\ +(1-\delta)(1-\rho^2)\sigma_v^2 \end{array} \right\}, \end{aligned}$$

$$\delta \equiv \frac{cov(v,s|p_T)}{var(s|p_T)} = \frac{(1-\rho^2)\sigma_v^2}{(1-\rho^2)\sigma_v^2 + \sigma_\varepsilon^2}.$$

The FOC for g yields

$$g = \frac{1}{2\phi\lambda^2 + 2\lambda}\left\{ \begin{array}{c} (1 - \lambda\beta - 2\phi\lambda^2\beta)\delta(s-p_0) + (2\phi\lambda^2 + \lambda)\eta + 2\phi\lambda(\bar{p}_T - p_0) \\ +[(1-\lambda\beta - 2\phi\lambda^2\beta)(1-\delta)\frac{\rho\sigma_v}{\sigma_T} + 2\phi\lambda](p_T - \bar{p}_T) \end{array} \right\}.$$

Comparing the FOC with the conjectured trading strategy (I02), we have

$$\gamma = \frac{1 - \lambda\beta - 2\phi\lambda^2\beta}{2\phi\lambda^2 + 2\lambda}\delta, \tag{I06}$$

$$\alpha = \frac{1 - \lambda\beta - 2\phi\lambda^2\beta}{2\phi\lambda^2 + 2\lambda}(1-\delta)\frac{\rho\sigma_v}{\sigma_T} + \frac{\phi}{1+\phi\lambda}, \tag{I07}$$

$$\eta = 2\phi\left(\bar{p}_T - p_0\right). \tag{I08}$$

The SOC for the government $2\phi\lambda^2 + 2\lambda > 0$ holds accordingly if the SOC for the insider (i.e., $\lambda > 0$) holds.

Third, we examine the market maker's problem. The market maker observes the aggregate order flow y and sets $p = E[v|y]$. Using E quations (I01)-(I03) and the projection theorem, we have

$$\lambda = \frac{(\beta+\gamma)\sigma_v^2 + \alpha\rho\sigma_v\sigma_T}{(\beta+\gamma)^2\sigma_v^2 + \gamma^2\sigma_\varepsilon^2 + \alpha^2\sigma_T^2 + \sigma_u^2 + 2(\beta+\gamma)\alpha\rho\sigma_v\sigma_T}. \tag{I09}$$

Fourth, we use the similar procedure in the proof of Theorem 1 to solve the system composed of Equations (I05)-(I09) as a polynomial about λ presented in the following Proposition S4, with the following coefficients:

$$\begin{aligned}
a_6 &= [4-2\delta-2(1-\delta)\rho^2]^2\phi^4\sigma_u^2, \\
a_5 &= 2(4-2\delta-2(1-\delta)\rho^2)(8-3\delta-3(1-\delta)\rho^2)\phi^3\sigma_u^2, \\
a_4 &= \left(\begin{array}{c} \phi^4\sigma_v^2[(8-4\delta)(1-\delta)\rho^2+4\delta-4-4(1-\delta)^2\rho^4]+\phi^4\sigma_T^2[4(\delta-3)(1-\delta)\rho^2+(4-2\delta)^2] \\ +\phi^4\rho\sigma_v\sigma_T[20\delta-8\delta^2-16+(12-20\delta+8\delta^2)\rho^2]+\phi^4\delta^2\sigma_\varepsilon^2(4-8\rho\sigma_T/\sigma_v+4\rho^2\sigma_T^2/\sigma_v^2) \\ +[(8-3\delta-3(1-\delta)\rho^2)^2+2(4-2\delta-2(1-\delta)\rho^2)(4-\delta-(1-\delta)\rho^2)]\phi^2\sigma_u^2 \end{array}\right), \\
a_3 &= \left(\begin{array}{c} \phi^3\sigma_v^2\left[-16+14\delta-2\delta^2+\left(8\delta^2-26\delta+18\right)\rho^2+\left(-6+12\delta-6\delta^2\right)\rho^4\right]+ \\ \phi^3\sigma_T^2\left[4(2-\delta)(4-\delta)+(-24+24\delta-4\delta^2)\rho^2\right]+\phi^3\delta^2\sigma_\varepsilon^2\left(4-8\rho\sigma_T/\sigma_v+4\rho^2\sigma_T^2/\sigma_v^2\right) \\ +\phi^3\rho\sigma_v\sigma_T\left[26\delta-24-8\delta^2+(18-26\delta+8\delta^2)\rho^2\right] \\ +2\phi\sigma_u^2(4-\delta-(1-\delta)\rho^2)(8-3\delta-3(1-\delta)\rho^2) \end{array}\right), \\
a_2 &= \left(\begin{array}{c} \phi^2\sigma_v^2[-24+18\delta-4\delta^2+(15-20\delta+5\delta^2)\rho^2-(1-2\delta+\delta^2)\rho^4]+ \\ \phi^2\sigma_T^2[(4-\delta)^2+(-12+8\delta-\delta^2)\rho^2]+\phi^2\rho\sigma_v\sigma_T[(2\delta-2\delta^2)\rho^2+2\delta^2-2\delta] \\ +\phi^2\delta^2\sigma_\varepsilon^2(-3+2\rho\sigma_T/\sigma_v+\rho^2\sigma_T^2/\sigma_v^2)+[4-\delta-(1-\delta)\rho^2]^2\sigma_u^2 \end{array}\right), \\
a_1 &= \left(\begin{array}{c} \phi\sigma_v^2[-16+10\delta-2\delta^2+(8-10\delta+2\delta^2)\rho^2]+ \\ \phi\delta^2\sigma_\varepsilon^2(-2+2\rho\sigma_T/\sigma_v)+\phi\rho\sigma_v\sigma_T\left[2\delta^2-8\delta+8+(-6+8\delta-2\delta^2)\rho^2\right] \end{array}\right), \\
a_0 &= [2\delta-4+(3-4\delta+\delta^2)\rho^2-(1-2\delta+\delta^2)\rho^4]\sigma_v^2+\delta^2\sigma_\varepsilon^2.
\end{aligned}$$

Finally, we compute those theoretical moments listed in the following

Proposition S4 *A linear pure strategy equilibrium is defined by five unknowns β, γ, α, η and λ, which are characterized by five equations (**??**)-(**??**), together with one SOC, $\lambda > 0$. The equation system can be changed as a polynomial of λ. Specifically, λ solves the following* *polynomial:*

$$a_6\lambda^6 + a_5\lambda^5 + a_4\lambda^4 + a_3\lambda^3 + a_2\lambda^2 + a_1\lambda + a_0 = 0,$$

where the coefficients $a_i's$ are listed above. All the other variables can be solved as expressions for λ as follows:

$$\begin{aligned}
\beta &= \frac{2\phi\lambda + 2 - [\delta + (1-\delta)\rho^2] - 2\phi\lambda\frac{\rho\sigma_T}{\sigma_v}}{4\phi\lambda^2 + 4\lambda - [\delta + (1-\delta)\rho^2](\lambda + 2\phi\lambda^2)}, \\
\gamma &= \frac{1 - 2\phi\lambda + (\lambda + 2\phi\lambda^2)\frac{\rho\sigma_T}{\sigma_v}\frac{\phi}{1+\phi\lambda}}{4\phi\lambda^2 + 4\lambda - [\delta + (1-\delta)\rho^2](\lambda + 2\phi\lambda^2)}\delta, \\
\alpha &= \frac{1 - 2\phi\lambda + (\lambda + 2\phi\lambda^2)\frac{\rho\sigma_T}{\sigma_v}\frac{\phi}{1+\phi\lambda}}{4\phi\lambda^2 + 4\lambda - [\delta + (1-\delta)\rho^2](\lambda + 2\phi\lambda^2)}(1-\delta)\frac{\rho\sigma_v}{\sigma_T} + \frac{\phi}{1+\phi\lambda}, \\
\eta &= 2\phi(\bar{p}_T - p_0),
\end{aligned}$$

where $\delta \equiv \frac{cov(v,s|p_T)}{var(s|p_T)} = \frac{(1-\rho^2)\sigma_v^2}{(1-\rho^2)\sigma_v^2+\sigma_\varepsilon^2}$. Then, the measure of price stability is

$$E[(p - p_T)^2] = \lambda(\beta + \gamma)\sigma_v^2 + (1 - 2\lambda\alpha)\sigma_T^2 + \lambda[\alpha - 2(\beta + \gamma)]\rho\sigma_v\sigma_T + (p_0 - \bar{p}_T)^2.$$

The measure of price discovery/efficiency is

$$var(v|p) = var(v|y) = [1 - \lambda(\beta + \gamma)]\sigma_v^2 - \lambda\alpha\rho\sigma_v\sigma_T.$$

The expected profit of the insider and expected cost of the government are, respectively,

$$\begin{aligned}
E(\pi) &= [1 - \lambda(\beta + \gamma)]\beta\sigma_v^2 - \lambda\alpha\beta\rho\sigma_v\sigma_T, \\
E(c) &= [\lambda(\beta + \gamma) - 1]\gamma\sigma_v^2 + \lambda\gamma^2\sigma_\varepsilon^2 + \lambda\alpha^2\sigma_T^2 + (\lambda\beta + 2\lambda\gamma - 1)\alpha\rho\sigma_v\sigma_T.
\end{aligned}$$

The correlation coefficient of the trading positions between the insider and the government is

$$corr(x, g) = \frac{\beta\gamma\sigma_v^2 + \beta\alpha\rho\sigma_v\sigma_T}{\sqrt{\beta^2\sigma_v^2\left[\gamma^2\left(\sigma_v^2 + \sigma_\varepsilon^2\right) + \alpha^2\sigma_T^2 + 2\gamma\alpha\rho\sigma_v\sigma_T\right]}}.$$

Releasing the price target

In this case, we assume that the government releases the price target signal before trading. With the enlarged information set $\{v, p_T\}$, the insider's maximization problem is changed as

follows:

$$\max_{\{x\}} E[(v-p)x|v,p_T]. \tag{J01}$$

Moreover, the market maker also sees the signal released by the government, $\{p_T\}$, and uses her new information set $\{y, p_T\}$ to update the conditional expectations about the fundamentals. Thus, the pricing rule of market efficiency is transformed into

$$p = E(v|y,p_T). \tag{J02}$$

We conjecture the decision rules for the insider and the government and the pricing rule for the market maker as follows:

$$\begin{aligned} x &= \beta_T(v-p_0)+\xi_T(p_T-\bar{p}_T), && \text{(J03)}\\ g &= \gamma_T(s-p_0)+\alpha_T(p_T-\bar{p}_T)+\eta_T, && \text{(J04)}\\ p &= p_0+\frac{\rho\sigma_v}{\sigma_T}(p_T-\bar{p}_T)+\lambda_T[y-E(y|p_T)], \text{ with } y=x+g+u, && \text{(J05)} \end{aligned}$$

where

$$E(y|p_T) = [(\beta_T+\gamma_T)\frac{\rho\sigma_v}{\sigma_T}+\xi_T+\alpha_T](p_T-\bar{p}_T)+\eta_T.$$

First, we solve the insider's problem. Using Equation (J04) and (J05), we compute

$$\begin{aligned} & E[(v-p)x|v,p_T] \\ = \; & E\left(\left\{\begin{array}{c} v-p_0-\frac{\rho\sigma_v}{\sigma_T}(p_T-\bar{p}_T)-\lambda_T[x+\gamma_T(s-p_0)+\alpha_T(p_T-\bar{p}_T) \\ +\eta_T+u-\left[(\beta_T+\gamma_T)\frac{\rho\sigma_v}{\sigma_T}+\xi_T+\alpha_T\right](p_T-\bar{p}_T)-\eta_T \end{array}\right\} x|v,p_T\right) \\ = \; & \left\{(1-\lambda_T\gamma_T)(v-p_0)-\lambda_T x+\left[\lambda_T\xi_T+(\lambda_T(\beta_T+\gamma_T)-1)\frac{\rho\sigma_v}{\sigma_T}\right](p_T-\bar{p}_T)\right\}x. \end{aligned}$$

The FOC for x yields

$$x = \frac{1-\lambda_T\gamma_T}{2\lambda_T}(v-p_0)+\frac{1}{2\lambda_T}[\lambda_T\xi_T+(\lambda_T(\beta_T+\gamma_T)-1)\frac{\rho\sigma_v}{\sigma_T}](p_T-\bar{p}_T). \tag{J06}$$

The SOC is $\lambda_T > 0$. Comparing the FOC (J06) with the conjectured strategy (J03) leads to

$$\beta_T = \frac{1-\lambda_T\gamma_T}{2\lambda_T}, \tag{J07}$$

$$\xi_T = \frac{\lambda_T \xi_T + [\lambda_T(\beta_T+\gamma_T)-1]\frac{\rho\sigma_v}{\sigma_T}}{2\lambda_T} = (\beta_T+\gamma_T-\frac{1}{\lambda_T})\frac{\rho\sigma_v}{\sigma_T}. \tag{J08}$$

Second, we solve the government's problem. Using Equation (J03) and (J05), the loss function of the government is computed as

$$\begin{aligned}
&E[\phi(p-p_T)^2+(p-v)g|s,p_T] \\
&= \left(\begin{array}{c}
\phi E\left[\left(\begin{array}{c} p_0+\frac{\rho\sigma_v}{\sigma_T}(p_T-\bar{p}_T)+\lambda_T[\beta_T(v-p_0)+\xi_T(p_T-\bar{p}_T)+g \\ +u-((\beta_T+\gamma_T)\frac{\rho\sigma_v}{\sigma_T}+\xi_T+\alpha_T)(p_T-\bar{p}_T)-\eta_T]-p_T \end{array}\right)^2 |s,p_T\right]+ \\
E\left[p_0+\frac{\rho\sigma_v}{\sigma_T}(p_T-\bar{p}_T)+\lambda_T\left(\begin{array}{c} \beta_T(v-p_0)+\xi_T(p_T-\bar{p}_T)+g+u- \\ ((\beta_T+\gamma_T)\frac{\rho\sigma_v}{\sigma_T}+\xi_T+\alpha_T)(p_T-\bar{p}_T)-\eta_T \end{array}\right)-v|s,p_T\right]g
\end{array}\right) \\
&= \left(\begin{array}{c}
\phi\left[p_0-p_T+(\frac{\rho\sigma_v}{\sigma_T}-\lambda_T(\beta_T+\gamma_T)\frac{\rho\sigma_v}{\sigma_T}-\lambda_T\alpha_T)(p_T-\bar{p}_T)+\lambda_T g-\lambda_T\eta_T\right]^2+\phi\lambda_T^2\beta_T^2 E[(v-p_0)^2|s,p_T] \\
+2\phi\lambda_T\beta_T[p_0-p_T+(\frac{\rho\sigma_v}{\sigma_T}-\lambda_T(\beta_T+\gamma_T)\frac{\rho\sigma_v}{\sigma_T}-\lambda_T\alpha_T)(p_T-\bar{p}_T)+\lambda_T g-\lambda_T\eta_T]E(v-p_0|s,p_T)+ \\
\phi\lambda_T^2\sigma_u^2+[(\lambda_T\beta_T-1)E(v-p_0|s,p_T)+\lambda_T g-\lambda_T\eta_T+(\frac{\rho\sigma_v}{\sigma_T}-\lambda_T(\beta_T+\gamma_T)\frac{\rho\sigma_v}{\sigma_T}-\lambda_T\alpha_T)(p_T-\bar{p}_T)]g
\end{array}\right)
\end{aligned}$$

where

$$E(v-p_0|s,p_T) = (1-\delta)\frac{\rho\sigma_v}{\sigma_T}(p_T-\bar{p}_T)+\delta(s-p_0),$$

$$var(v-p_0|s,p_T) = var\,(v-p_0|p_T) - \frac{cov\,(v-p_0,s|p_T)^2}{var\,(s|p_T)} = \frac{(1-\rho^2)\,\sigma_v^2\sigma_\varepsilon^2}{(1-\rho^2)\sigma_v^2+\sigma_\varepsilon^2},$$

$$\begin{aligned}
E\left[(v-p_0)^2|s,p_T\right] &= [E(v-p_0|s,p_T)]^2+var(v-p_0|s,p_T) \\
&= \left[(1-\delta)\frac{\rho\sigma_v}{\sigma_T}(p_T-\bar{p}_T)+\delta(s-p_0)\right]^2+\frac{(1-\rho^2)\,\sigma_v^2\sigma_\varepsilon^2}{(1-\rho^2)\sigma_v^2+\sigma_\varepsilon^2},
\end{aligned}$$

$$\delta \equiv \frac{cov(v,s|p_T)}{var(s|p_T)} = \frac{(1-\rho^2)\sigma_v^2}{(1-\rho^2)\sigma_v^2+\sigma_\varepsilon^2}.$$

The first-order-condition (FOC) for g gives

$$g = \frac{1}{2\phi\lambda_T^2+2\lambda_T}\left\{\begin{array}{c}
(1-\lambda_T\beta_T-2\phi\lambda_T^2\beta_T)\delta(s-p_0)+(2\phi\lambda_T^2+\lambda_T)\eta_T+2\phi\lambda_T(\bar{p}_T-p_0) \\
+\left[\begin{array}{c} (1+2\phi\lambda_T)(\lambda_T\alpha_T-\frac{\rho\sigma_v}{\sigma_T}+\lambda_T(\beta_T+\gamma_T)\frac{\rho\sigma_v}{\sigma_T}) \\ +2\phi\lambda_T+(1-\lambda_T\beta_T-2\phi\lambda_T^2\beta_T)(1-\delta)\frac{\rho\sigma_v}{\sigma_T} \end{array}\right](p_T-\bar{p}_T)
\end{array}\right\}.$$

The SOC is $2\phi\lambda_T^2+2\lambda_T>0$, which holds accordingly if $\lambda_T>0$ holds. Comparing the above

FOC of the government with its conjectured trading strategy (J04), we have

$$\gamma_T = \frac{1 - \lambda_T\beta_T - 2\phi\lambda_T^2\beta_T}{2\phi\lambda_T^2 + 2\lambda_T}\delta, \tag{J09}$$

$$\alpha_T = \frac{(1 + 2\phi\lambda_T)[\lambda_T(\beta_T + \gamma_T) - 1] + (1 - \lambda_T\beta_T - 2\phi\lambda_T^2\beta_T)(1 - \delta)}{\lambda_T}\frac{\rho\sigma_v}{\sigma_T} + 2\phi, \tag{J10}$$

$$\eta_T = \frac{(2\phi\lambda_T^2 + \lambda_T)\eta_T + 2\phi\lambda_T(\bar{p}_T - p_0)}{2\phi\lambda_T^2 + 2\lambda_T} = 2\phi(\bar{p}_T - p_0). \tag{J11}$$

Third, we consider the market maker's problem. By the projection theorem, Equation (J02) gives rise to

$$\begin{aligned} p &= E(v|p_T) + \frac{cov(v, y|p_T)}{var(y|p_T)}[y - E(y|p_T)] \\ &= E(v) + \frac{cov(v, p_T)}{var(p_T)}(p_T - \bar{p}_T) + \frac{cov(v, y|p_T)}{var(y|p_T)}[y - E(y|p_T)] \\ &= p_0 + \frac{\rho\sigma_v}{\sigma_T}(p_T - \bar{p}_T) + \frac{cov(v, y|p_T)}{var(y|p_T)}[y - E(y|p_T)]. \end{aligned}$$

Combining the above equation with Equation (J05) gives us

$$\lambda_T = \frac{cov(v, y|p_T)}{var(y|p_T)} = \frac{(\beta_T + \gamma_T)(1 - \rho^2)\sigma_v^2}{(\beta_T + \gamma_T)^2(1 - \rho^2)\sigma_v^2 + \gamma_T^2\sigma_\varepsilon^2 + \sigma_u^2}. \tag{J12}$$

By a procedure similar to that used to derive the polynomial in Proposition S4, we change the system composed of Equations (J07)-(J12) into the polynomial about λ_T presented in the following Proposition S5, solve other endogenous parameters as functions of λ_T, and compute the moments listed in Proposition S5.

We summarize the equilibrium results in the following

Proposition S5 *If the government releases the price target signal $\{p_T\}$, then a linear equilibrium is defined by six unknowns $(\beta_T, \xi_T, \gamma_T, \alpha_T, \eta_T, \lambda_T) \in R^6$, which are characterized by six equations (J07)-(J12), together with the SOC, $\lambda_T > 0$. The system of equations can be solved as the following fourth-order polynomial for λ_T:*

$$\left(\begin{array}{c} \phi^2(4 - 2\delta)^2\sigma_u^2\lambda_T^4 + 4\phi(2 - \delta)(4 - \delta)\sigma_u^2\lambda_T^3 + \\ [(4 - \delta)^2\sigma_u^2 + 4\phi^2\delta^2\sigma_\varepsilon^2 - 4\phi^2(1 - \delta)(1 - \rho^2)\sigma_v^2]\lambda_T^2 - \\ [4\phi\delta^2\sigma_\varepsilon^2 + (8 + 2\delta^2 - 6\delta)\phi(1 - \rho^2)\sigma_v^2]\lambda_T + \delta^2\sigma_\varepsilon^2 + 2(\delta - 2)(1 - \rho^2)\sigma_v^2 \end{array} \right) = 0.$$

All other endogenous parameters can be solved as expressions of λ_T as follows:

$$\begin{aligned}
\beta_T &= \frac{2\phi\lambda_T + 2 - \delta}{4\phi\lambda_T^2 + 4\lambda_T - (\lambda_T + 2\phi\lambda_T^2)\delta}, \\
\xi_T &= \frac{-2\phi\lambda_T - 2 + \delta}{4\phi\lambda_T^2 + 4\lambda_T - (\lambda_T + 2\phi\lambda_T^2)\delta}\frac{\rho\sigma_v}{\sigma_T}, \\
\gamma_T &= \frac{(1 - 2\phi\lambda_T)\delta}{4\phi\lambda_T^2 + 4\lambda_T - (\lambda_T + 2\phi\lambda_T^2)\delta}, \\
\alpha_T &= \frac{(1 + 2\phi\lambda_T)(-2\phi\lambda_T - 2 + \delta) + (2 + 2\phi\lambda_T)(1 - 2\phi\lambda_T)(1 - \delta)}{4\phi\lambda_T^2 + 4\lambda_T - (\lambda_T + 2\phi\lambda_T^2)\delta}\frac{\rho\sigma_v}{\sigma_T} + 2\phi, \\
\eta_T &= 2\phi(\bar{p}_T - p_0),
\end{aligned}$$

where $\delta \equiv \frac{(1-\rho^2)\sigma_v^2}{(1-\rho^2)\sigma_v^2+\sigma_\varepsilon^2}$. The measure of price stability is then

$$E[(p - p_T)^2] = \lambda_T(\beta_T + \gamma_T)(1 - \rho^2)\sigma_v^2 + \rho^2\sigma_v^2 + \sigma_T^2 - 2\rho\sigma_v\sigma_T + (p_0 - \bar{p}_T)^2.$$

The measure of price discovery/efficiency is

$$var(v|p) = [1 - \lambda_T(\beta_T + \gamma_T)](1 - \rho^2)\sigma_v^2.$$

The expected profits of the insider and expected costs of the government are as follows:

$$\begin{aligned}
E(\pi) &= [1 - \lambda_T(\beta_T + \gamma_T)]\beta_T(1 - \rho^2)\sigma_v^2, \\
E(c) &= [\lambda_T(\beta_T + \gamma_T) - 1]\gamma_T(1 - \rho^2)\sigma_v^2 + \lambda_T\gamma_T^2\sigma_\varepsilon^2.
\end{aligned}$$

The correlation coefficient of the trading positions between the insider and the government is

$$corr\,(x, g) = \frac{\beta_T\gamma_T\sigma_v^2 + (\beta_T\alpha_T + \xi_T\gamma_T)\,\rho\sigma_v\sigma_T + \xi_T\alpha_T\sigma_T^2}{\sqrt{\beta_T^2\sigma_v^2 + \xi_T^2\sigma_T^2 + 2\beta_T\xi_T\rho\sigma_v\sigma_T}\sqrt{\gamma_T^2\,(\sigma_v^2 + \sigma_\varepsilon^2) + \alpha_T^2\sigma_T^2 + 2\gamma_T\alpha_T\rho\sigma_v\sigma_T}}.$$

Releasing the noisy signal about the fundamental

Now, let us suppose that the government releases its noisy signal about the fundamental before trading. With the enlarged information set $\{v, s\}$, the insider's maximization problem is transformed as follows:

$$\max_{\{x\}} E[(v-p)x|v,s].$$

Moreover, observing the signal released by the government, $\{s\}$, the market maker uses the information set $\{y,s\}$ to update her conditional expectations about the fundamentals. Thus, the pricing rule of market efficiency is transformed into

$$p = E(v|y,s). \tag{K01}$$

Let us conjecture, instead, the decision and pricing rules as follows:

$$x = \beta_s(v-p_0)+\xi_s(s-p_0), \tag{K02}$$

$$g = \gamma_s(s-p_0)+\alpha_s(p_T-\bar{p}_T)+\eta_s, \tag{K03}$$

$$p = p_0+\delta_1(s-p_0)+\lambda_s[y-E(y|s)], \text{ with } y=x+g+u, \tag{K04}$$

where

$$\begin{aligned} E(y|s) &= \beta_s E(v-p_0|s)+(\xi_s+\gamma_s)(s-p_0)+\alpha_s E(p_T-\bar{p}_T|s)+\eta_s \\ &= (\beta_s\delta_1+\xi_s+\gamma_s+\alpha_s\delta_2)(s-p_0)+\eta_s. \end{aligned}$$

Firstly, we solve the insider's problem. Using Equations (K03) and (K04), we compute

$$\begin{aligned} & E[(v-p)x|v,s] \\ = \; & E\left\{\left[v-p_0-\delta_1(s-p_0)-\lambda_s\begin{pmatrix} x+\gamma_s(s-p_0)+\alpha_s(p_T-\bar{p}_T)+\eta_s+ \\ u-(\beta_s\delta_1+\xi_s+\gamma_s+\alpha_s\delta_2)(s-p_0)-\eta_s \end{pmatrix}\right]x|v,s\right\} \\ = \; & [v-p_0-\delta_1(s-p_0)-\lambda_s x+\lambda_s(\beta_s\delta_1+\xi_s+\alpha_s\delta_2)(s-p_0)-\lambda_s\alpha_s E(p_T-\bar{p}_T|v,s)]\,x \\ = \; & \left[v-p_0-\lambda_s x-\lambda_s\alpha_s\frac{\rho\sigma_T}{\sigma_v}(v-p_0)+(\lambda_s\beta_s\delta_1+\lambda_s\xi_s+\lambda_s\alpha_s\delta_2-\delta_1)(s-p_0)\right]x, \end{aligned}$$

where

$$E(p_T-\bar{p}_T|v,s)=E(p_T-\bar{p}_T|v)=\frac{\rho\sigma_T}{\sigma_v}(v-p_0).$$

The FOC for x yields

$$x=\frac{1-\lambda_s\alpha_s\rho\sigma_T/\sigma_v}{2\lambda_s}(v-p_0)+\frac{\lambda_s\beta_s\delta_1+\lambda_s\xi_s+\lambda_s\alpha_s\delta_2-\delta_1}{2\lambda_s}(s-p_0).$$

The SOC is $\lambda_s > 0$. Comparing the FOC with the conjectured strategy (K02) leads to

$$\beta_s = \frac{1-\lambda_s\alpha_s\frac{\rho\sigma_T}{\sigma_v}}{2\lambda_s} = \frac{1}{2\lambda_s} - \frac{\alpha_s}{2}\frac{\rho\sigma_T}{\sigma_v}, \tag{K05}$$

$$\xi_s = \frac{\lambda_s\beta_s\delta_1 + \lambda_s\xi_s + \lambda_s\alpha_s\delta_2 - \delta_1}{2\lambda_s} = -\frac{\delta_1}{2\lambda_s} - \frac{\delta_1\alpha_s}{2}\frac{\rho\sigma_T}{\sigma_v} + \alpha_s\delta_2, \tag{K06}$$

Secondly, we solve the government's problem. Using Equations (K02) and (K04), the objective function of the government is derived as

$$E[\phi(p-p_T)^2 + (p-v)g|s,p_T]$$
$$= \left(\begin{array}{c} \phi\{p_0 - p_T - \lambda_s\eta_s + \lambda_s g + [\delta_1 - \lambda_s(\beta_s\delta_1 + \gamma_s + \alpha_s\delta_2)](s-p_0)\}^2 + \\ 2\phi\lambda_s\beta_s\{p_0 - p_T - \lambda_s\eta_s + \lambda_s g + [\delta_1 - \lambda_s(\beta_s\delta_1 + \gamma_s + \alpha_s\delta_2)](s-p_0)\}E[v-p_0|s,p_T] \\ +\phi\lambda_s^2\sigma_u^2 + \phi\lambda_s^2\beta_s^2 E[(v-p_0)^2|s,p_T] + \lambda_s g^2 - \lambda_s\eta_s g + \\ [\delta_1 - \lambda_s(\beta_s\delta_1 + \gamma_s + \alpha_s\delta_2)](s-p_0)g + (\lambda_s\beta_s - 1)E[v-p_0|s,p_T]g \end{array}\right),$$

where

$$E[v-p_0|s,p_T] = (1-\delta)\frac{\rho\sigma_v}{\sigma_T}(p_T - \bar{p}_T) + \delta(s-p_0),$$

$$\delta \equiv \frac{(1-\rho^2)\sigma_v^2}{(1-\rho^2)\sigma_v^2 + \sigma_\varepsilon^2}.$$

The FOC for g yields:

$$g = \frac{1}{2\phi\lambda_s^2 + 2\lambda_s}\left(\begin{array}{c} [(1-\lambda_s\beta_s - 2\phi\lambda_s^2\beta_s)\delta + (1+2\phi\lambda_s)(\lambda_s\beta_s\delta_1 + \lambda_s\gamma_s + \lambda_s\alpha_s\delta_2 - \delta_1)](s-p_0) \\ +[(1-\lambda_s\beta_s - 2\phi\lambda_s^2\beta_s)(1-\delta)\frac{\rho\sigma_v}{\sigma_T} + 2\phi\lambda_s](p_T - \bar{p}_T) \\ +(2\phi\lambda_s^2 + \lambda_s)\eta_s + 2\phi\lambda_s(\bar{p}_T - p_0) \end{array}\right),$$

The SOC is $2\phi\lambda_s^2 + 2\lambda_s > 0$, which holds accordingly if $\lambda_s > 0$ holds. Comparing Equation (K03) with the FOC w.r.t g, we obtain

$$\gamma_s = \frac{(1-\lambda_s\beta_s - 2\phi\lambda_s^2\beta_s)\delta + (1+2\phi\lambda_s)(\lambda_s\beta_s\delta_1 + \lambda_s\gamma_s + \lambda_s\alpha_s\delta_2 - \delta_1)}{2\phi\lambda_s^2 + 2\lambda_s}, \tag{K07}$$

$$\alpha_s = \frac{(1-\lambda_s\beta_s - 2\phi\lambda_s^2\beta_s)(1-\delta)\frac{\rho\sigma_v}{\sigma_T} + 2\phi\lambda_s}{2\phi\lambda_s^2 + 2\lambda_s}, \tag{K08}$$

$$\eta_s = \frac{2\phi\lambda_s(\bar{p}_T - p_0) + (2\phi\lambda_s^2 + \lambda_s)\eta_s}{2\phi\lambda_s^2 + 2\lambda_s} = 2\phi(\bar{p}_T - p_0), \tag{K09}$$

Thirdly, we consider the market maker's problem. By the projection theorem, Equation (K01) gives rise to

$$p = E(v|s) + \frac{cov(v,y|s)}{var(y|s)}[y - E(y|s)] = p_0 + \delta_1(s - p_0) + \frac{cov(v,y|s)}{var(y|s)}[y - E(y|s)],$$

where

$$\begin{aligned}
& \frac{cov(v,y|s)}{var(y|s)} \\
= \; & \frac{cov(v - E(v|s), y - E(y|s))}{var(y - E(y|s))} \\
= \; & \frac{cov(v - p_0 - \delta_1(s - p_0), \beta_s(v - p_0) + \alpha_s(p_T - \bar{p}_T) + u - (\beta_s\delta_1 + \alpha_s\delta_2)(s - p_0))}{var(\beta_s(v - p_0) + \alpha_s(p_T - \bar{p}_T) + u - (\beta_s\delta_1 + \alpha_s\delta_2)(s - p_0))} \\
= \; & \frac{\begin{pmatrix} (1-\delta_1)(\beta_s - \beta_s\delta_1 - \alpha_s\delta_2)\sigma_v^2 + \\ (1-\delta_1)\alpha_s\rho\sigma_v\sigma_T + \delta_1(\beta_s\delta_1 + \alpha_s\delta_2)\sigma_\varepsilon^2 \end{pmatrix}}{\begin{pmatrix} (\beta_s - \beta_s\delta_1 - \alpha_s\delta_2)^2\sigma_v^2 + (\beta_s\delta_1 + \alpha_s\delta_2)^2\sigma_\varepsilon^2 \\ +\alpha_s^2\sigma_T^2 + \sigma_u^2 + 2(\beta_s - \beta_s\delta_1 - \alpha_s\delta_2)\alpha_s\rho\sigma_v\sigma_T \end{pmatrix}}.
\end{aligned}$$

Combining Equations (K04) and the above equation gives us

$$\lambda_s = \frac{cov(v,y|s)}{var(y|s)} = \frac{\begin{pmatrix} (1-\delta_1)(\beta_s - \beta_s\delta_1 - \alpha_s\delta_2)\sigma_v^2 + \\ (1-\delta_1)\alpha_s\rho\sigma_v\sigma_T + \delta_1(\beta_s\delta_1 + \alpha_s\delta_2)\sigma_\varepsilon^2 \end{pmatrix}}{\begin{pmatrix} (\beta_s - \beta_s\delta_1 - \alpha_s\delta_2)^2\sigma_v^2 + (\beta_s\delta_1 + \alpha_s\delta_2)^2\sigma_\varepsilon^2 \\ +\alpha_s^2\sigma_T^2 + \sigma_u^2 + 2(\beta_s - \beta_s\delta_1 - \alpha_s\delta_2)\alpha_s\rho\sigma_v\sigma_T \end{pmatrix}}. \tag{K10}$$

We solve the system composed of Equations (K05)-(K10) as a polynomial about λ_s, presented in the following Proposition S6, where the coefficients are as follows:

$$
\begin{aligned}
a_4 &= 4\phi^2[2-(1-\delta)\rho^2]^2\sigma_u^2, a_3 = 4\phi[2-(1-\delta)\rho^2][4-(1-\delta)\rho^2]\sigma_u^2, \\
a_2 &= \left(\begin{array}{c} [4-(1-\delta)\rho^2]^2\sigma_u^2 + 4\phi^2[(1-\delta)\rho^2 - \frac{\rho\sigma_T}{\sigma_v} - 1](1-\frac{\rho\sigma_T}{\sigma_v})[(1-\delta_1)^2\sigma_v^2 + \delta_1^2\sigma_\varepsilon^2] - \\ 4\phi^2[-2\frac{\rho\sigma_T}{\sigma_v} + (1-\delta)\rho^2][2-(1-\delta)\frac{\rho\sigma_v}{\sigma_T}][(1-\delta_1)\delta_2\sigma_v^2 - \delta_1\delta_2\sigma_\varepsilon^2 - (1-\delta_1)\rho\sigma_v\sigma_T] \\ +4\phi^2[2-(1-\delta)\frac{\rho\sigma_v}{\sigma_T}]^2(\delta_2^2\sigma_v^2 + \delta_2^2\sigma_\varepsilon^2 + \sigma_T^2 - 2\delta_2\rho\sigma_v\sigma_T) \end{array}\right), \\
a_1 &= \left(\begin{array}{c} 2\phi\{[(1-\delta)\rho^2 - \frac{\rho\sigma_T}{\sigma_v} - 1][2-(1-\delta)\rho^2] - 2(1-\frac{\rho\sigma_T}{\sigma_v})\}[(1-\delta_1)^2\sigma_v^2 + \delta_1^2\sigma_\varepsilon^2] - \\ 2\phi\left[\begin{array}{c} \left(-2\frac{\rho\sigma_T}{\sigma_v} + (1-\delta)\rho^2\right)(1-\delta)\frac{\rho\sigma_v}{\sigma_T} \\ -(1-\delta)\rho^2\left(2-(1-\delta)\frac{\rho\sigma_v}{\sigma_T}\right) \end{array}\right][(1-\delta_1)\delta_2\sigma_v^2 - \delta_1\delta_2\sigma_\varepsilon^2 - (1-\delta_1)\rho\sigma_v\sigma_T] \\ +4\phi[2-(1-\delta)\frac{\rho\sigma_v}{\sigma_T}](1-\delta)\frac{\rho\sigma_v}{\sigma_T}(\delta_2^2\sigma_v^2 + \delta_2^2\sigma_\varepsilon^2 + \sigma_T^2 - 2\delta_2\rho\sigma_v\sigma_T) \end{array}\right), \\
a_0 &= \left(\begin{array}{c} -2\left[2-(1-\delta)\rho^2\right]\left[(1-\delta_1)^2\sigma_v^2 + \delta_1^2\sigma_\varepsilon^2\right] + \\ (1-\delta)^2\rho^2\frac{\rho\sigma_v}{\sigma_T}\left[(1-\delta_1)\delta_2\sigma_v^2 - \delta_1\delta_2\sigma_\varepsilon^2 - (1-\delta_1)\rho\sigma_v\sigma_T\right] \\ +(1-\delta)^2\frac{\rho^2\sigma_v^2}{\sigma_T^2}(\delta_2^2\sigma_v^2 + \delta_2^2\sigma_\varepsilon^2 + \sigma_T^2 - 2\delta_2\rho\sigma_v\sigma_T) \end{array}\right).
\end{aligned}
$$

Finally, through substitutions, we solve the other parameters as functions of λ_s and computed the moments listed in the following

Proposition S6 *If the government releases the noisy signal about the fundamental $\{s\}$, then a linear equilibrium is defined by six unknowns $(\beta_s, \xi_s, \gamma_s, \alpha_s, \eta_s, \lambda_s) \in R^6$, which are characterized by six equations (K05)-(K10), together with one SOC, $\lambda_s > 0$. The system of equations degenerates to the following fourth-order polynomial for λ_s:*

$$a_4\lambda_s^4 + a_3\lambda_s^3 + a_2\lambda_s^2 + a_1\lambda_s + a_0 = 0,$$

where coefficients a_i's are listed above. All the other variables can be solved as expressions *of* λ_s *as follows:*

$$\begin{aligned}
\beta_s &= \frac{2\phi\lambda_s(1-\frac{\rho\sigma_T}{\sigma_v})+2-(1-\delta)\rho^2}{4\phi\lambda_s^2+4\lambda_s-(\lambda_s+2\phi\lambda_s^2)(1-\delta)\rho^2}, \\
\xi_s &= -\frac{2\phi\lambda_s[1-(1-\delta)\rho^2+\frac{\rho\sigma_T}{\sigma_v}]+2}{4\phi\lambda_s^2+4\lambda_s-(\lambda_s+2\phi\lambda_s^2)(1-\delta)\rho^2}\delta_1+\frac{(1-2\phi\lambda_s)(1-\delta)\frac{\rho\sigma_v}{\sigma_T}+4\phi\lambda_s}{4\phi\lambda_s^2+4\lambda_s-(\lambda_s+2\phi\lambda_s^2)(1-\delta)\rho^2}\delta_2, \\
\gamma_s &= (1+2\phi\lambda_s)\begin{pmatrix} -\frac{2\phi\lambda_s[1-(1-\delta)\rho^2+\frac{\rho\sigma_T}{\sigma_v}]+2}{4\phi\lambda_s^2+4\lambda_s-(\lambda_s+2\phi\lambda_s^2)(1-\delta)\rho^2}\delta_1 \\ +\frac{(1-2\phi\lambda_s)(1-\delta)\frac{\rho\sigma_v}{\sigma_T}+4\phi\lambda_s}{4\phi\lambda_s^2+4\lambda_s-(\lambda_s+2\phi\lambda_s^2)(1-\delta)\rho^2}\delta_2 \end{pmatrix}+\frac{\left[(-2\phi\lambda_s-4\phi^2\lambda_s^2)(1-\frac{\rho\sigma_T}{\sigma_v})+2\right]\delta}{4\phi\lambda_s^2+4\lambda_s-(\lambda_s+2\phi\lambda_s^2)(1-\delta)\rho^2}, \\
\alpha_s &= \frac{(1-2\phi\lambda_s)(1-\delta)\frac{\rho\sigma_v}{\sigma_T}+4\phi\lambda_s}{4\phi\lambda_s^2+4\lambda_s-(\lambda_s+2\phi\lambda_s^2)(1-\delta)\rho^2}, \\
\eta_s &= 2\phi(\bar{p}_T-p_0),
\end{aligned}$$

where $\delta_1 \equiv \frac{\sigma_v^2}{\sigma_v^2+\sigma_\varepsilon^2}$, $\delta_2 \equiv \frac{\rho\sigma_v\sigma_T}{\sigma_v^2+\sigma_\varepsilon^2}$, and $\delta \equiv \frac{(1-\rho^2)\sigma_v^2}{(1-\rho^2)\sigma_v^2+\sigma_\varepsilon^2}$. *The measure of price stability is then*

$$E[(p-p_T)^2] = \begin{pmatrix} [\delta_1^2+\lambda_s(1+\delta_1)(\beta_s-\beta_s\delta_1-\alpha_s\delta_2)]\sigma_v^2+(1-2\lambda_s\alpha_s)\sigma_T^2 \\ +[\lambda_s\alpha_s(1+\delta_1)-2\delta_1-2\lambda_s(\beta_s-\beta_s\delta_1-\alpha_s\delta_2)]\rho\sigma_v\sigma_T \\ +[\delta_1^2-\lambda_s\delta_1(\beta_s\delta_1+\alpha_s\delta_2)]\sigma_\varepsilon^2+(p_0-\bar{p}_T)^2 \end{pmatrix}.$$

The measure of price discovery/efficiency is

$$var(v|p) = \frac{\begin{pmatrix} \lambda_s(\beta_s-\beta_s\delta_1-\alpha_s\delta_2)[1-\delta_1-\lambda_s(\beta_s-\beta_s\delta_1-\alpha_s\delta_2)]\sigma_v^2+[\delta_1^2-\lambda_s\delta_1(\beta_s\delta_1 \\ +\alpha_s\delta_2)]\sigma_\varepsilon^2+\lambda_s[1-\delta_1-2\lambda_s(\beta_s-\beta_s\delta_1-\alpha_s\delta_2)]\alpha_s\rho\sigma_v\sigma_T-\lambda_s^2\alpha_s^2\rho^2\sigma_T^2 \end{pmatrix}}{\begin{pmatrix} [\delta_1^2+\lambda_s(1+\delta_1)(\beta_s-\beta_s\delta_1-\alpha_s\delta_2)]\sigma_v^2+[\delta_1^2-\lambda_s\delta_1(\beta_s\delta_1+\alpha_s\delta_2)]\sigma_\varepsilon^2 \\ +\lambda_s(1+\delta_1)\alpha_s\rho\sigma_v\sigma_T \end{pmatrix}}\sigma_v^2.$$

The expected profit of the insider and expected cost of the government are, respectively,

$$E(\pi) = \begin{pmatrix} [1-\delta_1-\lambda_s(\beta_s-\beta_s\delta_1-\alpha_s\delta_2)](\beta_s+\xi_s)\sigma_v^2+ \\ [\lambda_s(\beta_s\delta_1+\alpha_s\delta_2)-\delta_1]\xi_s\sigma_\varepsilon^2-\lambda_s\alpha_s(\beta_s+\xi_s)\rho\sigma_v\sigma_T \end{pmatrix},$$

$$E(c) = \begin{pmatrix} [\lambda_s(\beta_s-\beta_s\delta_1-\alpha_s\delta_2)+\delta_1-1](\gamma_s\sigma_v^2+\alpha_s\rho\sigma_v\sigma_T)+ \\ [\delta_1-\lambda_s(\beta_s\delta_1+\alpha_s\delta_2)]\gamma_s\sigma_\varepsilon^2+\lambda_s\alpha_s\gamma_s\rho\sigma_v\sigma_T+\lambda_s\alpha_s^2\sigma_T^2 \end{pmatrix}.$$

The correlation coefficient of the trading positions between the insider and the government

is

$$corr\,(x,g) = \frac{(\beta_s+\xi_s)\,\gamma_s\sigma_v^2 + (\beta_s+\xi_s)\,\alpha_s\rho\sigma_v\sigma_T + \xi_s\gamma_s\sigma_\varepsilon^2}{\sqrt{(\beta_s+\xi_s)^2\,\sigma_v^2 + \xi_s^2\sigma_\varepsilon^2}\sqrt{\gamma_s^2\,(\sigma_v^2+\sigma_\varepsilon^2) + \alpha_s^2\sigma_T^2 + 2\alpha_s\gamma_s\rho\sigma_v\sigma_T}}.$$

Releasing two private signals

Let us suppose that the government releases the price target and its noisy signal about the fundamental before trading. With the enlarged information set $\{v, p_T, s\}$, the insider's maximization problem is transformed as follows:

$$\max_{\{x\}} E[(v-p)x|v, p_T, s].$$

In this case, the market maker sees both signals released by the government and uses her new information set $\{y, p_T, s\}$ to update her conditional expectations about the fundamentals. Then, the pricing rule of market efficiency is transformed into

$$p = E(v|y, p_T, s). \tag{L01}$$

Let us conjecture the decision and pricing rules of the economy:

$$x = \beta_{s,T}(v-p_0) + \xi_{s,T}^{(1)}(s-p_0) + \xi_{s,T}^{(2)}(p_T-\bar{p}_T), \tag{L02}$$

$$g = \gamma_{s,T}(s-p_0) + \alpha_{s,T}(p_T-\bar{p}_T) + \eta_{s,T}, \tag{L03}$$

$$p = p_0 + (1-\delta)\frac{\rho\sigma_v}{\sigma_T}(p_T-\bar{p}_T) + \delta(s-p_0) + \lambda_{s,T}[y - E(y|s,p_T)],\ \text{with } y = x+g+u, \tag{L04}$$

where

$$\begin{aligned} E(y|s,p_T) &= \beta_{s,T}E(v-p_0|s,p_T) + (\xi_{s,T}^{(1)}+\gamma_{s,T})(s-p_0) + (\xi_{s,T}^{(2)}+\alpha_{s,T})(p_T-\bar{p}_T) + \eta_{s,T} \\ &= \begin{pmatrix} \beta_{s,T}\left[(1-\delta)\frac{\rho\sigma_v}{\sigma_T}(p_T-\bar{p}_T) + \delta(s-p_0)\right] \\ +(\xi_{s,T}^{(1)}+\gamma_{s,T})(s-p_0) + (\xi_{s,T}^{(2)}+\alpha_{s,T})(p_T-\bar{p}_T) + \eta_{s,T} \end{pmatrix}, \end{aligned}$$

$$\delta \equiv \frac{cov(v,s|p_T)}{var(s|p_T)} = \frac{(1-\rho^2)\,\sigma_v^2}{(1-\rho^2)\,\sigma_v^2+\sigma_\varepsilon^2}.$$

First of all, we solve the insider's problem. Using Equations (L03) and (L04), we compute

$$
\begin{aligned}
& E[(v-p)x|v,p_T,s] \\
= \; & E\left[\left(\begin{array}{c} v-p_0-(1-\delta)\frac{\rho\sigma_v}{\sigma_T}(p_T-\bar{p}_T)-\delta(s-p_0) \\ -\lambda_{s,T}\left(\begin{array}{c} x+\gamma_{s,T}(s-p_0)+\alpha_{s,T}(p_T-\bar{p}_T)+\eta_{s,T}+u \\ -\beta_{s,T}[(1-\delta)\frac{\rho\sigma_v}{\sigma_T}(p_T-\bar{p}_T)+\delta(s-p_0)] \\ -(\xi_{s,T}^{(1)}+\gamma_{s,T})(s-p_0)-(\xi_{s,T}^{(2)}+\alpha_{s,T})(p_T-\bar{p}_T)-\eta_{s,T} \end{array}\right) \end{array}\right) x|v,p_T,s\right] \\
= \; & \left(\begin{array}{c} v-p_0-(1-\delta)\frac{\rho\sigma_v}{\sigma_T}(p_T-\bar{p}_T)-\delta(s-p_0) \\ -\lambda_{s,T}\left[x-\left(\beta_{s,T}(1-\delta)\frac{\rho\sigma_v}{\sigma_T}+\xi_{s,T}^{(2)}\right)(p_T-\bar{p}_T)-(\beta_{s,T}\delta+\xi_{s,T}^{(1)})(s-p_0)\right] \end{array}\right)x.
\end{aligned}
$$

The FOC for x yields

$$
x=\frac{1}{2\lambda_{s,T}}\left\{\begin{array}{c} v-p_0+\left[(\lambda_{s,T}\beta_{s,T}-1)(1-\delta)\frac{\rho\sigma_v}{\sigma_T}+\lambda_{s,T}\xi_{s,T}^{(2)}\right](p_T-\bar{p}_T) \\ +\left[(\lambda_{s,T}\beta_{s,T}-1)\delta+\lambda_{s,T}\xi_{s,T}^{(1)}\right](s-p_0) \end{array}\right\}.
$$

The SOC is $\lambda_{s,T}>0$. Comparing the above FOC with the conjectured strategy (L02) leads to

$$
\beta_{s,T} = \frac{1}{2\lambda_{s,T}}, \tag{L05}
$$

$$
\xi_{s,T}^{(1)} = \frac{(\lambda_{s,T}\beta_{s,T}-1)\delta+\lambda_{s,T}\xi_{s,T}^{(1)}}{2\lambda_{s,T}}=-\frac{\delta}{2\lambda_{s,T}}, \tag{L06}
$$

$$
\xi_{s,T}^{(2)} = \frac{(\lambda_{s,T}\beta_{s,T}-1)(1-\delta)\frac{\rho\sigma_v}{\sigma_T}+\lambda_{s,T}\xi_{s,T}^{(2)}}{2\lambda_{s,T}}=-\frac{1-\delta}{2\lambda_{s,T}}\frac{\rho\sigma_v}{\sigma_T}. \tag{L07}
$$

Secondly, using Equations (L02) and (L04), the objective function of the government is computed as

$$
\begin{aligned}
& E[\phi(p-p_T)^2+(p-v)g|s,p_T] \\
= & \left(\begin{array}{c}
\phi\left(\begin{array}{c} p_0-p_T-\lambda_{s,T}\eta_{s,T}+\lambda_{s,T}g+\left[(1-\lambda_{s,T}\beta_{s,T})\delta-\lambda_{s,T}\gamma_{s,T}\right](s-p_0) \\ +\left[(1-\lambda_{s,T}\beta_{s,T})(1-\delta)\frac{\rho\sigma_v}{\sigma_T}-\lambda_{s,T}\alpha_{s,T}\right](p_T-\bar{p}_T) \end{array}\right)^2 \\
+\phi\lambda_{s,T}^2\beta_{s,T}^2E[(v-p_0)^2|s,p_T]+\phi\lambda_{s,T}^2\sigma_u^2 \\
+2\phi\lambda_{s,T}\beta_{s,T}\left(\begin{array}{c} p_0-p_T-\lambda_{s,T}\eta_{s,T}+\left[(1-\lambda_{s,T}\beta_{s,T})\delta-\lambda_{s,T}\gamma_{s,T}\right](s-p_0) \\ +\left[(1-\lambda_{s,T}\beta_{s,T})(1-\delta)\frac{\rho\sigma_v}{\sigma_T}-\lambda_{s,T}\alpha_{s,T}\right](p_T-\bar{p}_T)+\lambda_{s,T}g \end{array}\right)E[v-p_0|s,p_T] \\
+\left(\begin{array}{c} (\lambda_{s,T}\beta_{s,T}-1)E[v-p_0|s,p_T]+\left[(1-\lambda_{s,T}\beta_{s,T})(1-\delta)\frac{\rho\sigma_v}{\sigma_T}-\lambda_{s,T}\alpha_{s,T}\right](p_T-\bar{p}_T) \\ +\left[(1-\lambda_{s,T}\beta_{s,T})\delta-\lambda_{s,T}\gamma_{s,T}\right](s-p_0)+\lambda_{s,T}g-\lambda_{s,T}\eta_{s,T} \end{array}\right)g
\end{array}\right),
\end{aligned}
$$

where

$$
E[v-p_0|s,p_T]=(1-\delta)\frac{\rho\sigma_v}{\sigma_T}(p_T-\bar{p}_T)+\delta(s-p_0),
$$

$$
\delta\equiv\frac{cov(v,s|p_T)}{var(s|p_T)}=\frac{(1-\rho^2)\sigma_v^2}{(1-\rho^2)\sigma_v^2+\sigma_\varepsilon^2}.
$$

The first-order-condition (FOC) for g gives rise to

$$
g=\frac{1}{2\phi\lambda_{s,T}^2+2\lambda_{s,T}}\left(\begin{array}{c}
\left(-2\phi\lambda_{s,T}\delta+(1+2\phi\lambda_{s,T})\lambda_{s,T}\gamma_{s,T}\right)(s-p_0) \\
+\left(2\phi\lambda_{s,T}\left[1-(1-\delta)\frac{\rho\sigma_v}{\sigma_T}\right]+(1+2\phi\lambda_{s,T})\lambda_{s,T}\alpha_{s,T}\right)(p_T-\bar{p}_T) \\
+(2\phi\lambda_{s,T}^2+\lambda_{s,T})\eta_{s,T}+2\phi\lambda_{s,T}(\bar{p}_T-p_0)
\end{array}\right),
$$

The SOC is $2\phi\lambda_{s,T}^2+2\lambda_{s,T}>0$, which holds accordingly if $\lambda_{s,T}>0$ holds. Comparing Equation (L03) with the FOC w.r.t g, we obtain

$$
\begin{aligned}
\gamma_{s,T} &= \frac{-2\phi\lambda_{s,T}\delta+(1+2\phi\lambda_{s,T})\lambda_{s,T}\gamma_{s,T}}{2\phi\lambda_{s,T}^2+2\lambda_{s,T}}=-2\phi\delta, && \text{(L08)}\\
\alpha_{s,T} &= \frac{2\phi\lambda_{s,T}\left[1-(1-\delta)\frac{\rho\sigma_v}{\sigma_T}\right]+(1+2\phi\lambda_{s,T})\lambda_{s,T}\alpha_{s,T}}{2\phi\lambda_{s,T}^2+2\lambda_{s,T}}=2\phi\left[1-(1-\delta)\frac{\rho\sigma_v}{\sigma_T}\right], && \text{(L09)}\\
\eta_{s,T} &= \frac{2\phi\lambda_{s,T}(\bar{p}_T-p_0)+(2\phi\lambda_{s,T}^2+\lambda_{s,T})\eta_{s,T}}{2\phi\lambda_{s,T}^2+2\lambda_{s,T}}=2\phi(\bar{p}_T-p_0), && \text{(L10)}
\end{aligned}
$$

Thirdly, we consider the market maker's problem. By the projection theorem, Equation

(L01) gives rise to

$$\begin{aligned} p &= E(v|p_T, s) + \frac{cov(v, y|p_T, s)}{var(y|p_T, s)}[y - E(y|p_T, s)] \\ &= p_0 + (1-\delta)\frac{\rho\sigma_v}{\sigma_T}(p_T - \bar{p}_T) + \delta(s - p_0) + \frac{cov(v, y|p_T, s)}{var(y|p_T, s)}[y - E(y|p_T, s)], \end{aligned}$$

where

$$\begin{aligned} & \frac{cov(v, y|p_T, s)}{var(y|p_T, s)} \\ = & \frac{cov(v - E(v|p_T, s), y - E(y|p_T, s))}{var(y - E(y|p_T, s))} \\ = & \frac{cov\begin{pmatrix} (1-\delta)(v - p_0) - \delta\varepsilon - (1-\delta)\frac{\rho\sigma_v}{\sigma_T}(p_T - \bar{p}_T), \\ \beta_{s,T}(1-\delta)(v - p_0) - \beta_{s,T}\delta\varepsilon - \beta_{s,T}(1-\delta)\frac{\rho\sigma_v}{\sigma_T}(p_T - \bar{p}_T) \end{pmatrix}}{var\left(\beta_{s,T}(1-\delta)(v - p_0) - \beta_{s,T}\delta\varepsilon - \beta_{s,T}(1-\delta)\frac{\rho\sigma_v}{\sigma_T}(p_T - \bar{p}_T) + u\right)} \\ = & \frac{\beta_{s,T}\left[\left(1-\rho^2\right)(1-\delta)^2\sigma_v^2 + \delta^2\sigma_\varepsilon^2\right]}{\beta_{s,T}^2\left[\left(1-\rho^2\right)(1-\delta)^2\sigma_v^2 + \delta^2\sigma_\varepsilon^2\right] + \sigma_u^2}. \end{aligned}$$

Combining Equation (L04) and the above equation gives rise to

$$\lambda_{s,T} = \frac{cov(v, y|s, p_T)}{var(y|s, p_T)} = \frac{\beta_{s,T}\left[\left(1-\rho^2\right)(1-\delta)^2\sigma_v^2 + \delta^2\sigma_\varepsilon^2\right]}{\beta_{s,T}^2\left[\left(1-\rho^2\right)(1-\delta)^2\sigma_v^2 + \delta^2\sigma_\varepsilon^2\right] + \sigma_u^2}. \tag{L11}$$

Finally, substituting Equation (L05) into (L11) leads to the expression for $\lambda_{s,T}$ presented in the following Proposition S7, further substitutions lead to those expressions for $(\beta_{s,T}, \xi_{s,T}^{(1)}, \xi_{s,T}^{(2)}, \gamma_{s,T}, \alpha_{s,T}, \eta_{s,T})$, and we compute the theoretical moments correspondingly.

We summarize the model equilibrium in the following

Proposition S7 *If the government releases two private signals $\{p_T, s\}$, then a linear equilibrium is defined by seven unknowns $(\beta_{s,T}, \xi_{s,T}^{(1)}, \xi_{s,T}^{(2)}, \gamma_{s,T}, \alpha_{s,T}, \eta_{s,T}, \lambda_{s,T}) \in R^7$, which are characterized by seven equations (L05)-(L11), together with one SOC, $\lambda_{s,T} > 0$. The* *system of equations can be solved explicitly as follows:*

$$
\begin{aligned}
\beta_{s,T} &= \frac{\sigma_u}{\sqrt{(1-\rho^2)\,(1-\delta)^2\sigma_v^2+\delta^2\sigma_\varepsilon^2}}, \\
\xi_{s,T}^{(1)} &= -\frac{\delta\sigma_u}{\sqrt{(1-\rho^2)\,(1-\delta)^2\sigma_v^2+\delta^2\sigma_\varepsilon^2}}, \\
\xi_{s,T}^{(2)} &= -\frac{(1-\delta)\sigma_u}{\sqrt{(1-\rho^2)\,(1-\delta)^2\sigma_v^2+\delta^2\sigma_\varepsilon^2}}\frac{\rho\sigma_v}{\sigma_T}, \\
\gamma_{s,T} &= -2\phi\delta, \\
\alpha_{s,T} &= 2\phi\left[1-(1-\delta)\frac{\rho\sigma_v}{\sigma_T}\right], \\
\eta_{s,T} &= 2\phi(\bar{p}_T-p_0), \\
\lambda_{s,T} &= \frac{\sqrt{(1-\rho^2)\,(1-\delta)^2\sigma_v^2+\delta^2\sigma_\varepsilon^2}}{2\sigma_u}.
\end{aligned}
$$

The measure of price stability is then

$$
E[(p-p_T)^2]=\left[\frac{1}{2}(1-\delta)(1+\rho^2)+\delta\right]\sigma_v^2+\sigma_T^2-2\rho\sigma_v\sigma_T+(p_0-\bar{p}_T)^2.
$$

The measure of price discovery/efficiency is

$$
var(v|p)=\frac{(1-\rho^4)(1-\delta)^2\sigma_v^2+2\delta^2\sigma_\varepsilon^2}{2\,(1-\rho^2)\,\delta^2\sigma_v^2+2\,(1+\rho^2)\,\sigma_v^2+2\delta^2\sigma_\varepsilon^2}\sigma_v^2.
$$

The expected profit of the insider and expected cost of the government are, respectively,

$$
E(\pi)=\frac{\sigma_u\sqrt{(1-\rho^2)\,(1-\delta)^2\sigma_v^2+\delta^2\sigma_\varepsilon^2}}{2}, E(c)=0.
$$

The correlation coefficient of the trading positions between the insider and the government is

$$
corr\,(x,g)=0.
$$

S3 Disclosing the trading plan

S3.1 Model and equilibrium

For simplicity, we assume that there is a pre-trade period, in which the government sees its two signals $\{p_T, s\}$, sets up its trading plan $\{g\}$ based on the two signals, and discloses the trading plan to the financial market. When trade occurs, the government with commitment submits the disclosed trading position $\{g\}$ and trades alongside with other market participants.

With the enlarged information set $\{v, g\}$, the insider's maximization problem is changed as follows:

$$\max_{\{x\}} E[(v-p)x|v,g]. \tag{M01}$$

Moreover, the market maker also sees the trading position released by the government, $\{g\}$, and uses her new information set $\{y, g\}$ to update the conditional expectations about the fundamentals. Thus, the pricing rule of market efficiency is transformed into

$$p = E(v|y,g). \tag{M02}$$

Conjecture the decision rules for the insider and the government and the pricing rule for the market maker as follows:

$$\begin{aligned} x &= \beta_g(v-p_0)+\xi_g(g-\eta_g), && \text{(M03)} \\ g &= \gamma_g(s-p_0)+\alpha_g(p_T-\bar{p}_T)+\eta_g, && \text{(M04)} \\ p &= p_0+\delta_g(g-\eta_g)+\lambda_g[y-E(y|g)], \text{ with } y=x+g+u, && \text{(M05)} \end{aligned}$$

where

$$E(y|g) = (\beta_g\delta_g+\xi_g)(g-\eta_g)+g, \delta_g \equiv \frac{\gamma_g\sigma_v^2}{\gamma_g^2\left(\sigma_v^2+\sigma_\varepsilon^2\right)+\alpha_g^2\sigma_T^2}.$$

First of all, we solve the government's problem. Using (M03) and (M05), the loss function of the government is computed as

$$\begin{aligned} & E[\phi(p-p_T)^2+(p-v)g|s,p_T] \\ = & \begin{pmatrix} \phi\lambda_g^2\beta_g^2E[(v-p_0)^2|s,p_T]+\phi\left[(1-\lambda_g\beta_g)\delta_g\left(g-\eta_g\right)-p_T+p_0\right]^2 \\ +2\phi\lambda_g\beta_g\left[(1-\lambda_g\beta_g)\delta_g\left(g-\eta_g\right)-p_T+p_0\right]E(v-p_0|s,p_T) \\ +\phi\lambda_g^2\sigma_u^2+\left[\left(\lambda_g\beta_g-1\right)E(v-p_0|s,p_T)+(1-\lambda_g\beta_g)\delta_g\left(g-\eta_g\right)\right]g \end{pmatrix}, \end{aligned}$$

where

$$E(v-p_0|s,p_T) = E(v-p_0|s) = \delta(s-p_0), \delta \equiv \frac{\sigma_v^2}{\sigma_v^2+\sigma_\varepsilon^2}.$$

The FOC for g gives

$$g = \frac{\begin{pmatrix} \left[1-\lambda_g\beta_g - 2\phi\lambda_g\beta_g(1-\lambda_g\beta_g)\delta_g\right]\delta(s-p_0) \\ +2\phi(1-\lambda_g\beta_g)\delta_g\left(p_T-\bar{p}_T\right) \\ +2\phi(1-\lambda_g\beta_g)\delta_g\left(\bar{p}_T-p_0\right) \\ +(1-\lambda_g\beta_g)\delta_g\eta_g + 2\phi(1-\lambda_g\beta_g)^2\delta_g^2\eta_g \end{pmatrix}}{2\phi(1-\lambda_g\beta_g)^2\delta_g^2 + 2(1-\lambda_g\beta_g)\delta_g}.$$

The SOC for g is

$$2\phi(1-\lambda_g\beta_g)^2\delta_g^2 + 2(1-\lambda_g\beta_g)\delta_g > 0. \tag{M06}$$

Comparing the FOC of the government with the conjectured trading strategy of the government (M04), we have

$$\gamma_g = \frac{\left[1-\lambda_g\beta_g - 2\phi\lambda_g\beta_g(1-\lambda_g\beta_g)\delta_g\right]\delta}{2\phi(1-\lambda_g\beta_g)^2\delta_g^2 + 2(1-\lambda_g\beta_g)\delta_g} = \frac{(1-\phi\delta_g)\,\delta}{\phi\delta_g^2+2\delta_g}, \tag{M07}$$

$$\alpha_g = \frac{2\phi(1-\lambda_g\beta_g)\delta_g}{2\phi(1-\lambda_g\beta_g)^2\delta_g^2 + 2(1-\lambda_g\beta_g)\delta_g} = \frac{2\phi}{\phi\delta_g+2}, \tag{M08}$$

$$\eta_g = \frac{\begin{bmatrix} 2\phi(1-\lambda_g\beta_g)\delta_g\left(\bar{p}_T-p_0\right)+ \\ (1-\lambda_g\beta_g)\delta_g\eta_g + 2\phi(1-\lambda_g\beta_g)^2\delta_g^2\eta_g \end{bmatrix}}{2\phi(1-\lambda_g\beta_g)^2\delta_g^2 + 2(1-\lambda_g\beta_g)\delta_g} = 2\phi(\bar{p}_T-p_0). \tag{M09}$$

Secondly, we solve the insider's problem. Using equation (M05), we compute

$$\begin{aligned} & E[(v-p)x|v,g] \\ = \; & E\left[v-p_0-\delta_g(g-\eta_g)-\lambda_g[x-(\beta_g\delta_g+\xi_g)(g-\eta_g)+u]|v,g\right]x \\ = \; & \left\{v-p_0+\left[\left(\lambda_g\beta_g-1\right)\delta_g+\lambda_g\xi_g\right](g-\eta_g)-\lambda_g x\right\}x. \end{aligned}$$

The FOC for x yields

$$x = \frac{1}{2\lambda_g}(v-p_0) + \frac{\left(\lambda_g\beta_g-1\right)\delta_g+\lambda_g\xi_g}{2\lambda_g}\left(g-\eta_g\right). \tag{M10}$$

The SOC for x is $\lambda_g > 0$. Comparing the FOC (M10) with the conjectured strategy (M03) leads to

$$\beta_g = \frac{1}{2\lambda_g}, \tag{M11}$$

$$\xi_g = \frac{\left(\lambda_g\beta_g - 1\right)\delta_g + \lambda_g\xi_g}{2\lambda_g} = -\frac{\delta_g}{2\lambda_g}. \tag{M12}$$

Thirdly, we solve the market maker's problem. By the projection theorem, Equation (M02) gives rise to

$$\begin{aligned} p &= E(v|y,g) = E(v|g) + \frac{cov(v,y|g)}{var(y|g)}\left[y - E\left(y|g\right)\right] \\ &= p_0 + \frac{cov(v,g)}{var(g)}\left(g - \eta_g\right) + \frac{cov(v,y|g)}{var(y|g)}\left[y - E\left(y|g\right)\right], \end{aligned}$$

where

$$\begin{aligned} \frac{cov(v,g)}{var(g)} &= \frac{cov(v,\gamma_g(s-p_0)+\alpha_g(p_T-\bar{p}_T)+\eta_g)}{var(\gamma_g(s-p_0)+\alpha_g(p_T-\bar{p}_T)+\eta_g)} = \frac{\gamma_g\sigma_v^2}{\gamma_g^2(\sigma_v^2+\sigma_\varepsilon^2)+\alpha_g^2\sigma_T^2}, \\ \frac{cov(v,y|g)}{var(y|g)} &= \frac{cov\left(v,\beta_g(v-p_0)+\xi_g(g-\eta_g)+g+u|g\right)}{var\left(\beta_g(v-p_0)+\xi_g(g-\eta_g)+g+u|g\right)} = \frac{\beta_g var(v|g)}{\beta_g^2 var\left(v|g\right)+\sigma_u^2}, \\ var\left(v|g\right) &= var\left(v\right) - \frac{\left[cov\left(v,g\right)\right]^2}{var\left(g\right)} = \left(1 - \frac{cov(v,g)}{var(g)}\gamma_g\right)\sigma_v^2. \end{aligned}$$

Combining it with Equation (M05) gives us

$$\delta_g = \frac{\gamma_g\sigma_v^2}{\gamma_g^2(\sigma_v^2+\sigma_\varepsilon^2)+\alpha_g^2\sigma_T^2}, \tag{M13}$$

$$\lambda_g = \frac{\beta_g\left(1-\delta_g\gamma_g\right)\sigma_v^2}{\beta_g^2\left(1-\delta_g\gamma_g\right)\sigma_v^2+\sigma_u^2}. \tag{M14}$$

Substituting Equations (M07) and (M08) into (M13) leads to

$$\delta_g = \frac{\phi\delta\sigma_v^2 \pm \sqrt{9\phi^2\delta^2\sigma_v^4 + 16\phi^2\delta\sigma_v^2\sigma_T^2}}{4\phi^2\left(\delta\sigma_v^2+2\sigma_T^2\right)}. \tag{M15}$$

Substituting Equation (M1) into (M14) leads to

$$\lambda_g = \frac{\sqrt{\left(1-\delta_g\gamma_g\right)\sigma_v^2}}{2\sigma_u}\left(>0\right),$$

which stems from the SOC (i.e., $\lambda_g > 0$) and $1 - \delta_g\gamma_g = \frac{\gamma_g^2\sigma_\varepsilon^2+\alpha_g^2\sigma_T^2}{\gamma_g^2(\sigma_v^2+\sigma_\varepsilon^2)+\alpha_g^2\sigma_T^2} > 0$. Combining the two SOCs and (M10) establishes that δ_g is positive and thus

$$\delta_g = \frac{\phi\delta\sigma_v^2 + \sqrt{9\phi^2\delta^2\sigma_v^4 + 16\phi^2\delta\sigma_v^2\sigma_T^2}}{4\phi^2\left(\delta\sigma_v^2 + 2\sigma_T^2\right)}. \tag{M16}$$

By substitutions, we solve other endogenous parameters as functions of δ_g.

Finally, we compute the moments. The measure of price stability is solved as

$$\begin{aligned}
&E[(p-p_T)^2]_g \\
=\ & E\left[\left(\begin{array}{c} \lambda_g\beta_g(v-p_0) + \left(\delta_g + \lambda_g\xi_g\right)\gamma_g(s-p_0) + \\ \left(\delta_g + \lambda_g\xi_g\right)\alpha_g(p_T - \bar{p}_T) + \lambda_g u - p_T + p_0 \end{array}\right)^2\right] \\
=\ & E\left[\left(\begin{array}{c} \left(\lambda_g\beta_g + \delta_g\gamma_g + \lambda_g\xi_g\gamma_g\right)(v-p_0) + \left(\delta_g\gamma_g + \lambda_g\xi_g\gamma_g\right)\varepsilon \\ + \left(\delta_g\alpha_g + \lambda_g\xi_g\alpha_g - 1\right)(p_T - \bar{p}_T) + \lambda_g u + (p_0 - \bar{p}_T) \end{array}\right)^2\right] \\
=\ & \frac{1}{2}\left(1 + \delta_g\gamma_g\right)\sigma_v^2 + \left(1 - \delta_g\alpha_g\right)\sigma_T^2 + (p_0 - \bar{p}_T)^2.
\end{aligned}$$

The measure for price discovery/efficiency is

$$\begin{aligned}
var\,(v|p)_g &= var(v) - \frac{[cov(v,p)]^2}{var(p)} \\
&= var(v) - \frac{\left[cov\left(v, \left(\begin{array}{c} p_0 + \lambda_g\beta_g(v-p_0) + \lambda_g u + \\ \left(\delta_g + \lambda_g\xi_g\right)\left[\gamma_g(s-p_0) + \alpha_g(p_T - \bar{p}_T)\right] \end{array}\right)\right)\right]^2}{var\left(\begin{array}{c} p_0 + \lambda_g\beta_g(v-p_0) + \lambda_g u + \\ \left(\delta_g + \lambda_g\xi_g\right)\left[\gamma_g(s-p_0) + \alpha_g(p_T - \bar{p}_T)\right] \end{array}\right)} \\
&= \sigma_v^2 - \frac{\left(\lambda_g\beta_g + \delta_g\gamma_g + \lambda_g\xi_g\gamma_g\right)^2\sigma_v^4}{\left[\begin{array}{c} \left(\lambda_g\beta_g + \delta_g\gamma_g + \lambda_g\xi_g\gamma_g\right)^2\sigma_v^2 + \left(\delta_g\gamma_g + \lambda_g\xi_g\gamma_g\right)^2\sigma_\varepsilon^2 \\ + \lambda_g^2\sigma_u^2 + \left(\delta_g\alpha_g + \lambda_g\xi_g\alpha_g\right)^2\sigma_T^2 \end{array}\right]} \\
&= \frac{1}{2}\left(1 - \delta_g\gamma_g\right)\sigma_v^2.
\end{aligned}$$

The expected profits of the insider and the expected costs of the government are computed as

follows:

$$
\begin{aligned}
E(\pi) &= E[(v-p)x] \\
&= E\left[\begin{pmatrix} v-p_0-\lambda_g\beta_g(v-p_0) \\ -\lambda_g u-\left(\delta_g+\lambda_g\xi_g\right)\left(g-\eta_g\right) \end{pmatrix}\begin{pmatrix} \beta_g(v-p_0) \\ +\xi_g\left(g-\eta_g\right) \end{pmatrix}\right] \\
&= E\left[\begin{pmatrix} \left(1-\lambda_g\beta_g-\delta_g\gamma_g-\lambda_g\xi_g\gamma_g\right)(v-p_0)- \\ \left(\delta_g+\lambda_g\xi_g\right)\gamma_g\varepsilon-\left(\delta_g+\lambda_g\xi_g\right)\alpha_g(p_T-\bar{p}_T) \end{pmatrix}\begin{pmatrix} \left(\beta_g+\xi_g\gamma_g\right)(v-p_0) \\ +\xi_g\gamma_g\varepsilon \\ +\xi_g\alpha_g(p_T-\bar{p}_T) \end{pmatrix}\right] \\
&= \frac{1}{2}\left(1-\delta_g\gamma_g\right)\beta_g\sigma_v^2,
\end{aligned}
$$

$$
\begin{aligned}
E(c) &= E[(p-v)g] \\
&= E\left[\begin{pmatrix} \left(\lambda_g\beta_g-1\right)(v-p_0)+\lambda_g u+ \\ \left(\delta_g+\lambda_g\xi_g\right)\left[\gamma_g(s-p_0)+\alpha_g(p_T-\bar{p}_T)\right] \end{pmatrix}\begin{pmatrix} \gamma_g(s-p_0)+\eta_g \\ +\alpha_g(p_T-\bar{p}_T) \end{pmatrix}\right] \\
&= E\left[\begin{pmatrix} \left(\lambda_g\beta_g-1+\delta_g\gamma_g+\lambda_g\xi_g\gamma_g\right)(v-p_0) \\ +\left(\delta_g\gamma_g+\lambda_g\xi_g\gamma_g\right)\varepsilon \\ +\left(\delta_g\alpha_g+\lambda_g\xi_g\alpha_g\right)(p_T-\bar{p}_T) \end{pmatrix}\begin{pmatrix} \gamma_g(v-p_0)+\gamma_g\varepsilon \\ +\alpha_g(p_T-\bar{p}_T) \end{pmatrix}\right] \\
&= \frac{1}{2}\left(\delta_g\gamma_g-1\right)\gamma_g\sigma_v^2+\frac{1}{2}\delta_g\gamma_g^2\sigma_\varepsilon^2+\frac{1}{2}\delta_g\alpha_g^2\sigma_T^2=0.
\end{aligned}
$$

The correlation coefficient between the trading position of the insider and the government is

$$
\begin{aligned}
corr(x,g) &= \frac{cov(x,g)}{\sqrt{var(x)}\sqrt{var(g)}} \\
&= \frac{cov\left(\begin{pmatrix} \beta_g(v-p_0)+\xi_g\gamma_g(s-p_0) \\ +\xi_g\alpha_g(p_T-\bar{p}_T) \end{pmatrix},\begin{pmatrix} \gamma_g(s-p_0)+\eta_g \\ +\alpha_g(p_T-\bar{p}_T) \end{pmatrix}\right)}{\sqrt{var\begin{pmatrix} \beta_g(v-p_0)+\xi_g\gamma_g(s-p_0) \\ +\xi_g\alpha_g(p_T-\bar{p}_T) \end{pmatrix}}\sqrt{var\begin{pmatrix} \gamma_g(s-p_0)+\eta_g \\ +\alpha_g(p_T-\bar{p}_T) \end{pmatrix}}} \\
&= \frac{\beta_g\gamma_g\sigma_v^2-\beta_g\delta_g\left[\gamma_g^2\left(\sigma_v^2+\sigma_\varepsilon^2\right)+\alpha_g^2\sigma_T^2\right]}{\sqrt{\left(\beta_g+\xi_g\gamma_g\right)^2\sigma_v^2+\xi_g^2\gamma_g^2\sigma_\varepsilon^2+\xi_g^2\alpha_g^2\sigma_T^2}\sqrt{\gamma_g^2\left(\sigma_v^2+\sigma_\varepsilon^2\right)+\alpha_g^2\sigma_T^2}}=0.
\end{aligned}
$$

Then we summarize the above results in the following

Proposition S8 *If the government releases its trading position* $\{g\}$*, a linear equilibrium is defined by seven unknowns* $(\beta_g, \xi_g, \gamma_g, \alpha_g, \eta_g, \delta_g, \lambda_g) \in R^7$*, which are characterized by seven equations (M07)-(M09) and (M11)-(M14), together with two SOCs,* $\lambda_g > 0$ *and Equation (M06). The system of equations can be solved explicity as follows:*

$$\begin{aligned}
\beta_g &= \frac{\sigma_u}{\sqrt{\frac{(1+\delta)\phi\delta_g+2-\delta}{\phi\delta_g+2}\sigma_v^2}}, \xi_g = -\frac{\sigma_u\delta_g}{\sqrt{\frac{(1+\delta)\phi\delta_g+2-\delta}{\phi\delta_g+2}\sigma_v^2}}, \gamma_g = \frac{(1-\phi\delta_g)\,\delta}{\phi\delta_g^2+2\delta_g}, \alpha_g = \frac{2\phi}{\phi\delta_g+2}, \\
\eta_g &= 2\phi(\bar{p}_T - p_0), \lambda_g = \frac{\sqrt{\frac{(1+\delta)\phi\delta_g+2-\delta}{\phi\delta_g+2}\sigma_v^2}}{2\sigma_u}, \delta_g = \frac{\phi\delta\sigma_v^2 + \sqrt{9\phi^2\delta^2\sigma_v^4 + 16\phi^2\delta\sigma_v^2\sigma_T^2}}{4\phi^2\left(\delta\sigma_v^2 + 2\sigma_T^2\right)},
\end{aligned}$$

where $\delta \equiv \frac{\sigma_v^2}{\sigma_v^2+\sigma_\varepsilon^2}$*. The measure of price stability is then*

$$E[(p-p_T)^2]_g = \frac{1}{2}\left(1+\delta_g\gamma_g\right)\sigma_v^2 + (1-\delta_g\alpha_g)\,\sigma_T^2 + (p_0-\bar{p}_T)^2.$$

The measure of price discovery/efficiency is

$$var\,(v|p)_g = \frac{1}{2}\left(1-\delta_g\gamma_g\right)\sigma_v^2.$$

The expected profit of the insider and expected cost of the government are, respectively,

$$E\,(\pi)_g = \frac{1}{2}\left(1-\delta_g\gamma_g\right)\beta_g\sigma_v^2, E\,(c)_g = 0.$$

The correlation coefficient between the trading position of the insider and the government is

$$corr\,(x,g)_g = 0.$$

S3.2 Comparisons among the baseline model, disclosing trading plan and releasing both signals

In this subsection, we make two comparisions. First, we make the distinctions between disclosing the trading plan and releasing both signals. Second, we compare the three cases: the baseline case without communication, releasing both signals, and disclosing the trading plans.

First, since both disclosure scenarios have explicit solutions, as shown in Proposition 3 and Proposition S8, we directly compare their mathematical expressions. Thus, we have the following

Corollary S1 *Compared to the situation of releasing two signals, the government's disclosing the trading plan stabilizes the financial market more effectively, but obtains more inefficient asset prices and less market liquidity. Namely,* $E[(p-p_T)^2]_g < E[(p-p_T)^2]_{p_T,s}$, $1/var\,(v|p)_g < 1/var\,(v|p)_{p_T,s}$, *and* $1/\lambda_g < 1/\lambda_{p_T,s}$.

Proof From Proposition 3 and Proposition S8, we know that

$$\begin{aligned} E[(p-p_T)^2]_g - E[(p-p_T)^2]_{p_T,s} &= \frac{1}{2}\gamma_g\delta_g\sigma_v^2 - \alpha_g\delta_g\sigma_T^2 - \frac{1}{2}\delta\sigma_v^2 \\ &= -\frac{1}{\phi\delta_g+2}\left[\left(\phi\delta_g+\frac{1}{2}\right)\delta\sigma_v^2 + 2\phi\delta_g\sigma_T^2\right] < 0, \end{aligned}$$

$$\lambda_g - \lambda_{p_T,s} = \frac{\sqrt{1-\gamma_g\delta_g}\sigma_v}{2\sigma_u} - \frac{\sqrt{1-\delta}\sigma_v}{2\sigma_u} > 0, \text{ (due to } \delta-\gamma_g\delta_g = \frac{1+2\phi\delta_g}{2+\phi\delta_g}\delta > 0)$$

$$\begin{aligned} var\,(v|p)_g - var\,(v|p)_{p_T,s} &= \frac{1}{2}\left(1-\delta_g\gamma_g - \frac{(1-\delta)^2\sigma_v^2 + 2\delta^2\sigma_\varepsilon^2}{(1+\delta^2)\sigma_v^2+\delta^2\sigma_\varepsilon^2}\right)\sigma_v^2 \\ &= \frac{1}{2}\frac{(\delta-\gamma_g\delta_g)(1+\delta)}{(1+\delta^2)\sigma_v^2+\delta^2\sigma_\varepsilon^2}\sigma_v^4 \\ &= \frac{1}{2}\frac{(1+\delta)\sigma_v^4}{(1+\delta^2)\sigma_v^2+\delta^2\sigma_\varepsilon^2}\frac{1+2\phi\delta_g}{2+\phi\delta_g}\delta > 0.\square \end{aligned}$$

We discuss the intuitions of Proposition S8 and Corollary S1. Releasing both signals implies that the government abandons all its information advantages. However, in the situation of disclosing the trading plan, other market participants cannot know the composition of the government's trading position and the realization of each signal, the government has relative information advantages to the case of releasing both signals. Hence, the government's disclosing the trading plan stabilizes the financial market more effectively than releasing both signals, namely, $E[(p-p_T)^2]_g < E[(p-p_T)^2]_{p_T,s}$. Compared to the policy of disclosing the trading position, price is more efficient in the situation of releasing both signals, since releasing the fundamental signal has dominating positive effects on price efficiency. Government intervention with communication affects market liquidity through an information channel and a noise channel. Relative to the policy of releasing both signals, the policy of disclosing the trading plan has larger negative noise effect on market liquidity. Thus we have $1/\lambda_g < 1/\lambda_{p_T,s}$.

Second, we compare the market performance of government intervention among three cases: the baseline model without communication, disclosing the trading plan and releasing both signals. Since the baseline model has so explicit solutions, we simulate these three cases and plot Figure 10 ($\phi = 1$) and Figure 11 ($\phi = 3$), respectively.

Compared to the baseline setting without information disclosure, as shown in Figure 10 and Figure 11, both disclosure policies negatively affect financial stability. Intuitively, communication, whether disclosing the trading plan or releasing two signals, deteriorates the information advantages of the government and does harm to the stabilizing effect of government intervention on price stability.

Relative to the baseline setting without information disclosure, both disclosure policies improve price efficiency. With enlarged information set (i.e., $\{y, g\}$ or $\{y, p_T, s\}$), the market maker more easily uncovers the economic fundamentals and the price becomes more efficient.

As shown in Section 3.3, the effects on market liquidity of releasing both signals rely on the relative weight placed by the government on its policy motives: if the government places an equal weight on both goals, the positive effects on market liquidity of releasing the fundamental signal dominate and the financial market is deeper; if the government places more weight on its policy goals, the negative effects on market liquidity of releasing the price target dominate, and market liquidity is less than that of the benchmark setting. However, relative to the baseling setting, disclosing the trading plan decreases market liquitity. Intuitively, government intervention affects market liquidity through two channels (noise and information), and in this case the negative noise effect dominates the positive information effect.

[Insert Figure 10 and Figure 11 here.]

S4 Sketch of numerical solutions

Now we provide a sketch of the numerical analysis in this paper. There are eight exogenous variables in the model: the variance in the liquidation value of the risky asset, σ_v^2; variance in noisy trading, σ_u^2; variance of the information noise of the government, σ_ε^2; variance of the price target, σ_T^2; mean of the fundamental value, p_0; mean of the price target, $\bar{p}_T$; policy weight of the government, ϕ; and correlation coefficient between the price target and liquidation value of the fundamental, ρ. For analytical convenience, we make several specifications about these parameters. First, we define $\theta \equiv \sigma_u^2/\sigma_v^2$ as the amount of noisy trading per unit of private information and change its values continuously in $[1, 2]$. Second, we set $\sigma_\varepsilon^2 = \sigma_v^2 = \sigma_T^2 = 1$, which are the same as those used in Pasquariello et al. (2020). Third, p_0 and $\bar{p}_T$ enter only the measure for price volatility $E[(p - p_T)^2]$ as their squared difference $(p_0 - \bar{p}_T)^2$. We set

$(p_0 - \bar{p}_T)^2 = 1$. Fourth, we choose three possible values for $\phi : \{0, 1, 3\}$. When $\phi = 0$, the government is another insider. When $\phi = 1$, the government places equal weight on its policy goal and on profit maximization. When $\phi = 3$, the government cares more about the policy goal than about profit maximization. Fifth, we choose three possible values for $\rho : \{0, 0.1, 0.5\}$. When $\rho = 0$, the two signals of the government are independent. When $\rho = 0.1$, the two signals have a low positive correlation. When $\rho = 0.5$, the two signals have a high positive correlation.

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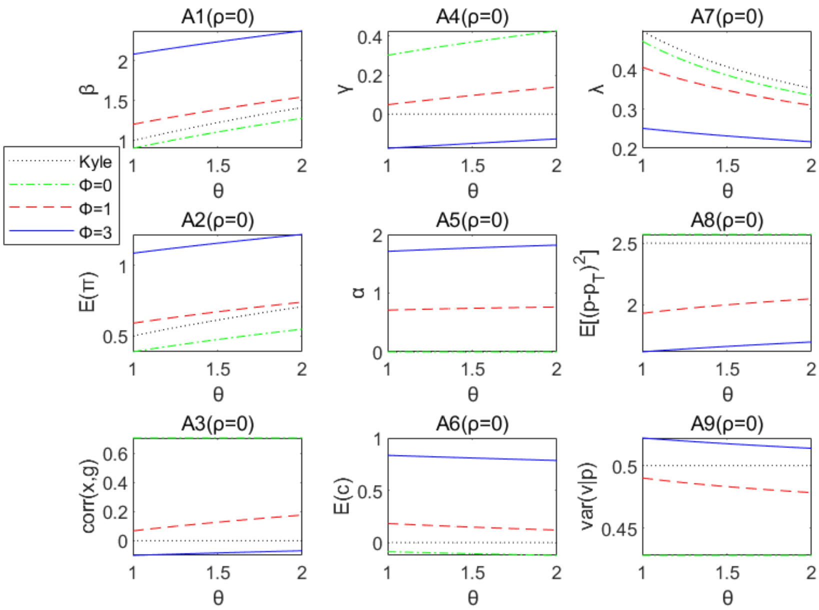

Figure 1: Figure 1: The baseline model without information disclosure. In each panel, the dotted black line represents the standard Kyle setting without government intervention, the dotted green line represents the case with $\phi = 0$, the dashed red line represents the case with $\phi = 1$, and the solid blue line represents the case with $\phi = 3$. The parameter values used in this model are: $\sigma_\varepsilon^2 = \sigma_v^2 = \sigma_T^2 = 1$, and $(p_0 - \bar{p}_T)^2 = 1$.

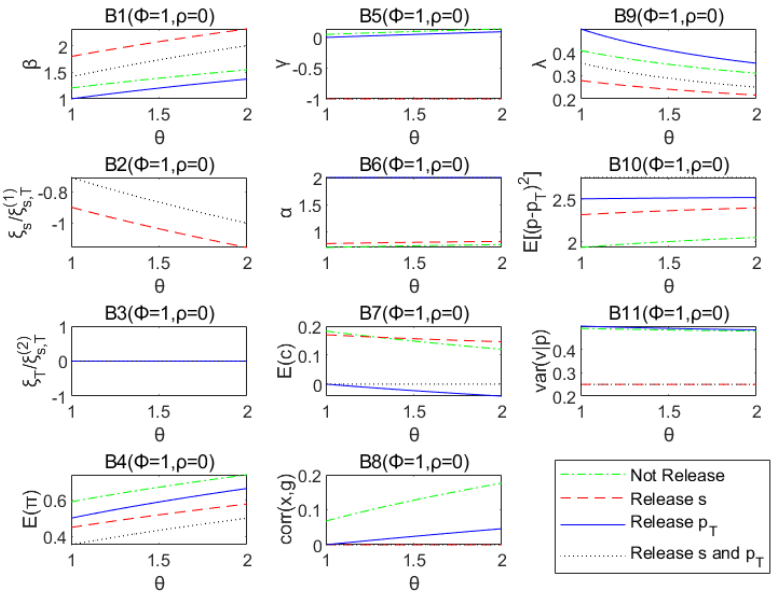

Figure 2: Figure 2: Comparisons among four cases with full disclosure ($\phi = 1$). In each panel, the dotted green line represents the case with no disclosure, the dashed red line represents the case with releasing s, the solid blue line represents the case with releasing p_T, and the dotted black line represents the case with releasing both signals. The parameter values used in this model are: $\sigma_\varepsilon^2 = \sigma_v^2 = \sigma_T^2 = 1$, and $(p_0 - \bar{p}_T)^2 = 1$.

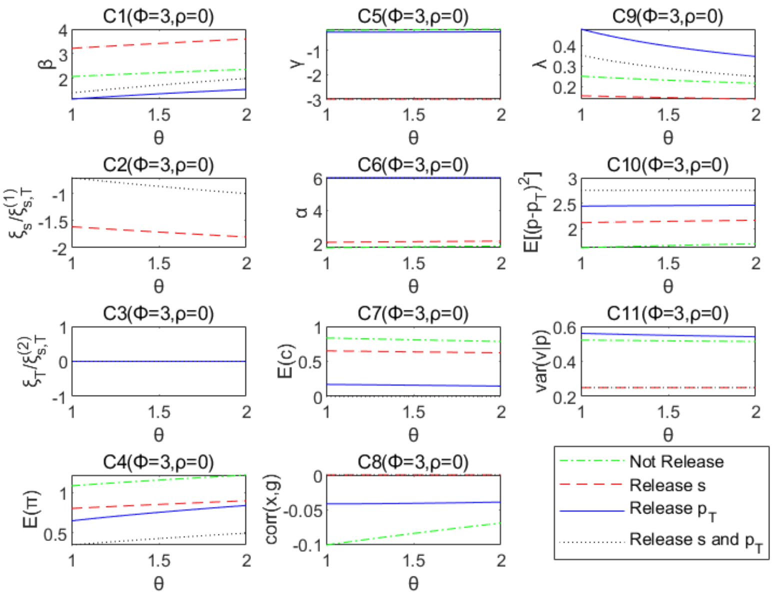

Figure 3: Figure 3: Comparisons among four cases with full disclosure ($\phi = 3$). In each panel, the dotted green line represents the case with no disclosure, the dashed red line represents the case with releasing s, the solid blue line represents the case with releasing p_T, and the dotted black line represents the case with releasing both signals. The parameter values used in this model are: $\sigma_\varepsilon^2 = \sigma_v^2 = \sigma_T^2 = 1$, and $(p_0 - \bar{p}_T)^2 = 1$.

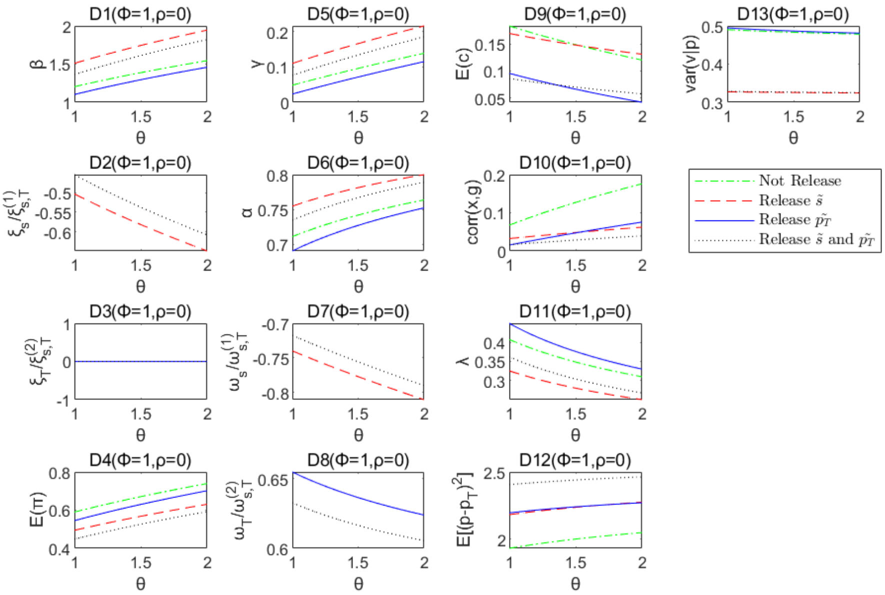

Figure 4: Figure 4: Comparisons among four cases with partial disclosure ($\phi = 1$). In each panel, the dotted green line represents the case with no disclosure, the dashed red line represents the case with releasing $\widetilde{s}$, the solid blue line represents the case with releasing $\widetilde{p}_T$, and the dotted black line represents the case with releasing both signals. The parameter values used in this model are: $\sigma_\varepsilon^2 = \sigma_v^2 = \sigma_T^2 = \sigma_{\varepsilon_1}^2 = \sigma_{\varepsilon_2}^2 = 1$, and $(p_0 - \bar{p}_T)^2 = 1$.

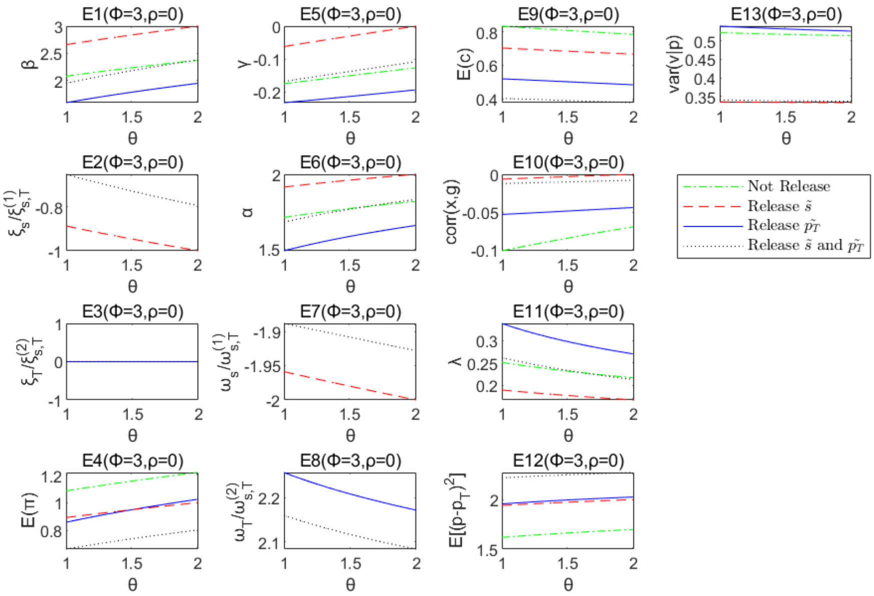

Figure 5: Figure 5: Comparisons among four cases with partial disclosure ($\phi = 3$). In each panel, the dotted green line represents the case with no disclosure, the dashed red line represents the case with releasing $\widetilde{s}$, the solid blue line represents the case with releasing $\widetilde{p}_T$, and the dotted black line represents the case with releasing both signals. The parameter values used in this model are: $\sigma_\varepsilon^2 = \sigma_v^2 = \sigma_T^2 = \sigma_{\varepsilon_1}^2 = \sigma_{\varepsilon_2}^2 = 1$, and $(p_0 - \bar{p}_T)^2 = 1$.

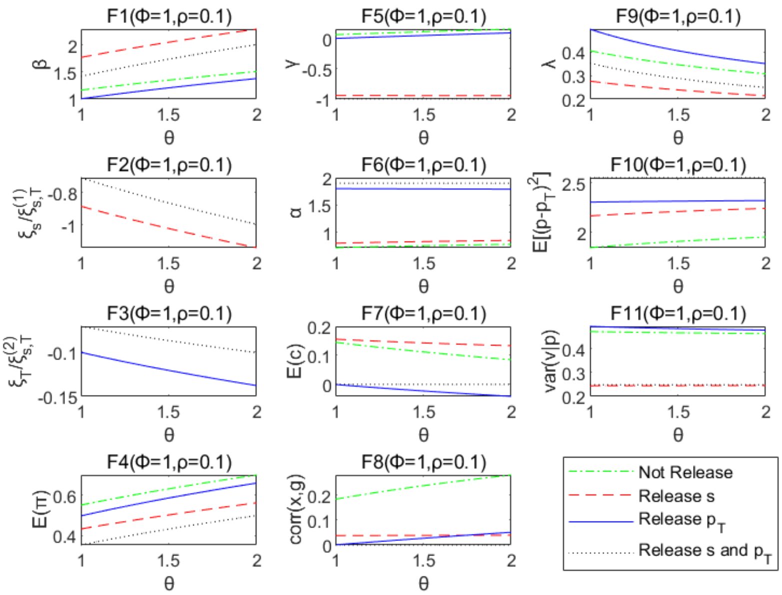

Figure 6: Figure 6: Comparisons among four cases with correlated signals ($\phi = 1$, $\rho = 0.1$). In each panel, the dotted green line represents the case with no disclosure, the dashed red line represents the case with releasing s, the solid blue line represents the case with releasing p_T, and the dotted black line represents the case with releasing both signals. The parameter values used in this model are: $\sigma_\varepsilon^2 = \sigma_v^2 = \sigma_T^2 = 1$, and $(p_0 - \bar{p}_T)^2 = 1$.

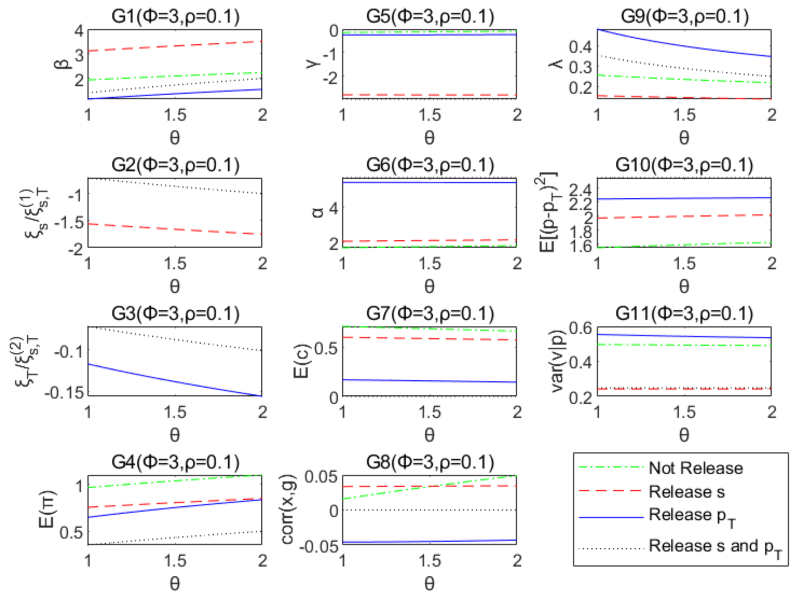

Figure 7: Figure 7: Comparisons among four cases with correlated signals ($\phi = 3$, $\rho = 0.1$). In each panel, the dotted green line represents the case with no disclosure, the dashed red line represents the case with releasing s, the solid blue line represents the case with releasing p_T, and the dotted black line represents the case with releasing both signals. The parameter values used in this model are: $\sigma_\varepsilon^2 = \sigma_v^2 = \sigma_T^2 = 1$, and $(p_0 - \bar{p}_T)^2 = 1$.

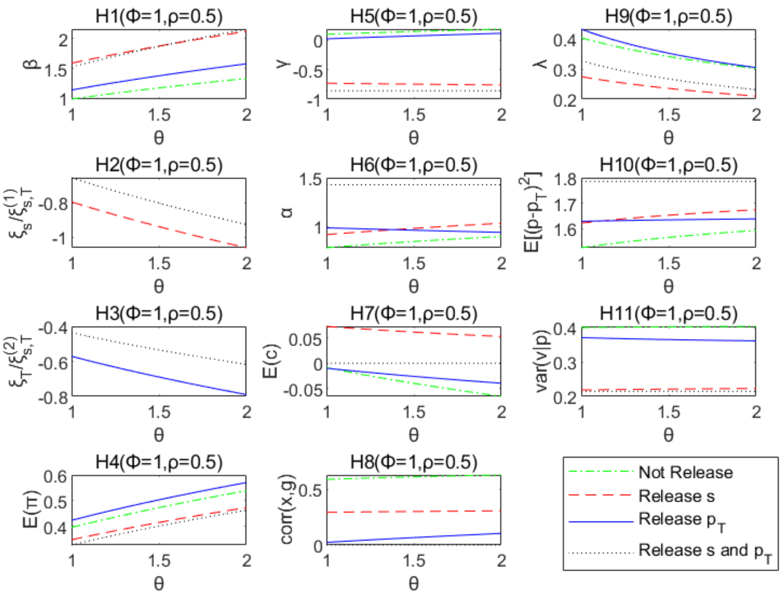

Figure 8: Figure 8: Comparisons among four cases with correlated signals ($\phi = 1$, $\rho = 0.5$). In each panel, the dotted green line represents the case with no disclosure, the dashed red line represents the case with releasing s, the solid blue line represents the case with releasing p_T, and the dotted black line represents the case with releasing both signals. The parameter values used in this model are: $\sigma_\varepsilon^2 = \sigma_v^2 = \sigma_T^2 = 1$, and $(p_0 - \bar{p}_T)^2 = 1$.

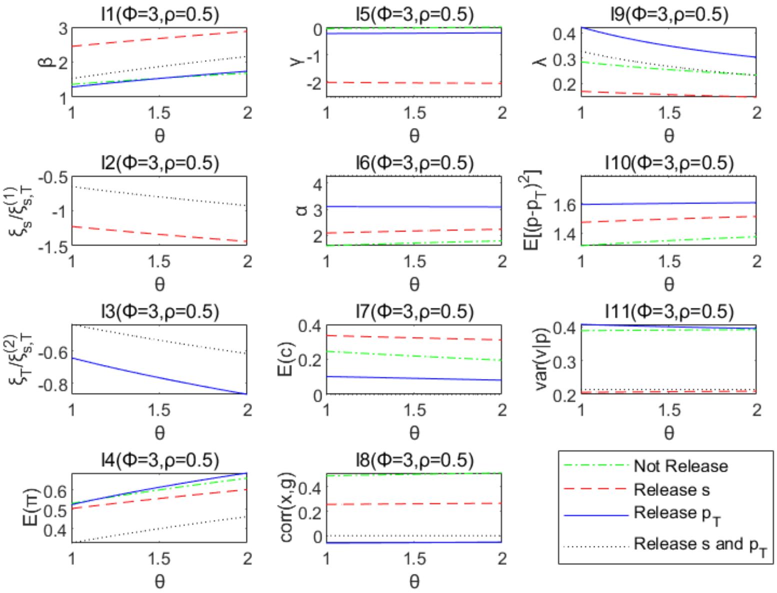

Figure 9: Figure 9: Comparisons among four cases with correlated signals ($\phi = 3$, $\rho = 0.5$). In each panel, the dotted green line represents the case with no disclosure, the dashed red line represents the case with releasing s, the solid blue line represents the case with releasing p_T, and the dotted black line represents the case with releasing both signals. The parameter values used in this model are: $\sigma_\varepsilon^2 = \sigma_v^2 = \sigma_T^2 = 1$, and $(p_0 - \bar{p}_T)^2 = 1$.

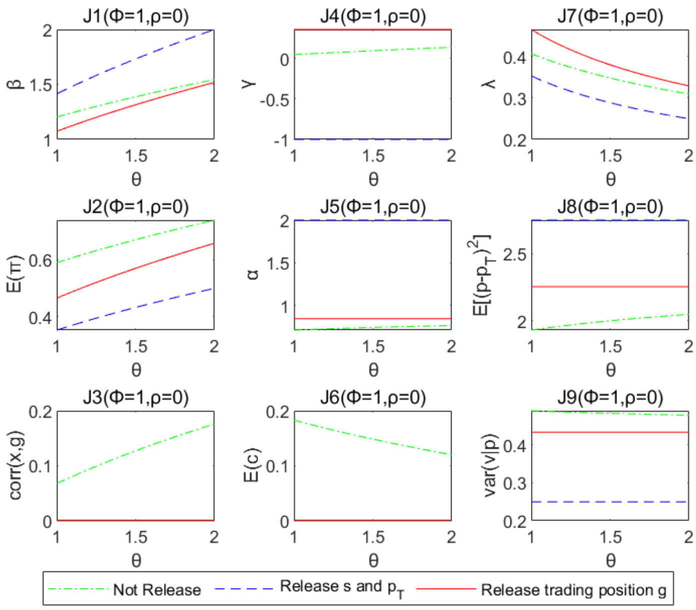

Figure 10: Figure 10: Comparisons between releasing two signals $\{p_T, s\}$ and releasing trading position $\{g\}$ ($\phi = 1$, $\rho = 0$). In each panel, the dotted and dashed green line represents the case with no disclosure, the dashed blue line represents the case with releasing $\{p_T, s\}$, and the solid red line represents the case with releasing $\{g\}$. The parameter values used in this model are: $\sigma_\varepsilon^2 = \sigma_v^2 = \sigma_T^2 = 1$, and $(p_0 - \bar{p}_T)^2 = 1$.

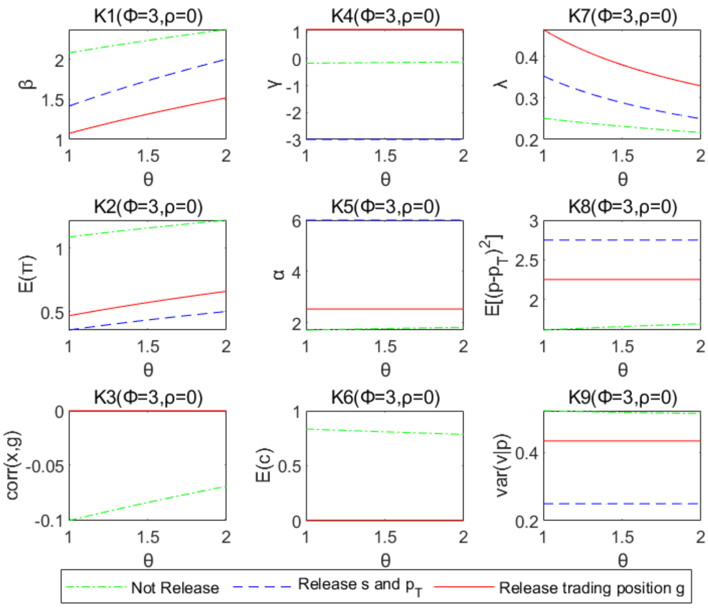

Figure 11: Figure 11: Comparisons between releasing two signals $\{p_T, s\}$ and releasing trading position $\{g\}$ ($\phi = 3$, $\rho = 0$). In each panel, the dotted and dashed green line represents the case with no disclosure, the dashed blue line represents the case with releasing $\{p_T, s\}$, and the solid red line represents the case with releasing $\{g\}$. The parameter values used in this model are: $\sigma_\varepsilon^2 = \sigma_v^2 = \sigma_T^2 = 1$, and $(p_0 - \bar{p}_T)^2 = 1$.