Asset Pricing on FOMC Announcements

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Abstract

Asset-pricing facts on FOMC announcements in the last decade have changed strikingly. The pre-announcement drift has disappeared, and other formerly established facts—the announcement premium and a stronger CAPM—now concentrate on a subset of announcements. We propose that these distinct patterns correspond to two equilibrium outcomes that arise in a rational-expectations context. The drift can be switched on and off across equilibria, and this has implications for return informativeness, beta dispersion and SML slope, and the way these two are responsible for a stronger CAPM. The model reveals that the key in understanding the facts is to condition on good and bad announcement outcomes; high-frequency data shows that the drift is mostly present and highly informative upon good news, and that the Fed's new communication policy may have triggered a shift from one equilibrium to the other.

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1 Introduction

It is now common in the literature to list two facts regarding asset returns on FOMC announcements: on these occasions most of the risk premium is realized and the CAPM works. That there is an announcement premium is not surprising to the extent that the announcement resolves uncertainty (Epstein and Turnbull, 1980); what is surprising is that it builds ahead of the announcement (Lucca and Moench, 2015). This "pre-announcement drift" could reflect prior information, but the absence of a positive relation between pre- and post-announcement returns seem to discard this possibility. Adding to the puzzle, the drift has in fact disappeared over the last decade (Boguth, Gregoire, and Martineau, 2019; Kurov, Wolfe, and Gilbert, 2021a), coinciding with the introduction of a press conference (PC) following some of the announcements. High returns and a stronger CAPM now concentrate on such "PC" days (Bodilsen, Eriksen, and Grønborg, 2021).

In this paper we ask, what does information ahead of announcements imply for pre-announcement returns and their beta formulation and can it be definitely ruled out as a driver of the facts? Why did the drift disappear, may it reappear and why do facts now concentrate on a subset of days? How are the facts related? For instance, the announcement premium comes with a compression in betas (Bodilsen et al., 2021; Andersen, Thyrsgaard, and Todorov, 2021), and these two facts could together or separately explain a better-performing CAPM. We first develop a theory based on private information and then revisit the facts by testing our theoretical predictions.

Our main argument is that the disappearance of the pre-announcement drift corresponds to an equilibrium shift. In a dynamic rational-expectations framework with a public announcement (e.g., He and Wang (1995)), there may be (at least) two equilibria—one in which prices carry no informational content (*E1*), and one in which they do (*E2*). In *E2* investors believe that others speculate on the announcement outcome ahead of it and trade exploiting the resulting price informativeness. In the other equilibrium (*E1*), all investors believe that others will not speculate and simply accommodate noise trading. Under the condition that noise trading is unpredictable, which in our model with continuous trading and in our empirical analysis with high-frequency data means that noise traders are not high-frequency traders, *E1* always exists whereas *E2* is fragile and arises depending on the extent of uncertainty in payoffs.

There are four ways of telling the two equilibria apart according to how their asset-pricing implications differ. First, in *E1* the premium realizes exactly on the announcement, whereas it builds ahead of it in *E2*. The presence of a drift in *E2* is a dynamic phenomenon. Because investors trade on short-term price swings there is a wedge between the weight Bayes' rule assigns to fundamentals and that assigned by prices (Cespa and Vives, 2012). In *E2* investors exploit price informativeness by chasing the trend, which causes prices to reveal more fundamental information than what Bayes' rule can justify. This mechanism feeds upon itself and since resolution of uncertainty commands a premium (Epstein and Turnbull, 1980) a drift builds up prior to the announcement. In the other equilibrium (*E1*), returns are cashed in exactly at the announcement because all investors believe that others will not speculate.

Second, there is a strong asymmetry in the drift (market reaction) across good and bad news in *E2* (*E1*). That uncertainty resolution commands a premium is nondirectional—there is a premium on announcements whether the announcement outcome is good or bad. Suppose now that we condition pre-announcement returns based on whether news is good or bad. Intuitively, we should see an upward (downward) drift ahead of positive (negative) news. Yet, because prices are informative in *E2* they partially resolve uncertainty and thus come with a premium. This premium adds to the existing positive return on good news, but partly offsets the negative drift on bad news. Therefore, whereas the drift is strong on good news it is substantially weaker on bad news. The same mechanism applies to market reaction in *E1*.

Expressing expected returns in terms of market betas, dispersion in betas across stocks may exhibit strikingly different patterns across equilibria. Although betas become systematically more compressed post-announcement, they may move in opposite directions pre-announcement depending on the extent of noise trading around the announcement. Specifically, if there is little noise beta compression also occurs prior to the announcement in *E2*, whereas betas in *E1* become suddenly more dispersed in *E1* close to the announcement. Finally, in both equilibria the rise in the market premium on announcements is responsible, to a large extent, for a strong CAPM relation. In fact the CAPM works "too well," in the sense that the slope of the Securities Market Line (SML) exceeds the market premium (due to noise trading). However, the origins of this "excess slope" differ across equilibria. In *E1* it is entirely explained by dispersion in fundamental value across stocks, and in *E2* it is additionally explained by compression in betas.

The point is that the drift can be "switched on and off" across the two equilibria, and that each equilibria is associated with different asset-pricing patterns. The switch from one equilibrium to the other fits well with the Fed adopting new communication policies as of April 2011, introducing press conferences (PC) held after the publication of FOMC statements. PCs are "intended to further enhance the clarity and timeliness of the Federal Reserves monetary policy communication" (Federal Reserve, 2011). Improved forward guidance could result in reduced uncertainty prior to the announcement, and the disappareance of the drift coincides with this new communication policy.[1] In the model *E2* disappears when residual uncertainty is reduced, and we would like to examine empirically whether PCs could be acting as a trigger.

We collect intraday stock prices for S&P 500 firms from the NYSE Trade and Quote (TAQ) database. We focus on the period between January 2001 and December 2020 and on days during which FOMC announcements took place, a sample of 151 announcements. We then split the sample into two subsamples: sample non-PC excludes PCs and thus runs from January 2001 and June 2018 and sample PC only contains PCs and spans the period from May 2011 to December 2020. We

[1] For instance, the average CBOE Volatility Index (VIX)—commonly used as a proxy for uncertainty—was significantly higher before A days in the pre-PC era. More specifically, between January 2001 and March 2011, the average VIX at the open of the announcement day was 22.6, while the average VIX in period April 2011-December 2020 was 16.7. The difference is statistically significant at the 1% level with a t-statistic of 4.24

then test whether asset-pricing implications regarding pre-announcement returns, beta dispersion and SML slope differ across the two subsamples as the theory predicts they do across equilibria.

The theory says that the drift reflects information but that informativess of pre-announcement returns concentrates on good news. Therefore, it is key to condition on good and bad news to examine how informative pre-announcement returns are. We define “good news” (“bad news”) as those announcements that come with a daily return falling in the upper (lower) quantile of all announcement days. We find a strong asymmetry within the non-PC sample along the lines of *E2*: the drift is almost entirely cashed in when the news is good (it is on average 63.89 bps on good news against -1.09 bps on bad news). In contrast, within the PC sample pre-annoucement returns exhibit virtually no drift, yet there is a marked asymmetry in market reaction across good and bad news, similar to the *E1* outcome.

The defining difference between equilibrium *E2* and *E1* is that returns are informative in the former but they are not in the latter. To examine the link between the asymmetry in the drift we uncover in the data and informativeness we adapt the measure of informed trading of Weller (2017) and calculate the frequency at which pre-announcement returns correctly predict the announcement outcome. Remarkably, we find that the strong drift ahead of good news in the non-PC sample is informative—82% of the time the market correctly anticipates the outcome. In contrast, in the PC sample pre-announcement returns do just as well as a simple coin flip on good and bad news (successful predictions occur exactly 50% of the time in both cases). That is, the same way informativeness differs across *E1* and *E2* pre-announcement returns are informative in the non-PC sample and uninformative in the PC sample.

Depending on the extent of noise around the announcement, at this time beta dispersion may move in opposite directions across equilibria. We now follow Andersen et al. (2021) to compute a measure of beta dispersion at high frequency. We find that betas become progressively more compressed over the day, consistent with Bodilsen et al. (2021) and Andersen et al. (2021), and that this pattern holds whether or not an announcement takes place. This pattern also extends to the non-PC sample. In the PC sample, although betas also become more compressed over the day they become markedly more dispersed at the announcement (beta dispersion spikes). These findings concur with the respective patterns in beta dispersion across equilibria *E1* and *E2* under the low noise scenario.

The CAPM works “too well” in the model, and beta compression plays a role in this regard only in *E2*. Running intraday Fama and MacBeth (1973) regressions we first confirm that the SML slope exceeds the market premium, and that this “excess slope” is statistically significant. In other words, the CAPM indeed works too well in both samples. Guided by the theory we then control for dispersion in betas and dispersion in value, the two origins of excess slope in the model. par. to be completed.

We conduct several robustness checks regarding the asymmetry in the drift, which could be driven by factors other than those our theory envisages. Intuitively, since speculating on bad news requires shorting the market, a natural explanation for the asymmetry is that short-selling is costly; we find that such costs are unlikely drivers of the asymmetry. Another possibility is that there is an asymmetry in the signal itself. In particular, the Fed tends to announce easing policies following a period of low market returns, the so-called "Fed put" (e.g., Cieslak and Vissing-Jorgensen (2020)). We find that the Fed put could in part drive the asymmetry but in an unexpected way—the market seems to speculate on it but does not correctly anticipate it. Other factors are known to explain a strong drift. For instance, the comovement between bond and stock returns (e.g., Cieslak and Schrimpf (2019) or Laarits (2022)) and measures of risk (the "risk shift" measure of Kroencke, Schmeling, and Schrimpf (2021) and the VIX (Lucca and Moench, 2015)). We find that both could play a role, which is consistent with our theory, e.g., when pre-announcement returns are (un)informative there is a (no) drift and market reaction is weaker (stronger) on the announcement and thus "risk shift" is weak (strong). Finally, we control for surprises in the Fed Fund target rate following Kuttner (2001) and find that they do not affect conclusions.

The literature has focused on alternative mechanisms to explain the facts. Among recent explanations are disaster risk (Wachter and Zhu, 2021), non-additive preferences (Ai and Bansal, 2018) and type of news release (Laarits, 2022), and endogenous timing of information acquisition (Ai, Bansal, and Han, 2022; Cocoma, 2022).......

[literature review to be completed]

2 Background

To interpret empirical findings it is important to understand how resolution of uncertainty affects risk premia and betas. The purpose of this section is to provide this intuition in a simple context.

Consider an economy with 3 dates indexed by $t = 1, 2, 3$. The market consists of one riskless asset and N risky stocks indexed by $n = 1, ..., N$. Trading takes place at dates 1 and 2 and consumption at date 3. There is no intermediate consumption, which means that the riskfree rate is exogenous, and normalized to 0. Stocks pay a liquidating dividend, $\widetilde{\mathbf{D}} \equiv [\widetilde{D}_1 \ \dots \ \widetilde{D}_N]'$, at date 3, which is unobservable at all trading dates and has a common factor structure:

$$\widetilde{\mathbf{D}} = \begin{bmatrix} D \\ D \\ \vdots \\ D \end{bmatrix} + \begin{bmatrix} \phi_1 \\ \phi_2 \\ \vdots \\ \phi_N \end{bmatrix} \widetilde{F} + \begin{bmatrix} \tilde{\epsilon}_1 \\ \tilde{\epsilon}_2 \\ \vdots \\ \tilde{\epsilon}_N \end{bmatrix} = \mathbf{1}\, D + \mathbf{\Phi} \widetilde{F} + \tilde{\boldsymbol{\epsilon}}, \quad (1)$$

where D is a positive scalar and $\mathbf{1}$ is a $N \times 1$ vector of ones. The common factor $\widetilde{F}$ and each stock-specific component $\tilde{\epsilon}_n$ are independently normally distributed with means zero and precisions τ_F and τ_ϵ. Without loss of generality, we assume that $\mathbf{\Phi}'\mathbf{\Phi} = 1$ (this assumption is equivalent to scaling

τ_F). We fix the aggregate number of shares for all stocks to $\mathbf{M}$ (hereafter the *market portfolio*), a $N \times 1$ vector; we denote the average loading by $\overline{\Phi} \equiv \mathbf{M}'\mathbf{\Phi}$.

The economy is populated with a continuum of identical investors indexed by $i \in [0, 1]$, who choose their portfolios at each trading date and derive utility from their terminal wealth, $u(\widetilde{W}_3)$. Investors know the structure of realized payoffs in Eq. (1), but do not observe the common factor $\widetilde{F}$. Each investor i forms expectations about it based on available information. The only source of information is a public announcement about $\widetilde{F}$ made at date 2:

$$\widetilde{A} = \widetilde{F} + \widetilde{v}, \tag{2}$$

with $\widetilde{v} \sim \mathscr{N}(0, \tau_A^{-1})$ independent of all other variables. The announcement provides market information, as opposed to firm-specific information (on $\widetilde{\boldsymbol{\epsilon}}$); this specification is motivated by our later focus on announcements made by the Fed and that concern the whole economy. For simplicity, we assume that markets are complete (and show in the extended model how incompleteness in the form of noise trading affects conclusions). We refer to the continuum as "the agent." This model corresponds to the framework of Epstein and Turnbull (1980) with an arbitrary but finite number of stocks and in which we rule out intermediate consumption.

For a given stochastic discount factor (SDF), $\widetilde{\xi}_t$, at date t, the agent solves the problem:

$$\max_{\widetilde{W}_3} \mathbb{E}_0[u(\widetilde{W}_3)] \quad \text{s.t.} \quad \mathbb{E}_0[\widetilde{\xi}_3 \widetilde{W}_3] \leq W_0. \tag{3}$$

From optimality conditions we obtain the dynamics of the SDF, with $\widetilde{\xi}_3 \propto u'(\widetilde{W}_3)$ and:

$$\widetilde{\xi}_2 \propto \mathbb{E}_2[\widetilde{\xi}_3 | \widetilde{A}] \quad \text{and} \quad \xi_1 \propto \mathbb{E}_1[\widetilde{\xi}_3]. \tag{4}$$

Let $\widetilde{\mathbf{P}}_t$ denote the $N \times 1$ vector of equilibrium stock prices at date t, as given by the expected present value of future cashflows:

$$\mathbf{P}_1 = \mathbb{E}_1\left[\widetilde{\xi}_3/\xi_1 \widetilde{\mathbf{D}}\right] \quad \text{and} \quad \widetilde{\mathbf{P}}_2 = \mathbb{E}_2\left[\widetilde{\xi}_3/\widetilde{\xi}_2 \widetilde{\mathbf{D}}\middle| \widetilde{A}\right]. \tag{5}$$

Thus the expected dollar return, $\widetilde{\mathbf{R}}_2 \equiv \widetilde{\mathbf{P}}_2 - \mathbf{P}_1$, on each asset from date 1 to date 2 is:

$$\mathbb{E}_1[\widetilde{\mathbf{R}}_2] = \mathbb{E}\left[\left(\frac{1}{\widetilde{\xi}_2} - \frac{1}{\xi_1}\right) \widetilde{\xi}_3 \widetilde{\mathbf{D}}\right]. \tag{6}$$

In words, there is an announcement premium to the extent that the SDF at dates 1 and 2 differ.[2] To determine how they differ we follow Epstein and Turnbull (1980) and further assume the agent has CARA utility, $u(W) \equiv \exp(-\gamma W)$ with γ the coefficient of absolute risk aversion. The SDF at

[2]There are other ways of generating an announcement premium. For instance, Ai and Bansal (2018) assume that $\xi_1 \equiv \widetilde{\xi}_2(\widetilde{A})$ and use non-time separable preferences to obtain a premium.

both dates becomes:

$$\widetilde{\xi}_2 \propto \exp(-\gamma\,\mathbb{E}_2[\mathbf{M}'\widetilde{\mathbf{D}}|\widetilde{A}] + \gamma^2/2\,\mathbb{V}_2[\mathbf{M}'\widetilde{\mathbf{D}}|\widetilde{A}]) \tag{7}$$

$$\neq \exp(-\gamma\,\mathbb{E}_1[\mathbf{M}'\widetilde{\mathbf{D}}] + \gamma^2/2\,\mathbb{V}_1[\mathbf{M}'\widetilde{\mathbf{D}}]) \propto \xi_1 \tag{8}$$

and the associated stock prices satisfy:

$$\widetilde{\mathbf{P}}_2 = \mathbb{E}_2[\widetilde{\mathbf{D}}|\widetilde{A}] - \gamma\,\mathbb{V}_2[\widetilde{D}|\widetilde{A}]\mathbf{M} \quad \text{and} \quad \mathbf{P}_1 = \mathbb{E}_1[\widetilde{\mathbf{D}}] - \gamma\,\mathbb{V}_1[\widetilde{D}]\mathbf{M}. \tag{9}$$

As is customary in this setup prices correspond to expected cashflows net of a discount for risk conditional on available information. By the law of iterated expectations we find that:

$$\mathbb{E}_1[\widetilde{\mathbf{R}}_2] = \gamma\overline{\Phi} \underbrace{\left(\tau_1^{-1} - \tau_2^{-1}\right)}_{\text{resolution of uncertainty}} \boldsymbol{\Phi}, \tag{10}$$

where $\tau_1 \equiv 1/\,\mathbb{V}_1[\widetilde{F}]$ and $\tau_2 \equiv 1/\,\mathbb{V}_2[\widetilde{F}|\widetilde{A}]$ denote the precision regarding the common factor conditional on available information at dates 1 and 2, respectively.

Corollary 1. ***(Epstein and Turnbull, 1980)*** *There is a positive announcement premium to the extent that the announcement resolves uncertainty (it has informational content).*

In this context systematic risk entirely explains the announcement premium. In particular, defining $\widetilde{\mathbf{R}}_3 \equiv \widetilde{\mathbf{D}} - \widetilde{\mathbf{P}}_2$ the CAPM holds at both trading dates:

$$\mathbb{E}[\widetilde{\mathbf{R}}_2] = \underbrace{\frac{\mathrm{Var}_1[\widetilde{\mathbf{P}}_2]\mathbf{M}}{\mathrm{Var}_1[\mathbf{M}'\widetilde{\mathbf{P}}_2]}}_{\equiv\boldsymbol{\beta}_1} \mathbb{E}_0[\mathbf{M}'\widetilde{\mathbf{R}}_2] \quad \text{and} \quad \mathbb{E}[\widetilde{\mathbf{R}}_3] = \underbrace{\frac{\mathrm{Var}_2[\widetilde{\mathbf{D}}|\widetilde{A}]}{\mathrm{Var}_2[\mathbf{M}'\widetilde{\mathbf{D}}|\widetilde{A}]}}_{\equiv\boldsymbol{\beta}_2} \mathbb{E}_0[\mathbf{M}'\widetilde{\mathbf{R}}_3], \tag{11}$$

where the betas satisfy:

$$\boldsymbol{\beta}_1 = \boldsymbol{\Phi}/\overline{\Phi} \quad \text{and} \quad \boldsymbol{\beta}_2 = \frac{\tau_1^{-1}\overline{\Phi}\boldsymbol{\Phi} + \tau_\epsilon^{-1}\mathbf{M}}{\tau_1^{-1}\overline{\Phi}^2 + \tau_\epsilon^{-1}\|\mathbf{M}\|^2}. \tag{12}$$

Note that the cross-section of stocks is spanned by both $\boldsymbol{\Phi}$ and $\mathbf{M}$ at date 2 and by $\boldsymbol{\Phi}$ only at date 1 (because asset-specific uncertainty, $\widetilde{\boldsymbol{\epsilon}}$, is only resolved at date 3). Under the additional assumption that the market portfolio is equally weighted, $\mathbf{M} \equiv \mathbf{1}\,/N$, the cross-sectional dispersion of betas at dates 1 and 2 are related according to:

$$\mathrm{Var}[\boldsymbol{\beta}_2] = \underbrace{\frac{\tau_1^{-2}\overline{\Phi}^2}{(\tau_1^{-1}\overline{\Phi}^2 + \tau_\epsilon^{-1}/N)^2}}_{\in(0,1)} \mathrm{Var}[\boldsymbol{\beta}_1]. \tag{13}$$

Corollary 2. *There is a compression in beta post-announcement.*

This compression arises because all betas are shrunk towards market beta (which is 1):

$$(1+\delta)(\boldsymbol{\beta}_2 - \mathbf{1}) = \boldsymbol{\beta}_1 - \mathbf{1}, \tag{14}$$

with $\delta = \tau_1/(\tau_\epsilon \overline{\Phi} N) > 0$, after the announcement is made.

Resolution of uncertainty is a simple mechanism that can explain why most of the equity premium is realized on days when announcements are made (e.g., Savor and Wilson (2013)) and why betas are more compressed on these occasions (Andersen et al. (2021); Bodilsen et al. (2021)). Interestingly, a higher premium (Corollary 1) or a compression in beta (Corollary 2) both cause a steepening of the SML. It is possible that these facts individually or together explain why the CAPM works magic on public announcements (e.g., Savor and Wilson (2014)), but this question requires a context in which the CAPM does not always hold. Furthermore, the current puzzle in the literature is that the premium in fact builds up prior to the announcement (Lucca and Moench, 2015), a pattern that has disappeared since 2015 (Kurov, Wolfe, and Gilbert, 2021b).

We exploit the disappearance of the pre-announcement drift to understand if and how these facts are related. In the next section we examine how this mechanism operates at high frequency (continuous time) in the presence of speculation (private information). In this context the CAPM does not always hold; this allows us to tell which of Corollary 1 or 2 leads to a better-performing CAPM, why there is a pre-announcement drift, and why it has disappeared (and may reappear).

3 Speculation and resolution of uncertainty

We introduce a continuous-time, multiple-stocks extension of He and Wang (1995). We present a new solution method, which makes this model not more difficult to solve than one with a single stock. Finally, we discuss two possible equilibria that arise in this model.

3.1 Model

Consider the model of Section 2 with the following, three modifications. First, time is now continuous and trading takes place continuously over $[0, T)$, where T denotes the horizon date at which stocks pay out $\widetilde{\mathbf{D}}$ (formerly date 3). We think of T as a trading day. The announcement $\widetilde{A}$ about the common factor $\widetilde{F}$ is made at date $\tau \in (0, T)$ (formerly date 2).

Second, each investor $i \in [0,1]$ in the continuum now receives private information about the common factor, $\widetilde{F}$, in the form of a flow of private signals, $(\widetilde{V}_t^i)_{t\geq 0}$:

$$\mathrm{d}\widetilde{V}_t^i = \widetilde{F}\mathrm{d}t + \tau_v^{-1/2}\mathrm{d}B_t^i, \quad \widetilde{V}_0^i = \widetilde{F} + \tilde{\epsilon}^i, \tag{15}$$

with $\tilde{\epsilon}^i$ an "idiosyncratic" Gaussian noise with mean zero and variance τ_V^{-1} and B^i an "idiosyncratic" Brownian noise. By "idiosyncratic" we mean that there is one such Brownian per investor i and that these Brownians are sufficiently independent for the Strong Law of Large Numbers to holds across investors (Duffie and Sun, 2007). In the analysis we will often set $\tau_v \equiv 0$ and $\tau_V > 0$, meaning that investors only receive an initial private signal at date 0.[3]

Third, to prevent equilibrium prices from fully revealing investors' private information, we assume that an unmodeled group of agents trade for liquidity needs and/or for non-informational reasons.[4] Liquidity traders have inelastic demands of $\widetilde{\mathbf{m}}_t$ shares at date t, a $N \times 1$ vector that evolves according to the multivariate OU process:

$$\mathrm{d}\widetilde{\mathbf{m}}_t = -\mathbf{b}\widetilde{\mathbf{m}}_t \mathrm{d}t + \tau_m^{-1/2}\mathrm{d}\mathbf{B}_{m,t}, \quad \widetilde{\mathbf{m}}_0 \sim \mathscr{N}(\mathbf{0}, \tau_m^{-1}\,\mathbf{I}) \tag{16}$$

with $\mathbf{B}_m$ a $N-$dimensional Brownian motion, $\mathbf{b}$ a constant $N \times N$ matrix and τ_m a constant scalar, which represents supply precision and which is assumed identical across stocks; the remainder, $\mathbf{M} - \widetilde{\mathbf{m}}_t$, is available for trade to informed investors at date t. This is the usual noise trading story adopted in the literature (e.g., He and Wang, 1995). We assume right away that supply shocks are IID, i.e., $\mathbf{b} \equiv \mathbf{0}$. For each stock $\mathbf{b}$ can be viewed as the fraction of the demand of noise traders who revert their trades over a time interval dt. Thus, $\mathbf{b} \equiv \mathbf{0}$ means that, unlike informed traders, noise traders are not high-frequency traders. This assumption is appropriate for the purpose of explaining intraday patterns.

Importantly, on the announcement date τ we assume that noise traders submit an additional, independent bulk order of size:

$$\Delta\widetilde{\mathbf{m}}_\tau \sim \mathscr{N}(0, \tau_M^{-1/2}\,\mathbf{I}). \tag{17}$$

In other words, noise traders react (irrationally) to the announcement, with identical precision τ_M across stocks. Suppose noise traders did not react to the announcement, the announcement outcome, $\widetilde{A}$, a single number, would then entirely drive announcement returns on all stocks; the covariance matrix of announcement returns would be non-invertible and portfolios undefined. Hence, an equilibrium does not exist without this feature. This feature is also empirically appealing as noise appears to be an important component of returns on announcements (Boguth, Gregoire, and Martineau, 2022).

[3]We assume the flow of signals is continuous as the law of large numbers ensures idiosyncratic components vanish in the aggregate. As a result, discreteness in private signals does not create discontinuities in asset prices (Cujean, 2020), whereas these discontinuities are the main focus of this paper.

[4]This creates noise in the supply of assets, prevents prices from revealing $\widetilde{F}$ (Grossman and Stiglitz, 1980) and investors from refusing to trade (Milgrom and Stokey, 1982). There are different ways to endogenize liquidity trading: private investment opportunities (Wang, 1994), investor specific endowment shocks, or income shocks (Farboodi and Veldkamp, 2017). These alternatives would unnecessarily complicate the analysis, without bringing additional economic insights.

3.2 New steps in the solution method

Commonly observable information at date t includes the history of prices and the announcement (when made) and thus satisfies:

$$\mathscr{F}_t^c \equiv \begin{cases} \sigma(\widetilde{\mathbf{P}}_s, s \leq t), & t < \tau \\ \sigma(\widetilde{\mathbf{P}}_s, s \leq t) \vee \sigma(\widetilde{A}), & t \geq \tau \end{cases}. \tag{18}$$

This information set corresponds to the data set of an empiricist who observes all public realizations of the model. An investor i observes the empiricist's data set along with her own flow of private information at each date t:

$$\mathscr{F}_t^i \equiv \mathscr{F}_t^c \vee \sigma(\widetilde{V}_s^i, s \leq t). \tag{19}$$

We adopt the following convention. Conditional on these information sets we denote the expectation of a random variable or process $\widetilde{\mathbf{x}}.$ with a hat and index it by the relevant set, $\widehat{\mathbf{x}}_t^i = \mathbb{E}[\widetilde{\mathbf{x}}.|\mathscr{F}_t^i]$ and $\widehat{\mathbf{x}}_t^c = \mathbb{E}[\widetilde{\mathbf{x}}.|\mathscr{F}_t^c]$. Because the (instantaneous) precision of information in Eq. (15) is identical for all investors their forecasts have identical precision at all dates t:

$$\tau_t \equiv \mathrm{Var}[\widetilde{F}|\mathscr{F}_t^i]^{-1}. \tag{20}$$

Similarly, we denote the empiricist's precision at date t by $\tau_t^c \equiv \mathrm{Var}[\widetilde{F}|\mathscr{F}_t^c]^{-1}$.

The first steps of the solution method are standard and follow He and Wang (1995), albeit extended to multiple stocks and continuous trading; we gather these steps in the next two propositions and relegate details to the appendix. We focus on a linear equilibrium:

$$\widetilde{\mathbf{P}}_t = \mathbf{1}D + \boldsymbol{\xi}_{0,t}\mathbf{M} + \boldsymbol{\xi}_t\widetilde{\mathbf{m}}_t + \boldsymbol{\Phi}\left(\lambda_t\widetilde{F} + (1-\lambda_t)\widehat{F}_t^c\right), \tag{21}$$

where the $N \times N$ matrices $\boldsymbol{\xi}_0$ and $\boldsymbol{\xi}$ and the scalar λ are deterministic price coefficients to be determined in equilibrium. We also conjecture that $\boldsymbol{\xi}_0$ and $\boldsymbol{\xi}$ are symmetric at all times.

This conjecture allows us to determine how investors and the empiricist update their views about $\widetilde{F}$ and noise traders' demand, $\widetilde{\mathbf{m}}$, by means of Kalman filtering. Let $\Delta^i \equiv \widehat{F}^i - \widehat{F}^c$ denote how investors and the empiricist disagree about the common factor $\widetilde{F}$; accordingly, define the $(N+1) \times 1$ vector $\boldsymbol{\Psi}^i \equiv (\ \Delta^i \quad (\widehat{\mathbf{m}}^i)'\ )'$. The next proposition shows that this vector entirely determines how an investor i's perceives her investment opportunity set.

Proposition 1. *Price changes (dollar returns) are Markovian in $\boldsymbol{\Psi}^i$ under $\mathscr{F}^i$ at all times. Specifically, for $t \in (0,\tau) \cup (\tau, T)$ (in between announcements) they evolve continuously as:*

$$\mathrm{d}\begin{pmatrix} \widetilde{\mathbf{P}}_t \\ \boldsymbol{\Psi}_t^i \end{pmatrix} = \begin{pmatrix} \dot{\boldsymbol{\xi}}_{0,t}\mathbf{M} \\ \mathbf{0} \end{pmatrix}\mathrm{d}t + \begin{pmatrix} \mathbf{A}_{\mathbf{P},t} \\ \mathbf{A}_{\boldsymbol{\Psi},t} \end{pmatrix}\boldsymbol{\Psi}_t^i\mathrm{d}t + \begin{pmatrix} \mathbf{B}_{\mathbf{P},t} \\ \mathbf{B}_{\boldsymbol{\Psi},t} \end{pmatrix}\mathrm{d}\widehat{\mathbf{B}}_t^i, \tag{22}$$

and jump at the announcement date, τ, according to:

$$\Delta \begin{pmatrix} \widetilde{\mathbf{P}}_\tau \\ \boldsymbol{\Psi}^i_\tau \end{pmatrix} = \begin{pmatrix} (\boldsymbol{\xi}_{0,\tau} - \boldsymbol{\xi}_{0,\tau-})\mathbf{M} \\ \mathbf{0} \end{pmatrix} + \begin{pmatrix} \mathbf{a}_{\mathbf{P}} \\ \mathbf{a}_{\boldsymbol{\Psi}} \end{pmatrix} \boldsymbol{\Psi}^i_{\tau-} + \begin{pmatrix} \mathbf{b}_{\mathbf{P}} \\ \mathbf{b}_{\boldsymbol{\Psi}} \end{pmatrix} \widetilde{\mathbf{y}}^i, \tag{23}$$

and with prices jumping at the liquidation date, T, according to:

$$\Delta \begin{pmatrix} \widetilde{\mathbf{P}}_T \\ \boldsymbol{\Psi}^i_T \end{pmatrix} = \begin{pmatrix} -\boldsymbol{\xi}_{0,T-}\mathbf{M} \\ \mathbf{0} \end{pmatrix} + \begin{pmatrix} \mathbf{a}_{T-} \\ -1 \\ \mathbf{0} \end{pmatrix} \boldsymbol{\Psi}^i_{T-} + \begin{pmatrix} \boldsymbol{\Phi} & \mathbf{0} \\ 0 & \mathbf{0} \\ \mathbf{0} & \mathbf{I} \end{pmatrix} \widetilde{\mathbf{y}}^i_T + \begin{pmatrix} \mathbf{I} \\ \mathbf{0} \end{pmatrix} \widetilde{\boldsymbol{\epsilon}}, \tag{24}$$

where $\widehat{\mathbf{B}}^i$ is a $(N+1)-$dimensional Brownian with respect to $\mathscr{F}^i$, and $\widetilde{\mathbf{y}}_\tau|_{\mathscr{F}^i_{\tau-}} \sim \mathscr{N}(\mathbf{0}, \boldsymbol{\Upsilon})$ and $\widetilde{\mathbf{y}}^i_T|_{\mathscr{F}^i_{T-}} \sim \mathscr{N}(\mathbf{0}, \mathbf{T}_{T-})$, and where $\mathbf{a}$ is a $N \times (N+1)$ deterministic matrix that satisfies:

$$\mathbf{a}_t \equiv \begin{pmatrix} \boldsymbol{\Phi}(1-\lambda_t) & -\boldsymbol{\xi}_t \end{pmatrix} \tag{25}$$

at any date t. The $N \times (N+1)-$matrices $\mathbf{a}_{\mathbf{P}}$, $\mathbf{b}_{\mathbf{P}}$, $\mathbf{A}_{\mathbf{P}}$ and $\mathbf{B}_{\mathbf{P}}$ and the $(N+1)\times(N+1)-$matrices $\mathbf{a}_{\boldsymbol{\Psi}}$, $\mathbf{b}_{\boldsymbol{\Psi}}$, $\mathbf{A}_{\boldsymbol{\Psi}}$, $\mathbf{B}_{\boldsymbol{\Psi}}$, $\boldsymbol{\Upsilon}$ and $\mathbf{T}_{T-}$ are deterministic and given in the appendix.

Given her perception of stock returns investor i decides on her investment strategy. She faces the following investment problem at date t:

$$J(W^i, \boldsymbol{\Psi}^i, t) = \max_{\mathbf{w}} \mathbb{E}\left[-\exp\left(-\gamma \widetilde{W}^i_T\right) \Big| \mathscr{F}^i_t\right] \tag{26}$$

$$\text{s.t.} \quad \widetilde{W}^i_T = W^i_0 + \int_0^T \mathbf{w}'_t \mathrm{d}\widetilde{\mathbf{P}}^{\text{cont.}}_t + \mathbf{w}'_{\tau-}\Delta\widetilde{\mathbf{P}}_\tau + \mathbf{w}'_{T-}\Delta\widetilde{\mathbf{P}}_T, \tag{27}$$

where J denotes investor i's value function and $\mathbf{w}$ denotes the $N \times 1$ vector of number of shares she invests in each risky asset. This investment problem is solved piecewise over the two subregions $[0,\tau)$ and $[\tau, T)$ along the lines of the next proposition.

Proposition 2. *The value function as defined in Eq. (26) takes the form:*

$$J(W, \boldsymbol{\Psi}, t) \equiv -\exp\left(-\gamma W - s(t) - \frac{1}{2}\left(\boldsymbol{\Psi}^\top \mathbf{U}(t) + \mathbf{U}(t)^\top \boldsymbol{\Psi} + \boldsymbol{\Psi}^\top \mathbf{V}(t)\boldsymbol{\Psi}\right)\right), \tag{28}$$

where s is a scalar, $\mathbf{U}$ an $N+1-$vector and $\mathbf{V}$ an $(N+1)\times(N+1)-$matrix, all of which are deterministic. For $t \in (0,\tau)\cup(\tau,T)$ (in between announcements) they satisfy:

$$\begin{aligned} \dot{\mathbf{U}} &= (\mathbf{B}_{\mathbf{P}}\mathbf{B}'_{\boldsymbol{\Psi}}\mathbf{V} - \mathbf{A}_{\mathbf{P}})'(\mathbf{B}_{\mathbf{P}}\mathbf{B}'_{\mathbf{P}})^{-1}\dot{\boldsymbol{\xi}}_0\mathbf{M} \\ &\quad + (\mathbf{B}_{\boldsymbol{\Psi}}(\mathbf{I} - \mathbf{B}'_{\mathbf{P}}(\mathbf{B}_{\mathbf{P}}\mathbf{B}'_{\mathbf{P}})^{-1}\mathbf{B}_{\mathbf{P}})\mathbf{B}'_{\boldsymbol{\Psi}}\mathbf{V} + \mathbf{B}_{\boldsymbol{\Psi}}\mathbf{B}'_{\mathbf{P}}(\mathbf{B}_{\mathbf{P}}\mathbf{B}'_{\mathbf{P}})^{-1}\mathbf{A}_{\mathbf{P}} - \mathbf{A}_{\boldsymbol{\Psi}})'\mathbf{U} \end{aligned} \tag{29}$$

$$\begin{aligned} \dot{\mathbf{V}} &= -\mathbf{A}'_{\mathbf{P}}(\mathbf{B}_{\mathbf{P}}\mathbf{B}'_{\mathbf{P}})^{-1}\mathbf{A}_{\mathbf{P}} + \mathbf{V}\left(\mathbf{B}_{\boldsymbol{\Psi}}\mathbf{B}'_{\mathbf{P}}(\mathbf{B}_{\mathbf{P}}\mathbf{B}'_{\mathbf{P}})^{-1}\mathbf{A}_{\mathbf{P}} - \mathbf{A}_{\boldsymbol{\Psi}}\right) \\ &\quad + \left(\mathbf{B}_{\boldsymbol{\Psi}}\mathbf{B}'_{\mathbf{P}}(\mathbf{B}_{\mathbf{P}}\mathbf{B}'_{\mathbf{P}})^{-1}\mathbf{A}_{\mathbf{P}} - \mathbf{A}_{\boldsymbol{\Psi}}\right)'\mathbf{V} + \mathbf{V}\mathbf{B}_{\boldsymbol{\Psi}}\left(\mathbf{I} - \mathbf{B}'_{\mathbf{P}}(\mathbf{B}_{\mathbf{P}}\mathbf{B}'_{\mathbf{P}})^{-1}\mathbf{B}_{\mathbf{P}}\right)\mathbf{B}'_{\boldsymbol{\Psi}}\mathbf{V}, \end{aligned} \tag{30}$$

with boundary conditions upon the announcement:

$$\mathbf{U}_{\tau-} = (\mathbf{I} + \mathbf{a}_{\boldsymbol{\Psi}})'(\mathbf{I} - \mathbf{V}_{\tau}\mathbf{b}_{\boldsymbol{\Psi}}\mathbf{S}_{\tau}\mathbf{b}'_{\boldsymbol{\Psi}})\mathbf{U}_{\tau} + (\mathbf{a}_{\mathbf{P}} - \mathbf{b}_{\mathbf{P}}\mathbf{S}_{\tau}\mathbf{b}'_{\boldsymbol{\Psi}}\mathbf{V}_{\tau}(\mathbf{I} + \mathbf{a}_{\boldsymbol{\Psi}}))'(\mathbf{b}_{\mathbf{P}}\mathbf{S}_{\tau}\mathbf{b}'_{\mathbf{P}})^{-1}((\boldsymbol{\xi}_{0,\tau} - \boldsymbol{\xi}_{0,\tau-})\mathbf{M} - \mathbf{b}_{\mathbf{P}}\mathbf{S}_{\tau}\mathbf{b}'_{\boldsymbol{\Psi}}\mathbf{U}_{\tau}) \tag{31}$$

$$\mathbf{V}_{\tau-} = (\mathbf{I} + \mathbf{a}_{\boldsymbol{\Psi}})'(\mathbf{I} - \mathbf{V}_{\tau}\mathbf{b}_{\boldsymbol{\Psi}}\mathbf{S}_{\tau}\mathbf{b}'_{\boldsymbol{\Psi}})\mathbf{V}_{\tau}(\mathbf{I} + \mathbf{a}_{\boldsymbol{\Psi}}) + (\mathbf{a}_{\mathbf{P}} - \mathbf{b}_{\mathbf{P}}\mathbf{S}_{\tau}\mathbf{b}'_{\boldsymbol{\Psi}}\mathbf{V}_{\tau}(\mathbf{I} + \mathbf{a}_{\boldsymbol{\Psi}}))'(\mathbf{b}_{\mathbf{P}}\mathbf{S}_{\tau}\mathbf{b}'_{\mathbf{P}})^{-1}(\mathbf{a}_{\mathbf{P}} - \mathbf{b}_{\mathbf{P}}\mathbf{S}_{\tau}\mathbf{b}'_{\boldsymbol{\Psi}}\mathbf{V}_{\tau}(\mathbf{I} + \mathbf{a}_{\boldsymbol{\Psi}})), \tag{32}$$

where $\mathbf{S}_{\tau} \equiv (\mathbf{b}'_{\boldsymbol{\Psi}}\mathbf{V}_{\tau}\mathbf{b}_{\boldsymbol{\Psi}} + \boldsymbol{\Upsilon}^{-1})^{-1}$ *and boundary conditions at the liquiditation date:*

$$\mathbf{U}_{T-} = -\tau_{\epsilon}\left(\mathbf{a}'_{T-}\boldsymbol{\xi}_{0,T-}\mathbf{M} - \frac{\tau_{\epsilon}}{\tau_{T-} + \tau_{\epsilon}}\mathbf{a}'_{T-}\boldsymbol{\Phi}\boldsymbol{\Phi}'\boldsymbol{\xi}_{0,T-}\mathbf{M}\right), \tag{33}$$

$$\mathbf{V}_{T-} = \tau_{\epsilon}\left(\mathbf{a}'_{T-}\mathbf{a}_{T-} - \frac{\tau_{\epsilon}}{\tau_{T-} + \tau_{\epsilon}}\mathbf{a}'_{T-}\boldsymbol{\Phi}\boldsymbol{\Phi}'\mathbf{a}_{T-}\right). \tag{34}$$

Equations for the coefficient s are omitted for brevity as they do not intervene in equilibrium.

The literature usually stops at this stage and solves these equations after markets have been cleared. However, in this multiple-stocks economy and even though matrices are conjectured symmetric, this system involves $N(N+1)$ ODEs to be solved piecewise. In constrast and in a new step, we now show that conjecturing the form of risk premia allows one to boil down this system of equations to just 4, irrespective of the number, N, of stocks. That is, an equilibrum with N stocks is not more difficult to solve than one with a single stock.

We start by writing consensus views regarding the common factor at date t as:

$$\overline{\mathbb{E}}_t[\widetilde{F}] \equiv \int_0^1 \widehat{F}_t^i \mathrm{d}i = \alpha_t\widetilde{F} + (1-\alpha_t)\widehat{F}_t^c, \tag{35}$$

where $\alpha_t \equiv (\tau_t - \tau_t^c)/\tau_t$ denotes the weight Bayesian investors assign to their private information. Thus consensus views track fundamentals based on the weight that is statistically optimal. However, as emphasized in Cespa and Vives (2012), the weight λ that prices assign to $\widetilde{F}$ in Eq. (21) need not coincide with α. Define the (relative) wedge between the two as:

$$\ell \equiv (\alpha - \lambda)/\alpha, \tag{36}$$

a coefficient that plays a central role in the analysis. We then use the wedge ℓ to decompose the matrix $\mathbf{a}$ defined in Eq. (25) into two matrices:

$$\mathbf{b}_t \equiv \begin{pmatrix} (1-\ell_t)(1-\alpha_t)\boldsymbol{\Phi} & -\boldsymbol{\xi}_t \end{pmatrix} \quad \text{and} \quad \mathbf{c}_t \equiv \begin{pmatrix} \ell_t\boldsymbol{\Phi} & \mathbf{0} \end{pmatrix}, \tag{37}$$

which have the property that:

$$\mathbf{a}_t = \mathbf{b}_t + \mathbf{c}_t \tag{38}$$

and that, in the special case when $\lambda \equiv \alpha$ (prices and Bayes rule agree), $\mathbf{b}_t \equiv \mathbf{a}_t$ and $\mathbf{c}_t \equiv \mathbf{0}$.

On non-announcement dates $t \in [0, \tau) \cup (\tau, T)$ the premium conditional on $\mathscr{F}^{\cdot}$ writes:

$$\mathbb{E}[\mathrm{d}\widetilde{\mathbf{P}}_t | \mathscr{F}_t^{\cdot}] = \mathbf{A_P} \boldsymbol{\Psi}_t^{\cdot} \mathrm{d}t + \dot{\boldsymbol{\xi}}_{0,t} \mathbf{M} \mathrm{d}t. \tag{39}$$

On the announcement returns jump and the premium immediately prior to it writes:

$$\mathbb{E}[\Delta \widetilde{\mathbf{P}}_t | \mathscr{F}_{\tau-}^{\cdot}] = \mathbf{a_P} \boldsymbol{\Psi}_{\tau-}^{\cdot} + (\boldsymbol{\xi}_{0,\tau} - \boldsymbol{\xi}_{0,\tau-})\mathbf{M}. \tag{40}$$

We now use the two matrices $\mathbf{a}$ and $\mathbf{b}$ to "guess" the form of this premium in equilibrium.

Conjecture 1. *We conjecture and verify later that:*

A The loading of the risk premium on $\boldsymbol{\Psi}$ on non-announcement dates t satisfies

$$\mathbf{A_P} \equiv \boldsymbol{\Sigma}_\mathbf{P}((\Pi_{1,t} \boldsymbol{\Phi}\boldsymbol{\Phi}' + \Pi_{2,t}\, \mathbf{I})\mathbf{b}_t + \Pi_{3,t} \mathbf{c}_t), \tag{41}$$

where $\boldsymbol{\Sigma}_\mathbf{P} \equiv \tau_m^{-1/2} \boldsymbol{\xi} - (1-\lambda)(\tau^c)^{-1} \tau_P^{1/2} \boldsymbol{\Phi}\boldsymbol{\Phi}'$ is the diffusion matrix of prices, and

$$\mathbf{a_P} \equiv \mathbf{b_P} \underbrace{\begin{pmatrix} \pi_1^A \boldsymbol{\Phi}' \\ \pi_1 \boldsymbol{\Phi}\boldsymbol{\Phi}' + \pi_2\, \mathbf{I} \end{pmatrix}}_{\equiv \boldsymbol{\pi}_b} \mathbf{b}_{\tau-} + \mathbf{b_P} \underbrace{\begin{pmatrix} \pi_2^A \boldsymbol{\Phi}' \\ \pi_3 \boldsymbol{\Phi}\boldsymbol{\Phi}' \end{pmatrix}}_{\equiv \boldsymbol{\pi}_c} \mathbf{c}_{\tau-}, \tag{42}$$

immediately prior to the announcement. The coefficients $\Pi_{\cdot}$ and $\boldsymbol{\pi}_{\cdot}$ are unknown market prices of risk (to be defined in equilibrium); they satisfy the relations:

$$(1-\ell)(\Pi_1 + \Pi_2) + \ell \Pi_3 \equiv -\tau_P^{1/2} \tag{43}$$

$$\mathbf{b_P}((1-\ell_{t-})\boldsymbol{\pi}_b + \ell_{t-}\boldsymbol{\pi}_c)\boldsymbol{\Phi} \equiv \mathbf{b_P} \underbrace{\begin{pmatrix} 1 \\ -\tau_M^{-1/2} \tau_G^{1/2} \boldsymbol{\xi}_t \boldsymbol{\Phi} \end{pmatrix}}_{\equiv \mathbf{y}}, \tag{44}$$

where $\tau_G^{1/2}$ and $\tau_P^{1/2}$ denote the change in the price-signal noise ratio (the speed at which prices reveal information) on non-announcement dates and at date τ, respectively:

$$-\tau_P^{1/2} \boldsymbol{\Phi} \equiv \tau_m^{1/2} \frac{\mathrm{d}}{\mathrm{d}t} \lambda_t \boldsymbol{\xi}_t^{-1} \boldsymbol{\Phi} \tag{45}$$

$$-\tau_G^{1/2} \boldsymbol{\Phi} \equiv \tau_M^{1/2} (\lambda_\tau \boldsymbol{\xi}_\tau^{-1} - \lambda_{\tau-} \boldsymbol{\xi}_{\tau-}^{-1}) \boldsymbol{\Phi}. \tag{46}$$

B The unconditional part of the risk premium on non-announcement dates satisfies

$$\dot{\boldsymbol{\xi}}_0 \mathbf{M} \equiv -\boldsymbol{\Sigma}_\mathbf{P} (\Pi_{1,t} \boldsymbol{\Phi}\boldsymbol{\Phi}' + \Pi_{2,t}\, \mathbf{I}) \boldsymbol{\xi}_{0,t} \mathbf{M} \tag{47}$$

and immediately prior to the announcement:

$$(\boldsymbol{\xi}_{0,\tau} - \boldsymbol{\xi}_{0,\tau-})\mathbf{M} \equiv -\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b\boldsymbol{\xi}_{0,\tau-}\mathbf{M}. \tag{48}$$

This conjecture conveys the same economic insight as the background model. Just like Corollary 1, Eq. (44) shows that the resolution of uncertainty the announcement brings about commands a premium. A difference, however, is that the announcement may also cause prices to reveal additional information, which commands an additional premium and is the meaning of Eq. (44). In contrast, on non-announcement dates there is a single channel through which there is a premium—prices partially reveal investors' private information as per Eq. (43). By the law of large numbers private signals are not directly priced but only through their informational effect on prices, unlike the public announcement. Conjecture 1 allows one to collapse the system of matrix equations of Proposition 2 to just 4 ODEs.

Proposition 3. *Under Conjecture 1 the value function matrices* $\mathbf{U}$ *and* $\mathbf{V}$ *take the form:*

$$\mathbf{U}_t \equiv (\mathbf{b}_t'\underbrace{(u_{1,t}\boldsymbol{\Phi}\boldsymbol{\Phi}' + u_{2,t}\,\mathbf{I})}_{\equiv \mathbf{u}_t} + u_{3,t}\mathbf{c}_t')\boldsymbol{\xi}_{0,t}\mathbf{M} \tag{49}$$

$$\mathbf{V}_t \equiv \mathbf{b}_t'\underbrace{(v_{1,t}\boldsymbol{\Phi}\boldsymbol{\Phi}' + v_{2,t}\,\mathbf{I})}_{\equiv \mathbf{v}_t}\mathbf{b}_t + v_{3,t}(\mathbf{b}_t'\mathbf{c}_t + \mathbf{c}_t'\mathbf{b}_t) + v_{4,t}\mathbf{c}_t'\mathbf{c}_t, \tag{50}$$

at all times, where u. and v. are scalar coefficients. Define the sum $v \equiv v_1 + v_2$*, and the following combinations of* v*,* v_3 *and* v_4 *based on the wedge* ℓ*:*

$$\bar{v}_1 \equiv (1-\ell)v + \ell v_3 \tag{51}$$

$$\bar{v}_2 \equiv (1-\ell)v_3 + \ell v_4 \tag{52}$$

$$\bar{v} \equiv (1-\ell)\bar{v}_2 + \ell\bar{v}_1. \tag{53}$$

For ℓ *given the value function can be equivalently described in terms of* v_2 *and of* v*,* $\bar{v}_1$ *and* $\bar{v}$ *(or any choice of 3 among the v.'s and the* $\bar{v}$*.'s), which in between announcement satisfy:*

$$v' = 2\frac{\tau_P^{1/2}}{\tau^c}(\Pi_1 + \Pi_2)(\alpha\bar{v}_1 - v) + \frac{\tau_v}{\tau^2}\bar{v}_1^2 - (\Pi_1 + \Pi_2)^2 \tag{54}$$

$$v_2' = -\Pi_2^2 \tag{55}$$

$$\bar{v}_1' = \tau_P\frac{\bar{v}_1}{\tau} + \frac{\tau_P^{1/2}}{\tau^c}(\Pi_1 + \Pi_2)(\alpha\bar{v} - \bar{v}_1) + \frac{\tau_v}{\tau^2}\bar{v}\bar{v}_1 + \tau_P^{1/2}(\Pi_1 + \Pi_2) \tag{56}$$

$$\bar{v}' = \frac{\tau_v}{\tau^2}\bar{v}^2 + 2\frac{\tau_P}{\tau}\bar{v} - \tau_P. \tag{57}$$

The boundary conditions for these ODEs upon the announcement are given by:

$$v_{\tau-} = v + \left(\frac{v - \alpha\bar{v}_1}{1-\alpha}\right)^2 (1-\pi_b)^2 \bar{\mathbf{x}}\mathbf{Q}\bar{\mathbf{x}}' + \boldsymbol{\Phi}'\boldsymbol{\pi}_b'\mathbf{b}_{\mathbf{P}}'((\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1} - v)\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b\boldsymbol{\Phi} \\ - 2\frac{v - \alpha\bar{v}_1}{1-\alpha}(1-\pi_b)\bar{\mathbf{x}}\mathbf{S}\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b\boldsymbol{\Phi} \tag{58}$$

$$\frac{\bar{v}_{1,\tau-}}{\tau_{\tau-}} = \frac{\bar{v}_1}{\tau} + \left(1 + \frac{\alpha\bar{v} - \bar{v}_1}{\tau^c}\right)\left(\boldsymbol{\Phi}'\boldsymbol{\pi}_b'\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\mathbf{S}\bar{\mathbf{x}}' + \frac{\alpha\bar{v}_1 - v}{1-\alpha}(1-\pi_b)\bar{\mathbf{x}}\mathbf{Q}\bar{\mathbf{x}}'\right) \tag{59}$$

$$\frac{\bar{v}_{\tau-}}{\tau_{\tau-}^2} = \tau_{\tau-}^{-1} - \tau^{-1} + \frac{\bar{v}}{\tau^2} + \left(1 + \frac{\alpha\bar{v} - \bar{v}_1}{\tau^c}\right)^2 \bar{\mathbf{x}}\mathbf{Q}\bar{\mathbf{x}}' \tag{60}$$

$$v_{2,\tau-} = v_{2,\tau} + \pi_2^2\tau_M/\xi_2^2. \tag{61}$$

where $\pi_b \equiv \boldsymbol{\Phi}'\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b\boldsymbol{\Phi}$*, and* $\bar{\mathbf{x}}$ *and* $\mathbf{Q}$ *are matrices defined in the appendix, and all coefficients on the right are evaluated at date* τ *(omitted for brevity). The boundary conditions at the horizon date satisfy:*

$$v_{T-} = \bar{v}_{1,T-} = \bar{v}_{T-} = \frac{\tau_\epsilon\tau_{T-}}{\tau_{T-} + \tau_\epsilon}. \tag{62}$$

Finally, the solution of the coefficients $u.$ *satisfies at all dates:*

$$u_{k,t} \equiv -v_{k,t}, \quad k = 1,2,3. \tag{63}$$

Using the result of Proposition 3 we can write an investor's demand as:

$$\mathbf{w}^i = \frac{\boldsymbol{\Sigma}_{\mathbf{P}}^{-1}}{\gamma}\Big(\underbrace{\boldsymbol{\Sigma}_{\mathbf{P}}^{-1}\,\mathbb{E}[\mathrm{d}\widetilde{\mathbf{P}}_t|\mathscr{F}_t^i]/\mathrm{d}t}_{\text{myopic demand}} - \underbrace{\mathbf{1}^\star\mathbf{B}_{\boldsymbol{\Psi}}'((\mathbf{v}\mathbf{b} + v_3\mathbf{c})'(\mathbf{b}\boldsymbol{\Psi}^i - \boldsymbol{\xi}_0\mathbf{M}) + (v_3\mathbf{b} + v_4\mathbf{c})'\mathbf{c}\boldsymbol{\Psi}^i)}_{\text{hedging demand}}\Big) \tag{64}$$

where

$$\mathbf{1}^\star \equiv \begin{pmatrix} \mathbf{0} & \mathbf{I} \end{pmatrix}. \tag{65}$$

The first term is the customary myopic mean-variance demand and the second term corresponds to a hedging demand. Interestingly, the hedging demand shows that an investor trades on the wedge ℓ (see Appendix A.3 for details).

The last step is to clear the market, verify Conjecture 1 and obtain equations for the price coefficients. The market-clearing condition at date t is:

$$\int_0^1 \mathbf{w}_t^i \mathrm{d}i = \mathbf{M} - \widetilde{\mathbf{m}}_t. \tag{66}$$

From this condition we obtain the following proposition.

Proposition 4. *In equilibrium the matrix coefficients* $\boldsymbol{\xi}$ *and* $\boldsymbol{\xi}_0$ *take the form:*

$$\boldsymbol{\xi}_t \equiv \boldsymbol{\xi}_{0,t} \equiv \xi_{1,t}\boldsymbol{\Phi}\boldsymbol{\Phi}' + \xi_{2,t}\,\mathbf{I}, \tag{67}$$

where ξ_1 *and* ξ_2 *are scalar coefficients with* $\xi_{2,t} = -\gamma/v_{2,t} = -\gamma\tau_\epsilon$*, which implies* $\Pi_2 \equiv 0$ *and* $\pi_2 \equiv 0$*; accordingly, let* $\Pi_1 + \Pi_2 = \Pi_1 \equiv \Pi$ *and* $\xi \equiv \xi_1 + \xi_2$*, then* ξ *and the wedge* ℓ *satisfy the ODEs:*

$$\ell' = \Sigma_{\mathbf{P}}(\tau_P^{1/2}/\alpha + (1-\ell)\Pi) + \tau_P(1/\alpha - (1-\ell)(2-\alpha))(\tau^c)^{-1} \tag{68}$$

$$\xi' = -\Sigma_{\mathbf{P}}\Pi\xi, \tag{69}$$

where the equilibrium market price of risk, Π*, is given by:*

$$\Pi = \tau_P^{1/2}\frac{\alpha\bar{v}_1 - v}{\tau^c} - \Sigma_{\mathbf{P}}\frac{\xi v + \gamma}{\xi}, \tag{70}$$

and where $\Sigma_{\mathbf{P}}$ *denotes the diffusion of a long only "value portfolio" and satisfies:*

$$\Sigma_{\mathbf{P}} \equiv \boldsymbol{\Phi}'\boldsymbol{\Sigma}_{\mathbf{P}}\boldsymbol{\Phi} = \tau_m^{-1/2}\xi - (1-\alpha(1-\ell))\tau_P^{1/2}/\tau^c. \tag{71}$$

These two ODEs have boundary conditions upon the announcement:

$$\xi_{\tau-} = \xi_\tau + \xi_{\tau-}\pi_b \tag{72}$$

$$\ell_{\tau-} = 1 - \left((1-\ell_\tau)\frac{\tau_{\tau-}}{\tau_\tau}\frac{\tau^c_{\tau-}}{\tau^c_\tau} + \left(1 - \frac{\tau^c_{\tau-}}{\tau^c_\tau} - y\right)/\alpha_{\tau-}\right)(1-\pi_b)^{-1}, \tag{73}$$

with $y \equiv \boldsymbol{\Phi}'\mathbf{b_P}\mathbf{y} = -\sqrt{\tau_G/\tau_M}\xi + (1-\lambda)(\tau_A + \tau_G)/\tau^c$*, and the equilibrium premium,* π_b*, is:*

$$\pi_b = \tau_\tau\frac{v_\tau - \alpha_\tau\bar{v}_{1,\tau}}{\tau^c_\tau}\boldsymbol{\Phi}'\mathbf{b_P}\mathbf{S}\bar{\mathbf{x}}'\xi_\tau/\xi_{\tau-} - \sigma_{\mathbf{P}}\frac{\gamma + v_\tau\xi_\tau}{\xi_{\tau-}} \tag{74}$$

and where $\sigma_{\mathbf{P}} \equiv \boldsymbol{\Phi}'\mathbf{b_P}\mathbf{S}\mathbf{b}'_{\mathbf{P}}\boldsymbol{\Phi}$ *satisfies:*

$$\sigma_{\mathbf{P}}^{-1} = v_\tau + \frac{\left(\frac{v_\tau - 2\alpha_\tau\bar{v}_{1,\tau} + \bar{v}_\tau\alpha_\tau^2}{(1-\alpha_\tau)^2}\frac{\tau_\tau - \tau_{\tau-}}{\tau_\tau} + \tau_{\tau-} - 2\frac{v_\tau - \alpha_\tau\bar{v}_{1,\tau}}{1-\alpha_\tau}y\right)\frac{\tau_\tau\tau_M}{\xi_\tau^2} - \left(\frac{v_\tau - \alpha_\tau\bar{v}_{1,\tau}}{1-\alpha_\tau}\right)^2\tau_A}{\left(\frac{v_\tau - 2\alpha_t\bar{v}_{1,\tau} + \bar{v}_\tau\alpha_\tau^2}{(1-\alpha_\tau)^2} - \tau_\tau\right)\tau_A + \tau_\tau^2 - \frac{1-\lambda_\tau}{1-\alpha_\tau}\left(\frac{1-\lambda_\tau}{1-\alpha_\tau}\frac{\tau_\tau - \tau_{\tau-}}{\tau_\tau} - 2y\right)\frac{\tau_\tau\tau_M}{\xi_\tau^2}}. \tag{75}$$

The boundary conditions at the liquidation date are:

$$\xi_{T-} = -\gamma v_{T-}^{-1} \equiv -\gamma(\tau_{T-}^{-1} + \tau_\epsilon^{-1}), \tag{76}$$

$$\ell_{T-} = 0. \tag{77}$$

Finally, substituting Eq. (70) *into the relation in Eq.* (43) *gives an algebraic equation for the* *equilibrium coefficient* $\tau_P^{1/2}$*:*

$$0 = \Sigma_{\mathbf{P}} \frac{\bar{v}_1 \xi + \gamma(1-\ell)}{\xi} - \tau_P^{1/2} \left(1 + \frac{\alpha \bar{v} - \bar{v}_1}{\tau^c}\right). \tag{78}$$

The analogous equilibrium equation for $\tau_G^{1/2}$ *upon the announcement is:*

$$0 = \sigma_{\mathbf{P}} \frac{\bar{v}_{1,\tau} \xi_{\tau-} \tau_{\tau-}/\tau_\tau + \gamma(1-\ell_{\tau-})}{\xi_{\tau-}} + \tau_{\tau-} \left(1 + \frac{\alpha_\tau \bar{v}_\tau - \bar{v}_{1,\tau}}{\tau_\tau^c}\right) \mathbf{\Phi}' \mathbf{b_P} \mathbf{S} \bar{\mathbf{x}}'. \tag{79}$$

The system of ODEs in Proposition 3 and 4 along with common precision (see Eq. (132)):

$$\tau_t^c = \tau_0^c + \int_0^t \tau_{P,s} \mathrm{d}s + (\tau_A + \tau_G) \mathbf{1}_{t \geq \tau} \tag{80}$$

form an autonomous system whose dimension is invariant in the number of stocks. This system is to be solved backwards for τ_{T-}^c given. The last step in closing the equilibrium is to determine τ_0^c, which is an endogenous number: at date 0 the empiricist observes a first realization of the vector of prices and updates her precision according to

$$\tau_0^c = \tau_F + \tau_m \left(\frac{\lambda_0}{\xi_0}\right)^2. \tag{81}$$

Thus, we can solve the ODEs numerically by iterating (typically through a "shooting method") until τ_{T-}^c and τ_0^c are consistent with one another.

3.3 Constructing (at least) two equilibria

We now construct two equilibria and for this purpose make the following assumption.

Assumption 1. *Investors only receive a private signal at date* $t = 0$*, i.e.,* $\tau_V > 0$ *but* $\tau_v \equiv 0$*.*

Under this assumption there exists (at least) two equilibria. The first equilibrium is one in which the wedge ℓ is zero at all times; it is also the equilibrium that obtains absent residual uncertainty in payoffs (and which, in this case, is unique); it is described in the next lemma.

Lemma 1. ***(Equilibrium 1, E1)*** *Under Assumption 1 an equilibrium in which*

$$\ell_t \equiv 0 \tag{82}$$

$$v_t \equiv -\gamma/\xi_t, \tag{83}$$

always exists with $\tau_P = \tau_G \equiv 0$ *at all times, and with:*

$$\xi_t = -\gamma((\tau_0^c + \tau_V)^{-1} + \tau_\epsilon^{-1})\, \mathbf{1}_{t<\tau} - \gamma((\tau_0^c + \tau_V + \tau_A)^{-1} + \tau_\epsilon^{-1})\, \mathbf{1}_{t \geq \tau}, \tag{84}$$

where the initial value of the empiricist' precision, τ^c, solves the cubic equation:

$$\tau_0^c = \tau_F + \tau_m \frac{\tau_V^2}{\gamma^2} \frac{\tau_\epsilon^2}{(\tau_0^c + \tau_V + \tau_\epsilon)^2}. \tag{85}$$

This equilibrium delivers the same intuition as that of Corollary 1. In particular, Eq. (84) satisfies Eq. (10) of the background model (with $\bar{\Phi} \equiv 1$) at all date $t \in (0, T)$. In words, there is no change in price informativeness and thus no premium, except upon the announcement; Eq. (84) shows that this premium is entirely due to the amount of uncertainty the announcement resolves, τ_A. Importantly, this equation also shows that in this equilibrium there is no pre-announcement drift—the premium is entirely realized at the announcement.

We now construct a second equilibrium in which $\tau_P \neq 0$. This equilibrium is necessarily associated with $\ell \neq 0$ and solves the system of ODEs of Propositions 3 and 4. In fact because $\tau_P \neq 0$ this system can be solved without knowledge of τ_P, which constitutes a great simplification, as the following corollary demonstrates.

Corollary 3. ***(Equilibrium 2, E2)*** *Under Assumption 1 and the conjecture that an equilibrium in which $\tau_P \neq 0$ and $\tau^c(t)$ is a monotonic function of time exists, this equilibrium can be solved without knowledge of τ_P itself. Define $\bar{\Sigma}_{\mathbf{P}}$ and $\bar{\Pi}$:*

$$\Sigma_{\mathbf{P}} = \tau_P^{1/2} \left(1 + \frac{\alpha\bar{v} - \bar{v}_1}{\tau^c}\right) \frac{\xi}{\bar{v}_1\xi + \gamma(1-\ell)} \equiv \tau_P^{1/2} \bar{\Sigma}_{\mathbf{P}}, \tag{86}$$

$$\Pi = \tau_P^{1/2} \left(\frac{\alpha\bar{v}_1 - v}{\tau^c} - \left(1 + \frac{\alpha\bar{v} - \bar{v}_1}{\tau^c}\right) \frac{\xi v + \gamma}{\bar{v}_1\xi + \gamma(1-\ell)}\right) \equiv \tau_P^{1/2} \bar{\Pi}, \tag{87}$$

along with the analogous expressions upon the announcement:

$$\sigma_{\mathbf{P}}^{-1} \mathbf{\Phi}' \mathbf{b}_{\mathbf{P}} \mathbf{S} \bar{\mathbf{x}}' = -\tau^{-1} \left((1-\ell)\left(\xi^{-1} - \frac{\tau_G + \tau_A}{\tau^c}\right) + \left(\frac{\tau_G + \tau_A}{\tau^c} - y\right)/\alpha\right) \left(1 + \frac{\alpha\bar{v} - \bar{v}_1}{\tau^c}\right)^{-1} \tag{88}$$

$$\sigma_{\mathbf{P}}^{-1} \frac{\pi_b}{1-\pi_b} = \tau \frac{v - \alpha\bar{v}_1}{\tau^c} \sigma_{\mathbf{P}}^{-1} \mathbf{\Phi}' \mathbf{b}_{\mathbf{P}} \mathbf{S} \bar{\mathbf{x}}' - (\gamma/\xi + v). \tag{89}$$

We then change dependent variable and rewrite each coefficient as a function of τ^c:

$$\frac{\mathrm{d}}{\mathrm{d}\tau^c}\ell = \bar{\sigma}_{\mathbf{P}}(1/\alpha + (1-\ell)\bar{\Pi}) + (1/\alpha - (1-\ell)(2-\alpha))/\tau^c \tag{90}$$

$$\frac{\mathrm{d}}{\mathrm{d}\tau^c}\xi = -\bar{\sigma}_{\mathbf{P}}\bar{\Pi}\xi \tag{91}$$

$$\frac{\mathrm{d}}{\mathrm{d}\tau^c}v = \left(\frac{\alpha\bar{v}_1 - v}{\tau^c}\right)^2 - \left(1 + \frac{\alpha\bar{v} - \bar{v}_1}{\tau^c}\right)^2 \left(\frac{v\xi + \gamma}{\bar{v}_1\xi + \gamma(1-\ell)}\right)^2 \tag{92}$$

$$\frac{\mathrm{d}}{\mathrm{d}\tau^c}\bar{v}_1 = \frac{1-\alpha}{\tau^c}\bar{v}_1 + \bar{\Pi}\left(1 + \frac{\alpha\bar{v} - \bar{v}_1}{\tau^c}\right), \tag{93}$$

subject to the boundary conditions of Proposition 3 and 4 and the two simplified conditions:

$$v_{\tau-} = v + \pi_b^2(\sigma_{\mathbf{P}}^{-1} - v) - \frac{v - \alpha\bar{v}_1}{1-\alpha}(1-\pi_b)\left(\frac{\frac{v-\alpha\bar{v}_1}{1-\alpha}(1-\pi_b)}{\frac{v-\alpha\bar{v}_1}{1-\alpha} + \frac{\tau\tau_M}{\xi^2\tau_A}y} + 2\pi_b\right)\sigma_{\mathbf{P}}^{-1}\bar{\mathbf{x}}\mathbf{S}\mathbf{b}_{\mathbf{P}}'\boldsymbol{\Phi} \tag{94}$$

$$\frac{\bar{v}_{1,\tau-}}{\tau_{\tau-}} = \frac{\bar{v}_1}{\tau} + \left(1 + \frac{\alpha\bar{v} - \bar{v}_1}{\tau^c}\right)\left(\pi_b - \frac{\frac{v-\alpha\bar{v}_1}{1-\alpha}(1-\pi_b)}{\frac{v-\alpha\bar{v}_1}{1-\alpha} + \frac{\tau\tau_M}{\xi^2\tau_A}y}\right)\sigma_{\mathbf{P}}^{-1}\boldsymbol{\Phi}'\mathbf{b}_{\mathbf{P}}\mathbf{S}\bar{\mathbf{x}}'. \tag{95}$$

The coefficient $\bar{v}$ is explicit and given by:

$$\bar{v}_t = \frac{\tau_t^c(\bar{v}_t\tau_t^c + \tau_{\tau-}^c(\tau_{\tau-}^c - \tau_t^c))}{(\tau_{\tau-}^c)^2}\mathbf{1}_{t<\tau} + \frac{\tau_t(\tau_\epsilon + \tau_{T-}^c - \tau_t^c)}{\tau_t + \tau_\epsilon + \tau_{T-}^c - \tau_t^c}\mathbf{1}_{t\geq\tau}, \tag{96}$$

where $\bar{v}_{\tau-}$ satisfies the following, simplified expression:

$$\frac{\bar{v}_{\tau-}}{\tau_{\tau-}^2} = \tau_{\tau-}^{-1} - \tau^{-1} + \frac{\bar{v}}{\tau^2} + \left(1 + \frac{\alpha\bar{v} - \bar{v}_1}{\tau^c}\right)^2\left(\frac{v - \alpha\bar{v}_1}{1-\alpha} + \frac{\tau\tau_M}{\xi^2\tau_A}y\right)^{-1}\sigma_{\mathbf{P}}^{-1}\boldsymbol{\Phi}'\mathbf{b}_{\mathbf{P}}\mathbf{S}\bar{\mathbf{x}}'. \tag{97}$$

The simplification associated with Corollary 3 exploits the possibility of solving for equilibrium coefficients taking τ^c as a dependent variable. Since this variables is itself endogenous, we conclude the equilibrium computation by solving Eq. (89) for τ_P analytically and by plugging the solution in Eq. (81). The second equilibrium we construct exploits this simplification.

To further simplify expressions suppose that the $\ell = 0$—equilibrium (Equilibrium 1) holds post-announcement. In this case the boundary conditions for the wedge, ℓ, and the liquidity discount, ξ, simplify to:

$$\ell_{t-} = \frac{1-\alpha_{t-}}{\alpha_{t-}}\left(\frac{v_t\xi_t^2 - \xi_t\tau_G^{1/2}\tau_M^{1/2} + \tau_M}{v_t\xi_t^2(1 + \tau_G/\tau_{t-}) + \tau_M} - 1\right) \tag{98}$$

$$\xi_t - \xi_{t-} = \underbrace{\gamma(\tau_{t-}^{-1} - \tau_t^{-1})}_{\text{background}} + \underbrace{\gamma\frac{\alpha_{t-}}{(1-\alpha_{t-})\tau_{t-}}\ell_{t-}}_{\text{dynamic effect}}. \tag{99}$$

Hence in Equilibrium 1 (henceforth, *E1*), in which $\ell \equiv 0$ throughout, we recover the intuition of the background model of Section 2; in Equilibrium 2 (henceforth, *E2*), even when *E1* holds post-announcement, the announcement causes prices to reveal information, $\tau_G < 0$; this in turn creates a negative wedge $\ell < 0$ immediately prior to the announcement (the first equation above), which reduces the premium immediately prior the announcement (the second equation above). Note that $\ell \neq 0$ cannot arise in a static context: Cespa and Vives (2012) show that in a dynamic context a wedge may arise because investors trade on short-term price swings—not only on fundamental value—causing prices to load more or less aggressively on fundamentals relative to Bayes' rule. We elaborate on the way this mechanism operates in this model in Section 4.1.

For now, the point is that the wedge ℓ creates a pre-announcement drift. The purpose of the next section is to examine how asset-pricing implications differ when there is a pre-announcement drift (*E2*) and when there is not (*E1*).

4 Asset-pricing implications of switching the drift on and off

In this section we examine asset returns across the two equilibria of Section 3.3, and find they differ in four respects:

1. In *E1* prices are uninformative and thus the premium is entirely realized at the announcement; in *E2* there is informed speculation and thus there is a pre-announcement drift.
2. Conditioning on "good" and "bad" news the drift in *E2* and market reactions in *E1* become asymmetric across good and bad news.
3. Beta compression is systematic post-announcement in both equilibria, but beta dispersion pre-announcement may move in opposite directions across equilibria.
4. The CAPM works "too well" in both equilibria, which (pre-announcement) is entirely explained by dispersion in value in *E1* but also explained by beta compression in *E2*.

We now elaborate on each of these predictions.

4.1 Patterns in expected returns on the market

We first examine how market returns behave pre-announcement across equilibria. We introduce the notation, $\mathrm{d}R^e_{\mathbf{M},t} \equiv \mathbf{M}'\mathrm{d}\widetilde{\mathbf{P}}_t$, for excess returns on the market (recall that the riskfree rate is normalized to zero); we further denote its unconditional expected return at date t by $\mu_{\mathbf{M},t} \equiv \mathbb{E}[\mathrm{d}R^e_{\mathbf{M},t}]$.

(Prediction 1) the drift results from informed speculation. The main difference between *E1* and *E2* is that the indirect asset-pricing effect of information is absent (prices carry no informational content) in *E1*. As a result, in this equilibrium the "diffusive part" of the premium $\Pi_t \equiv 0$ associated with resolution of uncertainty through prices is zero at all times, and the premium entirely accrues in a lump when the announcement resolves uncertainty, as in the background model (Section 2):

$$\mu_{\mathbf{M},t} = -\bar{\Phi}^2\gamma\xi^{-1}_{\tau-}(\tau^{-1}_{\tau-} - \tau^{-1}_{\tau})\mathbf{1}_{t=\tau}. \tag{100}$$

In contrast, in *E2* an early premium can arise—a pre-announcement drift—because prices reveal investors' private information, $\tau_P \neq 0$. The "lump" in the premium at the announcement differs, low τ_M

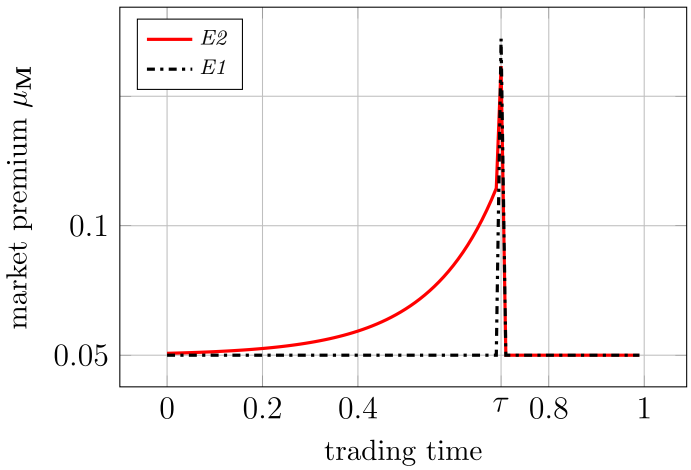

Figure 1: Switching the drift on and off. This figure illustrates the market premium $\mu_{\mathbf{M}}$ across *E1* (black, dashdotted line) and *E2* (solid, red line) (see Lemma 1 and Corollary 3, respectively) over the day. The calibration is $\tau_V = 0.7$, $\tau_\epsilon = 1.1$, $\tau_M = 0.12$, $\tau_A = 2.6$, $\bar{\Phi} = 0.98$, $N = 20$, $\tau_F = 0.5/0.35$, $\gamma = 0.5$, $\tau_m = 1/4$, $\tau = 0.7$ and $T = 1$.

too, as the announcement now affects price informativeness too:

$$\mu_{\mathbf{M},t-} = \underbrace{-\bar{\Phi}^2 \xi_t^{-1} \sigma_{\mathbf{P}} \Pi_t \mathrm{d}t}_{\text{effect of PI}} - \bar{\Phi}^2 \gamma \xi_{\tau-}^{-1} \left(\tau_{t-}^{-1} - \tau_t^{-1} + \underbrace{\frac{\alpha_{t-}}{(1-\alpha_{t-})\tau_{t-}} \ell_{t-}}_{\text{effect of PI}} \right) \mathbf{1}_{t=\tau}. \tag{101}$$

Figure 1 illustrates expected (dollar) returns across the two equilibria; each panel corresponds to different parameter values.

In this model the pre-announcement drift of *E2* is due entirely to informed speculation. More specifically, the indirect effect of price informativeness on premia is driven, to a large extent, by the wedge ℓ. The equation above makes this clear at the announcement but the same mechanism holds pre-announcement. Formally, we can rewrite investors' demand in Eq. (64) as follows.

Lemma 2. *In equilibrium investors' demand satisfies:*

$$\mathbf{w}^i = \underbrace{-(1-\ell)(1-\alpha)/\xi \Delta^i \mathbf{\Phi}}_{\text{speculative intensity}} + \mathbf{M} - \widetilde{\mathbf{m}}. \tag{102}$$

Suppose that $\ell < 0$, meaning that prices reveal more fundamental information than Bayes' rule can justify. Then investors speculate more agressively than they would in an economy in which prices reflect the statistically optimal amount of fundamental information (and vice versa when $\ell > 0$). In *E2* investors believe (rationally) that all other investors will trade ahead of the announcement, speculating on their own private piece of information. Speculation causes prices to reveal more information, $\ell < 0$, than Bayes' rule can justify, leading in turn to more

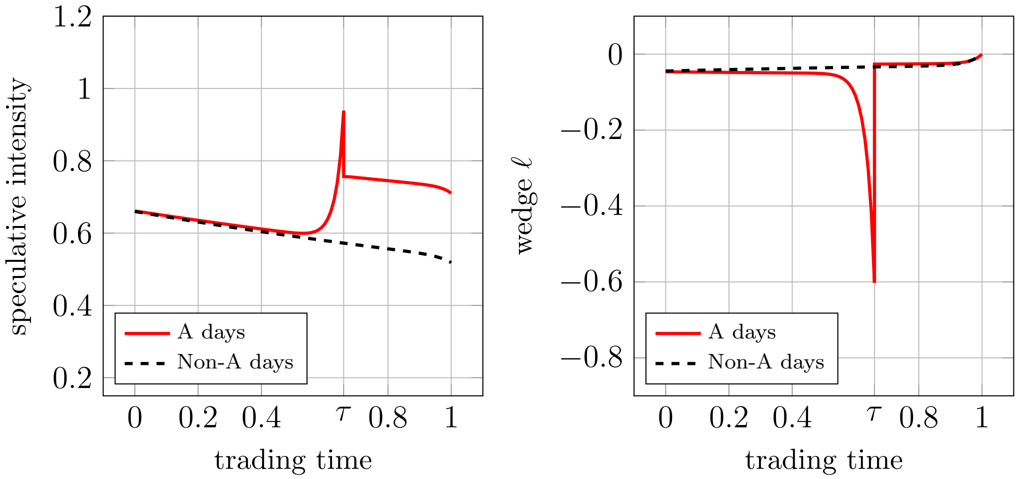

Figure 2: Speculative intensity and the wedge ℓ in *E2*. The left-hand and right-hand plot illustrate speculative intensity (see Lemma 2) and the wedge ℓ in *E2* (see Corollary 3) as a function of time (over the day). The black, dashed line assumes there is no public announcement over the day (Non-A days), whereas the solid, red line assumes an announcement takes place (A-days) at time τ. The calibration is $\tau_F = 0.5/0.35$, $\tau_V = 1/2$, $\tau_\epsilon = 0.8$, $\gamma = 0.8$, $T = 1$, $\tau = 2/3$, $\tau_m = 1/4$, $\tau_M = 3$, $\tau_A = 1.6$, $\bar{\Phi} = 0.15$ and $N = 20$.

intensive speculation; more intensive speculation feeds back into prices and further broadens the wedge, ℓ, ultimately resulting in a premium building ahead of the announcement at exponential speed. In *E1* this premium is absent because investors believe that no investor will trade prior to the announcement. Figure 2 illustrates this feedback effect between the wedge ℓ and speculative intensities.

Overall, a first way to tell the two equilibria apart is to look jointly at price informativeness and the pre-announcement drift.

(Prediction 2) asymmetry across good and bad news. The mechanism of Section 2 (uncertainty resolution commands a premium) is nondirectional—there is a premium on announcements whether the outcome $\widetilde{A}$ is good or bad. Suppose now that we condition pre-announcement returns based on whether the outcome $\widetilde{A}$ is good or bad, then we should observe an asymmetry between the two; the next proposition formalizes this intuition.

Proposition 5. *Conditioning expected excess market returns on "good"* ($\operatorname{sign}(\widetilde{A}) = +1$) *and bad* ($\operatorname{sign}(\widetilde{A}) = -1$) *public announcements, returns now satisfy the relation:*

$$\mathbb{E}\left[\mathrm{d}R^e_{\mathbf{M},t}\middle|\operatorname{sign}(\widetilde{A})\right] = \left(\mu_{\mathbf{M},t} - \Sigma_{\mathbf{P}}(\lambda_t\Pi_t + \tau_P^{1/2})\operatorname{sign}(\widetilde{A})\frac{1}{\tau_t^c}\sqrt{\frac{2}{\pi}\frac{\tau_A\tau_F}{\tau_A+\tau_F}}(1-\mathbf{1}_{t=\tau})\bar{\Phi}\right)\mathrm{d}t \qquad (103)$$
$$+\mathbf{1}_{t=\tau}\left(\mu_{\mathbf{M},t-} + \operatorname{sign}(\widetilde{A})\frac{1}{\tau_t^c}\sqrt{\frac{2}{\pi}\frac{\tau_A\tau_F}{\tau_A+\tau_F}}(y-\lambda_{t-}\pi_b+1-\lambda_t)\bar{\Phi}\right).$$

In *E1* prices are uninformative, $\tau_P \equiv 0$, and thus there is no conditional premium due to

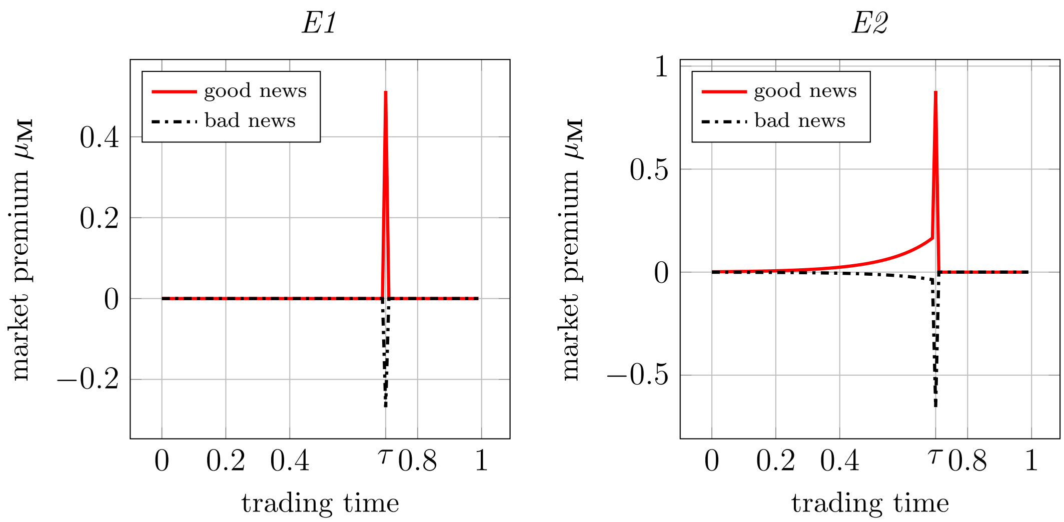

Figure 3: Asymmetric drift across good and bad news. This figure illustrates the market premium $\mu_{\mathbf{M}}$ conditioning on good ($\text{sign}(\widetilde{A}) = +1$, solid, red line) and bad ($\text{sign}(\widetilde{A}) = -1$, black, dashdotted line) news over the day. The left-hand (right-hand) panel makes this comparison in *E1* (*E2*). The calibration is $\tau_V = 0.7$, $\tau_\epsilon = 1.1$, $\tau_M = 0.12$, $\tau_A = 2.6$, $\bar{\Phi} = 0.98$, $N = 20$, $\tau_F = 0.5/0.35$, $\gamma = 0.5$, $\tau_m = 1/4$, $\tau = 0.7$ and $T = 1$.

uncertainty resolution, $\Pi \equiv 0$. As a result, the asymmetry between good and bad news only takes place at the announcement when the news is released. In constract, in *E2* prices are informative, there is a conditional premium associated with it and thus an asymmetry in drift arises across good and bad news. Figure 3 illustrates this asymmetry.

We conclude that a second of telling the two equilibria apart is to condition on news direction.

4.2 Beta formulation

Whether or not there is a drift has implications for beta dispersion and SML slope, and the way the two are responsible for a better-performing CAPM. Therefore, we now consider the vector of unconditional expected excess returns, which we denote by $\boldsymbol{\mu}_t \equiv \mathbb{E}[\mathrm{d}\widetilde{\mathbf{P}}_t]$, across the entire cross section of stocks. We use Conjecture 1 to formulate this vector in terms of market betas. To make results as transparent as possible we make the following assumption.[5]

Assumption 2. *The market portfolio is equally weighted, meaning that* $\mathbf{M} \equiv \mathbf{1}/N$.

It is helpful to start at the horizon date, T, where the CAPM holds in the eyes of investors but not from the perspective of the empiricist. In particular, investors' betas satisfy:

$$\boldsymbol{\beta}_{T-} = \frac{1}{\sigma^2_{\mathbf{M},T-}}(\tau_{T-}^{-1}\bar{\Phi}\boldsymbol{\Phi}' + \tau_\epsilon^{-1}/N\,\mathbf{1}), \tag{104}$$

[5]This assumption simplifies computations but is not without loss of generality (see Andrei, Cujean, and Wilson (2021)).

where $\sigma^2_{\mathbf{M}}$ denotes the variance of market returns under investors' information:

$$\sigma^2_{\mathbf{M},T-} = \tau_{T-}^{-1}\bar{\Phi}^2 + \tau_\epsilon^{-1}/N \quad \text{and} \quad \widehat{\sigma}^2_{\mathbf{M},T-} = (\tau^c_{T-})^{-1}\bar{\Phi}^2 + \tau_\epsilon^{-1}/N, \tag{105}$$

and where we denote with a hat the analogue under empiricist's information. The two vectors of betas are related through:

$$\widehat{\boldsymbol{\beta}}_{T-} - \mathbf{1} = \frac{\sigma^2_{\mathbf{M},T-}}{\widehat{\sigma}^2_{\mathbf{M},T-}} \frac{\tau_{T-}}{\tau^c_{T-}} \left(\boldsymbol{\beta}_{T-} - \mathbf{1}\right). \tag{106}$$

Denote by $\boldsymbol{\mu}_{T-} \equiv \mathbb{E}[\Delta\widetilde{\mathbf{P}}_{T-}]$ the vector of expected returns on the cross section of stocks and by $\mu_{\mathbf{M},T-} \equiv \mathbb{E}[\mathbf{M}'\Delta\widetilde{\mathbf{P}}_{T-}]$ expected market returns. Conditioning down we find the CAPM holds for investors at the horizon date, $\boldsymbol{\mu}_{T-} = \boldsymbol{\beta}_{T-}\mu_{\mathbf{M},T-}$, which is because the problem is static at T (hedging demands drop out). However, because there is an informational gap between investors and the empiricist, the CAPM fails for the empiricist (Andrei et al., 2021):

$$\boldsymbol{\mu}_{T-} = \left(1 - \frac{\widehat{\sigma}^2_{\mathbf{M},T-}}{\sigma^2_{\mathbf{M},T-}} \frac{\tau^c_{T-}}{\tau_{T-}}\right) \mu_{\mathbf{M},T-}\,\mathbf{1} + \frac{\widehat{\sigma}^2_{\mathbf{M},T-}}{\sigma^2_{\mathbf{M},T-}} \frac{\tau^c_{T-}}{\tau_{T-}} \mu_{\mathbf{M},T-}\widehat{\boldsymbol{\beta}}_{T-}, \tag{107}$$

which follows from substituting empiricist's betas in Eq. (106).

At any other time before T the CAPM fails both for investors and the empiricist.

Proposition 6. *Let $\mu_{\mathbf{M}}$ and $\sigma_{\mathbf{M}}$ denote market expected return and volatility, respectively. At any date strictly prior to the liquidation date and for the whole cross section of stocks the time pattern of investors' betas, $\boldsymbol{\beta}$, is entirely parametrized by $\sigma_{\mathbf{M}}$ according to:*

$$\boldsymbol{\beta}(\sigma_{\mathbf{M}};\tau_\cdot) \equiv \frac{1}{\sigma^2_{\mathbf{M}}}((\sigma^2_{\mathbf{M}} - \tau_\cdot^{-1}\gamma^2\tau_\epsilon/N)/\bar{\Phi}\boldsymbol{\Phi} + \tau_\cdot^{-1}\gamma^2\tau_\epsilon/N\,\mathbf{1}), \tag{108}$$

and the time pattern of expected returns, $\boldsymbol{\mu}$, is parametrized by $\mu_{\mathbf{M}}$ and $\sigma_{\mathbf{M}}$ according to:

$$\boldsymbol{\mu}(\mu_{\mathbf{M}},\sigma_{\mathbf{M}};\tau_\cdot) \equiv \underbrace{-\frac{\gamma^2/\tau_\cdot\tau_\epsilon/N\mu_{\mathbf{M}}}{\sigma^2_{\mathbf{M}} - \gamma^2/\tau_\cdot\tau_\epsilon/N}}_{\text{intercept}}\mathbf{1} + \underbrace{\frac{\sigma^2_{\mathbf{M}}\mu_{\mathbf{M}}}{\sigma^2_{\mathbf{M}} - \gamma^2/\tau_\cdot\tau_\epsilon/N}}_{\text{slope}}\boldsymbol{\beta}(\sigma_{\mathbf{M}};\tau_\cdot). \tag{109}$$

At any date in between announcements, $t \in (0,\tau) \cup (\tau, T)$, $\tau_\cdot \equiv \tau_m$ and:

$$\mu_{\mathbf{M},t} \equiv -\sigma_{\mathbf{P}}\xi_t\Pi_t\bar{\Phi}^2 \tag{110}$$

$$\sigma^2_{\mathbf{M},t} \equiv ((\sigma^2_{\mathbf{P}} - \tau_m^{-1}\xi^2_{2,t})\bar{\Phi}^2 + \tau_m^{-1}\xi^2_{2,t}/N), \tag{111}$$

with $\widehat{\boldsymbol{\beta}} \equiv \boldsymbol{\beta}$ (empiricist's and investors' beta coincide). At the announcement, $\tau_{\cdot} \equiv \tau_M$ and:

$$\mu_{\mathbf{M},\tau-} \equiv -\xi_{\tau-}(\underbrace{\sigma_{\mathbf{P},\tau}\tau_M^{1/2}\xi_\tau^{-1}\pi}_{\text{indirect effect through PI}} + \underbrace{(1-\lambda_\tau)(\tau_\tau^c)^{-1}\tau_A\pi_1^A}_{\text{direct effect}})\bar{\Phi}^2 \tag{112}$$

$$\sigma^2_{\mathbf{M},\tau-} \equiv \tau_{\tau-}^{-1}(\tau_\tau\sigma^2_{\mathbf{P},\tau} - \gamma^2\tau_M^{-1}\tau_\epsilon^2 - \tau_A((1-\lambda_\tau)(\tau_\tau^c)^{-1}\tau_\tau - \gamma^2\tau_M^{-1}\tau_\epsilon^2))\bar{\Phi}^2 + \gamma^2\tau_M^{-1}\tau_\epsilon^2/N, \tag{113}$$

where $\sigma^2_{\mathbf{P},\tau} \equiv \tau_M^{-1/2}\xi_\tau - (1-\lambda_\tau)(\tau_\tau^c)^{-1}\tau_G^{1/2}$. Empiricist's and investors' betas differ immediately prior to the announcement and satisfy the relation:

$$\widehat{\boldsymbol{\beta}}_{\tau-} - \mathbf{1} = \frac{\sigma^2_{\mathbf{M},\tau-}}{\widehat{\sigma}^2_{\mathbf{M},\tau-}}\frac{\widehat{\sigma}^2_{\mathbf{M},\tau-} - \gamma^2\tau_M^{-1}\tau_\epsilon^2/N}{\sigma^2_{\mathbf{M},\tau-} - \gamma^2\tau_M^{-1}\tau_\epsilon^2/N}(\boldsymbol{\beta}_{\tau-} - \mathbf{1}). \tag{114}$$

We use the beta formulation of Proposition 6 to examine its implications for beta dispersion and the slope of the Securities Market Line (SML).

(Prediction 3) Beta dispersion may move in opposite directions. We first emphasize that a great advantage of observing data at high frequency is that quadratic variations are observable. This means that the econometrician and investors must agree on instantaneous covariances. In particular, the information gap between investors and the empiricist becomes negligible as the sampling frequency increases—the law of total variance becomes an identity:

$$\mathbb{V}[\Delta\widetilde{\mathbf{P}}_t|\mathscr{F}_t^c] = \mathbb{V}[\Delta\widetilde{\mathbf{P}}_t|\mathscr{F}_t^i] + \underbrace{\mathbb{V}\left[\mathbb{E}[\Delta\widetilde{\mathbf{P}}_t|\mathscr{F}_t^i]\middle|\mathscr{F}_t^c\right]}_{O(\mathrm{d}t^2)\to 0}. \tag{115}$$

As a result empiricist and investors agree on betas, $\widehat{\boldsymbol{\beta}} \equiv \boldsymbol{\beta}$, and thus measuring betas based on realized returns is theoretically appropriate (in between announcements but not at announcements).[6]

We first use Eq. (108) in Proposition 6 to compute cross-sectional dispersion of betas as:

$$\sigma_{\boldsymbol{\beta}} \equiv \frac{1}{\sigma^2_{\mathbf{M}}}|\sigma^2_{\mathbf{M}} - \tau_{\cdot}^{-1}\gamma^2/\tau_\epsilon/N|\frac{\sigma_{\boldsymbol{\Phi}}}{\bar{\Phi}}. \tag{116}$$

This expression shows that the only source of cross-sectional variation in betas is the dispersion of loadings, $\sigma_{\boldsymbol{\Phi}}$, on the common factor). Figure 4 illustrates beta dispersion across two different calibrations. If there is little noise trading around the announcement beta dispersion reacts in opposite directions across the two equilibria. Specifically, in *E1* betas become suddenly more dispersed towards the announcement, whereas they become suddenly more compressed in *E2*. In both cases, consistent with Corollary 2, they become more compressed after the announcement. The possibility of increased dispersion does not arise in the background model because it does not

[6] On the announcement, however, the jump implied by the discreteness of the announcement regenerates the information gap between investors and, as a result, their betas differ (according to Eq. (114)). We leave this issue out of the analysis.

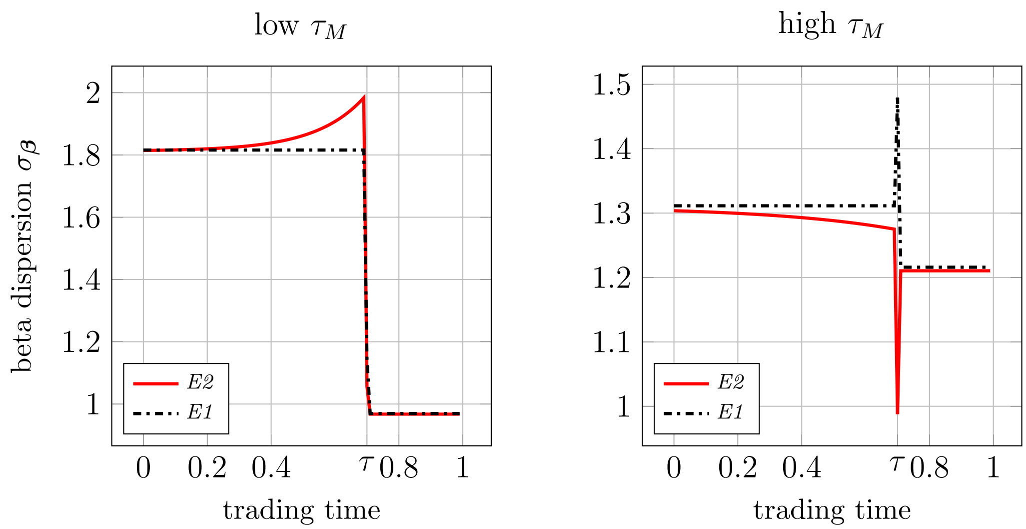

Figure 4: Beta dispersion across equilibria. This figure illustrates cross-sectional dispersion of investors' beta $\sigma_{\boldsymbol{\beta}}$ (see Proposition 6) across *E1* (black, dashdotted line) and *E2* (solid, red line) (see Lemma 1 and Corollary 3, respectively) over the day. The left-hand panel uses the calibration is $\tau_V = 0.7$, $\tau_\epsilon = 1.1$, $\tau_M = 0.12$ and $\tau_A = 2.6$. The right-hand panel uses $\tau_V = 4$, $\tau_\epsilon = 0.8$, $\tau_M = 2$ and $\tau_A = 0.6$. Both use $\bar{\Phi} = 0.1$, $N = 20$, $\tau_F = 0.5/0.35$, $\gamma = 0.5$, $\tau_m = 1/4$, $\tau = 0.7$ and $T = 1$.

incorporate noise trading. Thus, another way to tell the two equilibria apart is to examine beta dispersion.

(Prediction 4) the CAPM works "too well." Proposition 6 shows that the CAPM fails at all times both for investors and the empiricist at all dates except at the close. This failure is a direct consequence of noise trading, without which the CAPM would hold (see Section 2). The form this failure takes in the beta-return relation of Eq. (109) is simple: the SML has a non zero intercept and a slope that differs from the market premium, $\mu_{\mathbf{M}}$.[7] Note also that the way the beta-return relation evolves over time is parametrized by just two numbers, $\mu_{\mathbf{M}}$ and $\sigma_{\mathbf{M}}$.

There are two possible scenarios (depending on the sign of $\sigma_{\mathbf{M}}^2 - \gamma^2/\tau.\tau_\epsilon/N$). If this expression is positive the slope is greater than $\mu_{\mathbf{M}}$ and the CAPM works "too well"; if it is negative, the relation is downward-sloping, even though the market premium is always positive. Although interesting from a theoretical perspective, the second scenario is unlikely to be empirically relevant. We therefore focus on parameter values that lead to the first scenario, that is the SML slope exceeds market premium. Figure 5 illustrates this outcome, with the SML slope appearing as a scaled-up version of the market premium in Figure 1.

[7]The CAPM fails this wax due to the assumption of a diagonal covariance matrix of noise in Eqs. (16) and (17). Relaxing this assumption could be interesting as the SML no longer plots on a line, for isntance.

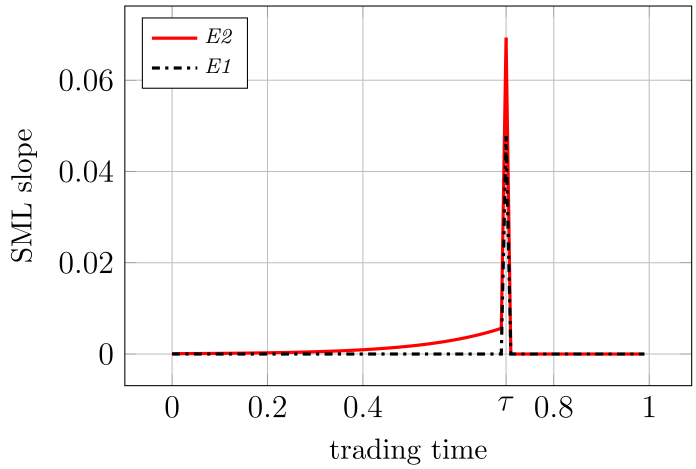

Figure 5: SML slope across equilibria. This figure illustrates the slope of SML as measured by investors (see Proposition 6) across *E1* (black, dashdotted line) and *E2* (solid, red line) over the day. The calibration is $\tau_V = 0.7$, $\tau_\epsilon = 1.1$, $\tau_M = 0.12$, $\tau_A = 2.6$, $\bar{\Phi} = 0.1$, $N = 20$, $\tau_F = 0.5/0.35$, $\gamma = 0.5$, $\tau_m = 1/4$, $\tau = 0.7$ and $T = 1$.

This "excess slope" may have two origins in the model. Formally, we can rewrite this slope as:

$$\text{SML Slope} = \mu_{\mathbf{M}} \frac{\sigma_{\mathbf{\Phi}}}{\bar{\Phi}\sigma_{\boldsymbol{\beta}}}, \tag{117}$$

In words, the extent to which the slope "overshoots" market premium is determined by the ratio of dispersion in $\mathbf{\Phi}$ to dispersion in betas. Andrei, Cujean, and Fournier (2019) show that $\mathbf{\Phi}$ can be thought of as market-to-book ratios. Therefore, dispersion in book-to-market ratios and/or compression in betas together explain excess slope. Note that in *E1* betas become more dispersed pre-announcement, which is a force that reduces slope. However, since the slope is higher that $\mu_{\mathbf{M}}$ in *E1* it follows that $\sigma_{\mathbf{\Phi}}/(\bar{\Phi}\sigma_{\boldsymbol{\beta}}) > 1$ and thus excess slope is entirely explained by dispersion in market-to-book ratios. In *E2* betas become gradually more compressed and thus excess slope is also explained by beta compression.

5 Empirical tests

In this section we test the four empirical predictions of Section 4. We create two subsamples according to the type of announcements, those followed by a press conference (PC) and those that are not. We attempt to link the difference in asset-pricing patterns across the two subsamples to a shift across the two equilibria of the model, *E1* and *E2*. We start with a description of the data and proceed with each prediction in separate subsections.

5.1 Data description and sample selection

The analysis focuses on intraday stock returns around FOMC announcements between January 2001 and December 2020.[8] The FOMC holds eight regularly scheduled meetings during the year and policy decisions are published in a statement after each meeting. From 2001 to March 2011, statements were published at 2:15pm, from April 2011 to January 2013 at 12:30pm (eight announcements) or 2:15pm (seven announcements), and since March 2013 at 2:00pm.[9] Since there is substantial intraday variation in returns we drop 12:30pm announcements to make meaningful comparisons across announcements that take place at the same time of the day. We end up with a sample of 151 announcements.

We further split the sample into two subsamples, a subsample "non-PC" that only contains announcements that are followed by a press conference. This sample spans the period that starts in January 2001 and runs through June 2018, when PCs became systematic; a second subsample "PC" contains all announcements that are followed by a press conference. This subsample runs between April 2011, when the Fed introduced PCs, and December 2020. PCs represent a shift in communication policy that is "intended to further enhance the clarity and timeliness of the Federal Reserves monetary policy communication" (Federal Reserve, 2011). The literature shows strikingly different asset-pricing patterns across the two subsamples (e.g., Boguth et al. (2019); Bodilsen et al. (2021)).[10] We split the sample into PC and non-PCs days to take this shift into account, and more importantly to link this difference in patterns to a change in equilibrium.

We collect intraday stock price data from the New York Stock Exchange (NYSE) Trade and Quote (TAQ) database. We restrict the stock universe to S&P 500 stocks. The data cleaning procedure follows BarndorffNielsen, Reinhard Hansen, Lunde, and Shephard (2009) and only considers transactions that are settled via one exchange (NYSE in our case). Because not all of the S&P 500 stocks are traded on the NYSE, our daily average sample size consists of 418 stocks.

On each trading day, we sample stock prices every five minutes and apply the previous-tick method: at the end of every 5-minute interval, we choose the most recent transaction price for each stock. To avoid potential issues arising at the market opening, we exclude the first five minutes of the trading day so that the first interval starts at 09:34 am.[11] Finally, we use a value-weighted

[8] We select data starting in 2001 to ensure sufficient trading volume so as to avoid problems caused by stale prices.

[9] Since the actual publication time sometimes differs slightly from 2:15 p.m., we use the Bloomberg or Dow Jones Newswires timestamp provided by Lucca and Moench (2015) as a more precise announcement time.

[10] For instance, this improved forward guidance coincides with a reduction in uncertainty prior to the announcement: the CBOE Volatility Index (VIX)—commonly used as a proxy for uncertainty—was on average significantly higher before announcements in the pre-PC era compared to the period in which PCs were regularly held. Between January 2001 and March 2011, the average VIX at the open on the announcement days was 22.6, while the average VIX in period April 2011-December 2020 was 16.7. The difference is statistically significant at the 1% level with a t-statistic of 4.24.

[11] This starting time is chosen so that we can cleanly separate the pre-announcement and post-announcement periods. Last prices before the announcement time are at 13:59 or 14:14, respectively.

portfolio of all stocks present in the sample as a market proxy. For the intraday analysis of the CAPM, we create beta-sorted portfolios and follow Bodilsen et al. (2021) closely. A more detailed procedure is described in section 5.3.

5.2 Pre-announcement returns across good and bad news (Prediction 1 and 2)

In the model there is a pre-announcement drift only to the extent that there is informed trading. That is, pre-announcement returns should be informative about the announcement outcome (Prediction 1). However, the model also predicts that the pre-announcement drift is weak when the outcome is bad (Prediction 2). Taken together these two predictions imply that conditioning on good and bad news is key in examining the extent to which pre-announcement drifts are informative.

5.2.1 Drift across good and bad news

We start by examining pre-announcement returns across good and bad news. We define good and bad news based on the return over the day, assigning each announcement to one of the following two groups: annoucements that take place on a day with (1) high, positive returns (PN) and (2) large, negative returns (NN). Specifically, PN days are announcement days with a daily return that falls in the upper 25% quantile of the return distribution of all announcement days in the subsamples and NN days in the lower 25% quantile.[12] This procedure intends to capture both the extent to which announcements are informative and the "direction" of the information they provide (good or bad news).

Figure 3 depicts cumulative market returns for the two samples non-PC and PC, and Table 1 shows a more detailed overview with summary statistics. There are two main facts. First, the pre-announcement drift over announcements that are not followed by a press conference (non-PC) is mainly driven by PN days (good news). That is, the drift arises mostly ahead of positive news: the average pre-announcement return on PN days is 63.89 bps, whereas it is -1.09 bps on NN days. This asymmetry in the drift suggests that equilibrium *E2* holds in the non-PC sample. Second, in the PC sample, pre-announcement returns exhibit virtually no drift, both across PN and NN days: there is an average positive drift of 14.09 bps on PN days and a drift of 5.23 bps on NN days. Furthermore, market reaction on the announcement is much stronger on PN days. The absence of the drift in the PC sample is consistent with the conclusion of Boguth et al. (2019) and Kurov et al. (2021a) that the average drift before all A days has vanished since the introduction of PCs, and the asymmetry in market reaction is consistent with *E1*.[13] Overall, these patterns support

[12] We use full day returns instead of post-announcement returns because we want to consider potential anticipations before the announcement is made.

[13] Boguth et al. (2019) find that the pre-FOMC drift between 2011 and 2017 is limited to announcements with PCs. Kurov et al. (2021a) extend the sample to 2019 and find that the drift essentially disappeared

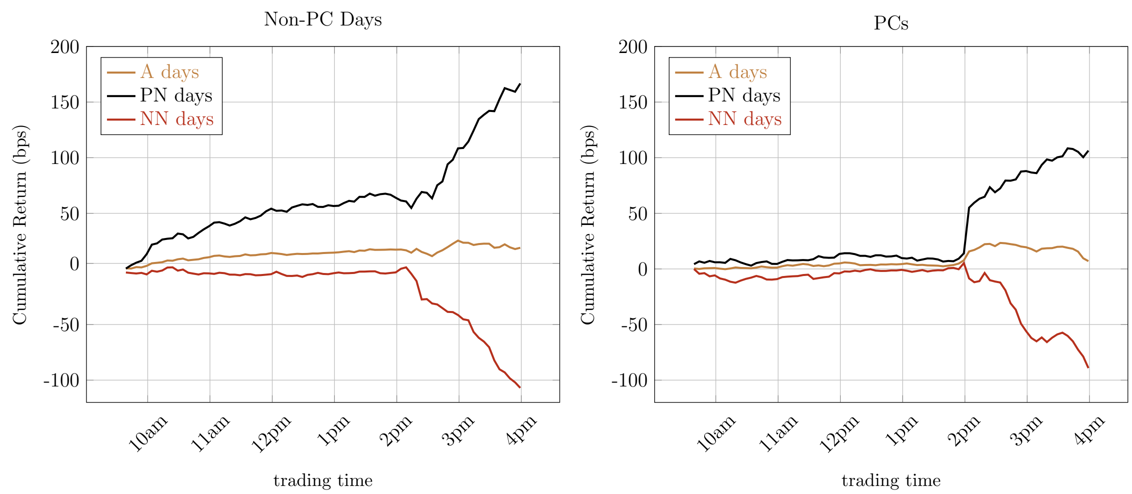

Figure 6: Cumulative returns on announcement days. This figure shows the average cumulative return on a market proxy consisting of S&P500 stocks which are traded on the NYSE. The time period of the non-PC sample runs from January 2001 through June 2018. The time period of the PC sample runs from April 2011 (when press conferences after FOMC announcements were introduced) through December 2020. Positive news (PN) days are announcement days with a daily return that falls in the upper 75% quantile of the daily return distribution of the respective sample, and negative news (NN) days returns in the lower 25% quantile.

Prediction 2.

5.2.2 Informativeness across good and bad news

We now examine to what extent pre-annoucement returns are informative. To measure informativeness before the announcement, we adapt the measure of informed trading of Weller (2017) and define:

$$\omega = \frac{R^{pre}}{R^A}, \tag{118}$$

where R^{pre} denotes the return between the market open and the announcement and R^A is the return over the day. The statistic ω has an intuitive interpretation: positive values indicate that the market was correct in anticipating the outcome of the announcement, whereas negative values indicate the opposite. We calculate ω for all announcement days and report in Table 1 the relative frequency of ω being positive, which we denote by Ω. By construction, Ω takes values between 0 and

after 2015, also on PC days. In the period bwetween April 2011-December 2015, We find that 50% of PC days are PN days, whereas only 17% are NN days. Thus, the average drift on PC days was positive in this period, but mainly driven by the larger fraction of PN days. In the period between 2016-2019 however, PC days were evenly distributed among PN/NN and LI days, such that the average drift on PC days was close to zero, as reported by Kurov et al. (2021a)

1. If Ω=50%, prices are informative only by chance (coin toss). If $\Omega > 50\%$, prices are informative in the sense that an external observer can learn about the announcement outcome from observing returns in the run-up to the announcement. Values that are below 50% indicate that markets are systematically wrong in anticipating the announcement outcome.

Table 1 shows that the strong drift ahead of PN days in the non-PC sample is associated with high price informativeness: in 82% of cases, the market correctly anticipates the outcome of the announcement. In the PC sample, pre-announcement returns predict returns 50% of the time, meaning that a simple coin flip would have done just as well in predicting returns. When taking all announcements together, Ω is slightly below 50% in the non-PC sample and substantially below 50% on the PC sample, which is consistent with the finding that pre- and post-announcement returns are unrelated (e.g., Laarits (2022)); in the PC sample betting in the direction opposite to pre-announcement returns would have done better at predicting the announcement outcome than the market prior to the announcement. These findings support the model's predictions that the drift is strongly associated to price informativeness and that conditioning on good and bad news is key in identifying informative pre-annoucement returns.

5.2.3 Alternative explanations for the asymmetry in the drift

In the model speculation is associated with an upward (downward) pre-announcement drift ahead of positive (negative) news. Because prices are informative they partially resolve uncertainty and thus command a premium pre-announcement. This premium adds to the existing positive return on PN days, but partly offsets the negative drift on NN days, which ultimately creates an asymmetry in the pre-announcement returns. This prediction of the model is consistent with what we find in the data. However, this asymmetry could also be driven by other factors, which we will now test and discuss in this section. We start by controlling for two plausible, alternative stories. We then control for factors that are known to explain a strong drift.

Difficulty in short-selling. Since speculation on bad news requires selling short, a natural explanation for the asymmetry is that short-selling is costly. We create a proxy for short-selling costs using option prices, which we obtain from OptionMetrics.[14] Following Lamont and Thaler (2003) we create a synthetic short position in the market index by writing a call at the bid, buying a put at the ask and borrowing money in the amount of the strike price.[15] We use European at-the-money (ATM) put and call option pairs on the S&P 500 index (SPX) with same strike price and maturity to remain as close as possible to put-call parity. We then define implicit short-selling costs as the percentage deviation of the synthetic short from the S&P 500 index one day before the announcements. We consider all available ATM put and call pairs for different maturities at each

[14] There is evidence that put-call parity violations are positively related to short-selling costs (Lamont and Thaler (2003); Ofek, Richardson, and Whitelaw (2004), Evans, Geczy, Musto, and Reed (2008) Atmaz and Basak (2019).)

[15] If the underlying pays dividends, the present value of the dividends must be additionally borrowed

	A-Days	PN Days	NN Days
		Non-PC Days	
Return (bps)	19.01*	166.76***	-106.95***
	(1.73)	(8.98)	(-8.4)
Pre-A Drift (bps)	17.71***	63.89***	-1.02
	(3.74)	(5.60)	(-0.13)
Ω	50.89	82.14	46.43
Numb. of Days	112	28	28
		PCs	
Return (bps)	7.00	106.38***	-89.15***
	(0.56)	(7.77)	(-7.77)
Pre-A Drift (bps)	7.77	14.02	5.23
	(1.44)	(1.31)	(0.39)
Ω	30.77	50.00	50.00
Numb. of Days	39	10	10

Table 1: Returns and price informativeness on announcement days. This table shows the average pre-announcement returns, average returns and the price informativeness Ω on FOMC announcement days. Ω is the relative frequency of ω being positive, indicating a correct anticipation of the announcement outcome of the FOMC announcement. The time period of the non-PC sample runs from January 2001 through June 2018. The time period of sample B runs from April 2011 (when press conferences after FOMC announcements were introduced) through December 2020. Positive news (PN) days are announcement days with a daily return that falls in the upper 75% quantile of the daily return distribution of the respective sample, and negative news (NN) days in the lower 25% quantile. The p-values of the t-tests for the significance of the respective means are shown in brackets. **,* indicate significance at the 5% and the 1% level, respectively.

	(1)	(2)	(3)	(4)
Intercept	20.81***	33.11***	20.60***	20.68***
	(2.24)	(2.07)	(2.49)	(2.60)
NoPCs	16.83***		16.83***	16.72***
	(3.14)		(3.16)	(3.60)
NN		0.71	0.82	0.49
		(4.45)	(4.23)	(5.51)
NoPCs×*NN*				0.44
				(7.75)
R-squared	0.11	0.00	0.11	0.11

Table 2: Time-dependent differences in implied short-selling costs. This table shows the results of a regression which estimates differences in the implied short-seeling costs (in bps) of the market across different type of days and periods. Short-selling costs are proxied by a synthetic short position that is replicated with at-the-money European index options on the S&P 500. The independent variables are day-dependent dummies, where *NN* represent announcement days with negative news, *Sample non-PC* includes announcements that are followed by a press conference and *NN* × *Sample non-PC* is an interaction variable, i.e. representing NN days in the non-PC sample. The considered time horizon runs from January 2011 through December 2020. All the measures are calculated at the close before the announcement day. Heteroskedasticity-robust standard errors are shown in brackets. **,**,* indicate significance at the 10%, 5% and the 1% level, respectively.

date and calculate a weighted average of short-selling costs, taking the relative open interest of the respective option pairs as the weight.

In Table 2 we show how short-selling costs differ across types of announcement days and samples. Specifically, we regress short-selling costs on the following time-dependent dummies: *Sample non-PC* takes value 1 if announcements take place before the end of March 2011, *NN* takes value 1 on announcement days with negative news, and *NN* × *Sample non-PC* is an interaction variable, which controls for NN days within the non-PC sample. Table 2 shows that although short-selling costs are significantly higher in sample non-PC relative to the PC sample, it was not more expensive to short on NN days compared to other days.

Since the asymmetry in the pre-announcement drift occurs in the non-PC sample only, short-selling costs could indeed have an effect on this asymmetry. To examine whether this is the case, we regress pre-announcement returns on our measure of short-selling costs for positive news (Table 3) and negative news (Table 4) separately. The two tables show that short-selling costs have a significant impact on PN days and no significant impact on NN days on the pre-A drift. This suggests that short-selling costs are an unlikely driver of the asymmetry.

Asymmetry in signal. Another possibility is that there is an asymmetry in the signal itself.

Among possible asymmetries the Fed's put comes to mind.[16] There is evidence that the Fed tends to conduct accommodating monetary policies following periods of low market returns, but does not systematically tighten policies in good times. That is, there exists a Fed put without a corresponding Fed call, which introduces an asymmetry in signals across positive and negative news. From a trader's perspective, negative returns over the past FOMC cycle (Cieslak and Vissing-Jorgensen, 2020) signal a Fed put[17]. To control for the Fed put, we create a dummy variable that takes value 1 if market excess return is negative over the previous FOMC cycle and 0 otherwise.

Regressing pre-announcement returns on this dummy, Table 4 shows that negative returns over the past cycle in fact raise pre-announcement returns upon bad news (see regression (3) in the table). This evidence suggests that the market might incorrectly anticipate a Fed put on NN days. Whereas past negative returns also lead to a higher pre-announcement drift on PN days (see Table 3), which would indicate that the market "correctly" speculates on the Fed put, the effect is statistically weak. We conclude that the Fed put could be a driver of the asymmetry in the drift, but perhaps in an unexpected way (as the market seems to incorrectly speculate on it).

Other relevant variables. Another possibility, which we do not consider in our model, is that the asymmetry comes from the "type" of news disclosed. The literature makes a distinction between a "monetary policy channel" and an "information channel" (e.g., Grkaynak, Sack, and Swanson (2005), Matheson and Stavrev (2014), Cieslak and Schrimpf (2019), Kroencke et al. (2021) or Laarits (2022)). They identify the former channel with positive comovement between stock and bond returns and the latter with negative comovement.[18] To examine whether the asymmetry in the drift can be explained by an asymmetry between the two channels, we create a dummy variable *MP-channel* that takes value of 1 if treasury bond returns and stock returns move in the same direction on the announcement day ("monetary mechanism") and 0 if they move in opposite directions ("information channel").[19] Regression (2) in Table 3 shows that the pre-announcement drift on PN days is on average 62 bps weaker if the announcement affects the stock market through the monetary channel. This suggests that non-monetary announcements could be in part responsible for the asymmetry.

We also verify that the market properly anticipates the news, that is PN and NN days are not merely positive or negative surprises. We follow Kuttner (2001) and evaluate the effect of a surprise change in the Fed funds target rate. Specifically, we compute surprise changes from 30-day Federal

[16]See Cieslak and Vissing-Jorgensen (2020) for a detailed study on this topic

[17]A FOMC cycle is the period between two FOMC announcements, which usually lasts six weeks.

[18]The former concerns monetary news and their effect on asset prices, e.g., unexpected hikes (drops) in target rates reduce (raise) asset prices, which is associated with positive comovement between stock and bond returns; the latter captures non-monetary news that affect expectations of economic outlooks or risk premia, and tends to be associated with a negative covariance between stocks and bonds (Cieslak and Schrimpf, 2019).

[19]We use the return on a portfolio consisting of an ETF of 1-3 year treasury bonds (ticker: SHY) and an ETF of 7-10 year treasury bonds (ticker: IEF) as a measure of bond returns. The data is retrieved from CRSP. Since time series for these ETFs start in July 2002, we use changes of treasury yields with different maturities obtained from s a measure for bond returns for the period January 2001-July2002.

funds futures data, which we include as a control in the regression (*unexp* ΔFF). The effect is close to being insignificant in the non-PC sample and insignficant in the PC sample, although one should apply some caution in interpreting this result. Due to the zero lower bound on rates and given that rates have been low in the last decade it is possible that the market properly anticipates the news simply because significant changes could only be updwards.

Finally, we control for measures of risk. In particular, we use the "risk shift" (RS) measure of Kroencke et al. (2021), which is intended to measure the effect of the announcement on risk appetite (high risk shift indicates that markets went in "risk-on" mode).[20] Additionally, we control for the level of the VIX at the open of the announcement day, as Lucca and Moench (2015) find that higher levels of VIX are associated with a higher pre-announcement drift. We find that higher risk shifts have a significantly negative effect on the pre-announcement drift on PN days. We interpret this result as risk shifts being highest if news are positive and come as a surprise (there is no anticipation in the run-up and thus no drift). We find that higher VIX has a positive (negative) effect on the pre-announcement return on PN (NN) days. Therefore, a higher level of VIX seems to amplify price informativeness on announcement days, although the magnitude is twice as large on PN days.

[20]We obtain the data on RS for 2006-2019 directly from Tim Kroenckes website. For the 2001-2005 period, VIX is used as the only risky asset to calculate RS.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	52.48***	78.50***	35.04***	-6.70	17.22	71.61***	19.80
	(9.77)	(13.96)	(12.05)	(17.37)	(22.37)	(12.25)	(28.57)
unexp ΔFF *(bps)*	3.05*						2.74
	(1.81)						(3.79)
MP		-62.00***					-41.77
		(15.64)					(30.73)
FedPutSignal			33.20*				-1.63
			(19.14)				(23.87)
VIX				2.25***			2.26
				(0.78)			(1.47)
ShortSellingCosts					0.88**		-0.04
					(0.44)		(0.87)
RS						-22.48**	-5.41
						(10.93)	(16.20)
R-squared	0.06	0.28	0.08	0.23	0.17	0.12	0.49
Numb. of Announcements	38	38	38	38	38	37	37

Table 3: Drivers of pre-Announcement returns on PN Days This table shows the regression estimates of the pre-announcement market return on PN days on various potential drivers. The pre-announcement drift is calculated between the open and the time when the announcement is made.*unexp* ΔFF *(bps)* is the unexpected change of the Federal funds target rate, which is calculated with the approach of Kuttner (2001). *MP-channel* is a dummy variable which is 1 if the returns on the announcement day of a portfolio of treasury securities and the market return have the same sign, and 0 otherwise. *FedPutSignal* is a dummy variable which assumes the value 1 if the previous FOMC cycle return was negative, and 0 otherwise. *VIX* is the CBOE implied volatility index at the market open of the announcement day. *ShortSellingCosts* obtained from a synthetic short position by using ATM European Index options on the S&P500 and *RiskShift* is the measure for change in risk appetite introduced by Kroencke et al. (2021). The considered time horizon starts in January 2001 and ends in December 2020, except of the regressions that include *RS*, as the data is only available until 2019. Heteroskedasticity-robust standard errors are shown in brackets. **,**,* indicate significance at the 10%, 5% and the 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Intercept	-3.00	2.47	-12.63**	26.80**	13.55	-2.86	-36.17
	(6.19)	(9.72)	(5.73)	(11.39)	(10.75)	(8.57)	(31.12)
unexp ΔFF *(bps)*	4.71						4.19**
	(4.09)						(1.93)
MP		-5.02					4.50
		(12.37)					(14.37)
FedPutSignal			41.95***				30.90
			(15.51)				(20.13)
VIX				-1.02**			1.06
				(0.43)			(1.40)
ShortSellingCosts					-0.34		-0.11
					(0.24)		(0.41)
RS						-9.99	-12.86
						(6.99)	(15.10)
R-squared	0.13	0.00	0.24	0.10	0.05	0.05	0.43
Numb. of Announcements	38	38	38	38	38	36	36

Table 4: Drivers of pre-Announcement returns on NN Days This table shows the regression estimates of the pre-announcement market return on PN days on various potential drivers. The pre-announcement drift is calculated between the open and the time when the announcement is made.*unexp* ΔFF *(bps)* is the unexpected change of the Federal funds target rate, which is calculated with the approach of Kuttner (2001). *MP-channel* is a dummy variable which is 1 if the returns on the announcement day of a portfolio of treasury securities and the market return have the same sign, and 0 otherwise. *FedPutSignal* is a dummy variable which assumes the value 1 if the previous FOMC cycle return was negative, and 0 otherwise. *VIX* is the CBOE implied volatility index at the market open of the announcement day. *ShortSellingCosts* obtained from a synthetic short position by using ATM European Index options on the S&P500 and *RiskShift* is the measure for change in risk appetite introduced by Kroencke et al. (2021). The considered time horizon starts in January 2001 and ends in December 2020, except of the regressions that include *RS*, as the data is only available until 2019. Heteroskedasticity-robust standard errors are shown in brackets. **,**,* indicate significance at the 10%, 5% and the 1% level, respectively.

5.3 The CAPM on FOMC announcements (Prediction 3 and 4)

The model predicts that the CAPM works “too well” on annoucements and that dispersion in value and potentially beta compression can explain this fact. Is this true in the data? We now attempt to link predictions across equilibria to empirical findings across the PC and non-PC sample. We start by testing Prediction 3 regarding beta dispersion.

5.3.1 Beta dispersion across subsamples (Prediction 3)

To estimate beta we follow Andersen et al. (2021) and Bodilsen et al. (2021) closely. Specifically, on each trading day we estimate the intraday beta at the stock level as follows:

$$\beta_i = \frac{\sum_{i=1}^{n_c} R_i R_m}{\sum_{i=1}^{n_v} R_m^2}, \tag{119}$$

where R_m is the market return and R_i is the return on stock i. Since covariances tend to be downward biased at very high frequencies due to asynchronous trading—the so-called “Epps effect” (Epps, 1979)—we use a 10-minute frequency for the covariation part (n_c=38) and a 5-minute frequency for the variation part (n_v=75). This way we attenuate measurement issues associated with asynchronous trading and microstructure noise. Every day, realized betas on individual stocks are used to form ten value-weighted beta-sorted portfolios, which we index by $p = \{1, 2, ..., 10\}$. In a third step, we estimate betas for each beta-sorted portfolio using a 5-minute frequency for both the covariation and the variation part of the beta formulation in Eq. (119).[21]

We follow Andersen et al. (2021) in estimating beta dispersion, and define:

$$\sigma^2_{\boldsymbol{\beta}} = \frac{1}{10} \sum_{i=p}^{10} (\beta_p - 1)^2. \tag{120}$$

We then plot beta dispersion in Figure 7 on A days over 90-minutes rolling windows. Betas become more compressed over the course of the trading day, confirming the pattern documented by Andersen et al. (2021) and Bodilsen et al. (2021) and which holds on any day, whether or not an announcements takes place. The key difference between the non-PC and PC samples is that there is a spike in beta dispersion at the announcement in the PC sample, whereas betas become more compressed in the non-PC sample.[22] This finding corresponds to the pattern of beta dispersion across equilibria *E1* and *E2* in Figure 4 under low noise trading (Prediction 3).

[21] The complications arising from asynchronous trading and microstructure noise is a minor issue if we use portfolios instead of stocks. Therefore, we estimate covariances at a 5-min frequency.

[22] The spike in beta dispersion was not found by Bodilsen et al. (2021). This is most likely coming from the fact that we do not truncate the stock returns, as we are particular interested in both the diffusion and the jumps in returns.

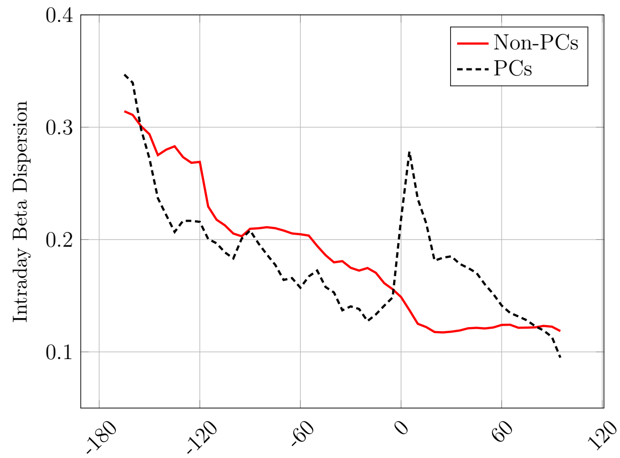

Figure 7: Intrada beta dispersion. This figure shows the average beta dispersion on announcement days of S&P500 stocks which are traded on the NYSE. For the beta estimation, we use ten beta-sorted portfolios consisting of S&P500 stocks which are traded on the NYSE. Beta dispersion is estimated over 90-min rolling windows. The non-PCs sample consists of FOMC announcement days without press conferences (PCs) between January 2001-June 2018. The time period of the PC sample runs from April 2011 (when press conferences after FOMC announcements were introduced) through December 2020.

5.3.2 The CAPM works "too well" (Prediction 4)

One of the main asset-pricing facts about FOMC announcements is that the CAPM works better on these occasions (Savor and Wilson, 2014). Our analysis in fact indicates that the CAPM works "too well" on announcements, meaning that the SML slope is higher than the market premium. To examine how well the CAPM works in the data, we run Fama and MacBeth (1973) regressions and estimate the SML slope at a daily level first. To further control for beta compression, we use full sample betas for the daily SML estimation. Table 5 presents an overview of the results at the daily frequency. Excess slope is the difference between the SML slope and the market return. If the excess return is 0, it means that the CAPM just works "spot on." We make the following two observations. First, the SML slope is statistically significantly different from zero only on PN and NN days. Second, the CAPM works too well on PN days and in the non-PC sample only.

We now examine the behavior of the SML at the intraday frequency. In the model, the evolution of the slope of the SML is driven by the market premium $\mu_{\mathbf{M}}$, beta dispersion $\sigma_{\boldsymbol{\beta}}$ and dispersion in value $\sigma_{\boldsymbol{\Phi}}$ (see Eq. (117)). Specifically, more compressed betas, and/or more dispersed fundamental values and/or higher market premia lead to a steeper SML. To evaluate the relevance of each driver at the intraday frequency, in Figure 8 we plot the estimated intraday SML slope (a) across PC and non-PC days. We further compute "excess slope," the gap between the slope and market return, across non-PC days (panel b) and PC days (panel c). In each panel, to control for the effect of beta compression, we plot the excess slope that is based on (fixed) full-sample betas (red line) and compare it to the excess slope based on time-varying betas computed over 1.5-hours rolling windows (black line).

	A-Days	PN-Days	NN-Days
		non-PCs	
Intercept (bps)	-20.88***	-118.04	26.43
	(0.42)	(-3.25)	(1.51)
Slope (bps)	38.56	279.48***	-133.30***
	(0.1)	(5.95)	(-6.44)
Excess Slope	19.55	112.72***	-26.35
	(1.61)	(3.1)	(-1.54)
Observations	112	28	28
		PCs	
Intercept (bps)	-11.85	-48.99	44.54*
	(-1.33)	(-1.73)	(1.83)
Slope (bps)	19.79	159.13***	-135.96***
	(0.04)	(4.5)	(-4.70)
Excess Slope	12.79	52.75	-46.81
	(0.87)	(1.68)	(-1.61)
Observations	39	10	10

Table 5: SML estimation, daily. This table shows the intercept and slope of the SML on announcement days which we estimate at a daily level with the Fama and MacBeth (1973) approach. We use ten beta-sorted portfolios consisting of S&P500 stocks which are traded on the NYSE. We calculate betas over all announcements of the respective subsample (PC and non-PCs, respectively). The non-PCs sample consists of FOMC announcement days without press conferences (PCs) between January 2001-June 2018. The time period of the PC sample runs from April 2011 (when press conferences after FOMC announcements were introduced) through December 2020 Positive news (PN) days are announcement days with a daily return that falls in the upper 75% quantile of the daily return distribution of the respective sample, and negative news (NN) days in the lower 25% quantile in the respective sample of announcement days. T-statistics are shown in brackets. ***,**,* indicate significance at the 10%, 5% and the 1% level, respectively.

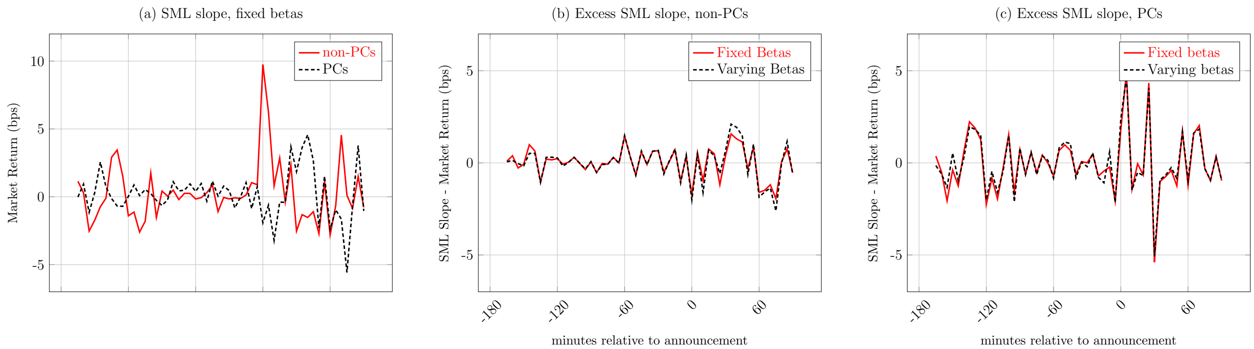

Figure 8: Intraday SML and its deviation from market returns. Plot (a) shows the average intraday SML slopes at a five-minute frequency on non-PC (red solid line) and PC days (black dashed line). Plot (b) and (c) depict the difference between the SML slope and the market return ("excess slope") for fixed betas (red line) and time-varying betas (black line). Fixed betas are calculated over all the announcement days of the respective sample, whereas varying betas are calculated over 1.5-hour windows. The stock universe consists of S&P500 stocks which are traded on the NYSE. The non-PCs sample consists of FOMC announcement days without press conferences (PCs) between January 2001-June 2018. The time period of the PC sample runs from April 2011 (when press conferences after FOMC announcements were introduced) through December 2020.

Plot (a) reveals that the intraday SML slope spikes at the announcement on non-PC days, and thus "overshoots" the market risk premium at this date. Panel (b) and (c) show that beta dispersion barely affects results. To further examine whether dispersion in value can explain excess slope, in Table 6 we control for value. This table shows that value in the non-PC sample indeed raises significantly returns on high-beta portfolios, and thus that the excess slope is at least in part explained by value.

[this section is under construction]

	non-PCs									
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Intercept	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00**	-0.00	0.00	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Mrkt	0.51***	0.67***	0.76***	0.87***	0.93***	1.01***	1.12***	1.24***	1.38***	1.72***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
HML	-0.04	-0.05**	-0.04	0.00	-0.01	0.04*	0.10***	0.20***	0.37***	0.56***
	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)	(0.04)	(0.06)
R-squared	0.58	0.77	0.83	0.87	0.88	0.89	0.91	0.91	0.88	0.84
	PCs									
Intercept	-0.00	0.00	0.00	-0.00	-0.00	-0.00	0.00	-0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Mrkt	0.58***	0.78***	0.84***	0.93***	0.97***	1.02***	1.07***	1.16***	1.29***	1.53***
	(0.03)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.05)
HML	0.18***	-0.01	-0.10***	-0.15***	-0.14***	-0.14***	-0.15***	0.01	0.07	0.27**
	(0.07)	(0.05)	(0.03)	(0.03)	(0.02)	(0.02)	(0.03)	(0.03)	(0.05)	(0.11)
R-squared	0.51	0.81	0.88	0.92	0.92	0.93	0.93	0.90	0.88	0.72

Table 6: Value Exposure. This table shows the coefficients of a regression of five-minute returns of ten beta-sorted portfolios on the market return *Mrkt* and the value factor *HML*. The ten beta-sorted portfolios consist of S&P500 stocks which are traded on the NYSE. The regression is run for days with press conferences (PCs) and without press conferences (non-PCs) seperately. The time period is restricted to 2001-2017. Standard errors are Newey-West adjusted and shown in parentheses. ***, **,* indicate significance at the 10%, 5% and the 1% level, respectively.

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A Appendix

A.1 Proof of Proposition 1

In this appendix we determine how an investor i perceives her investment opportunity set conditional on her information. We slice the time interval $[0, T)$ into two subperiods, $[0, \tau)$ and $[\tau, T)$. We first determine how beliefs are updated over $(0, \tau)$ and (τ, T) and then turn to how they are updated at date τ. Removing commonly observable terms, prices are informationally equivalent to:

$$\widetilde{\mathbf{P}}_t^a = \boldsymbol{\xi}_t \widetilde{\mathbf{m}}_t + \boldsymbol{\Phi} \lambda_t \widetilde{F}. \tag{121}$$

We stack observables (excluding public announcements), both private and public, in a vector $\mathbf{s}_t^i = \begin{pmatrix} \widetilde{V}_t^i & (\widetilde{\mathbf{P}}_t^a)' \end{pmatrix}'$ and unobservables in a vector $\mathbf{z}_t = \begin{pmatrix} \widetilde{F} & \widetilde{\mathbf{m}}_t' \end{pmatrix}'$. Applying Ito's lemma to the sufficient price statistic, their dynamics satisfy:

$$\mathrm{d}\mathbf{s}_t^i = \underbrace{\begin{pmatrix} 1 & \mathbf{0} \\ \lambda_t' \boldsymbol{\Phi} & \dot{\boldsymbol{\xi}}_t - \boldsymbol{\xi}_t \mathbf{b} \end{pmatrix}}_{\equiv \mathbf{A}_{sz}} \mathbf{z}_t \mathrm{d}t + \underbrace{\begin{pmatrix} \tau_v^{-1/2} & \mathbf{0} \\ \mathbf{0} & \tau_m^{-1/2} \boldsymbol{\xi}_t \end{pmatrix}}_{\equiv \mathbf{b}_s} \mathrm{d} \underbrace{\begin{pmatrix} B_t^i \\ \mathbf{B}_{m,t} \end{pmatrix}}_{\equiv \mathbf{B}_t}, \tag{122}$$

and

$$\mathrm{d}\mathbf{z}_t = \underbrace{\begin{pmatrix} 0 & \mathbf{0} \\ \mathbf{0} & -\mathbf{b} \end{pmatrix}}_{\equiv \mathbf{A}_{zz}} \mathbf{z}_t \mathrm{d}t + \underbrace{\begin{pmatrix} 0 & \mathbf{0} \\ \mathbf{0} & \tau_m^{-1/2} \mathbf{I} \end{pmatrix}}_{\equiv \mathbf{b}_z} \mathrm{d}\mathbf{B}_t, \tag{123}$$

where $\mathbf{0}$ denotes a vector or matrix of zeros of conformable size. Kalman filtering equations (e.g., Lipster and Shiryaev (2001)) imply that investor i's expectations about $\mathbf{z}_t$ are updated according to:

$$\mathrm{d}\widehat{\mathbf{z}}_t^i = \mathbf{A}_{zz} \widehat{\mathbf{z}}_t^i \mathrm{d}t + (\mathbf{T}_t \mathbf{A}_{sz}' + \mathbf{b}_z \mathbf{b}_s')(\mathbf{b}_s \mathbf{b}_s')^{-1/2} \mathrm{d}\widehat{\mathbf{B}}_t^i, \tag{124}$$

where $\widehat{\mathbf{B}}^i$ is a $N+1-$dimensional $\widehat{\mathbb{P}}^i-$Brownian motion and $\mathbf{T}_t \equiv \mathrm{Var}[\mathbf{z}_t | \mathscr{F}_t^i]$ denotes the posterior covariance matrix. Using observational equivalence, which implies that

$$\widetilde{\mathbf{m}}_t - \widehat{\mathbf{m}}_t^i = -\boldsymbol{\xi}_t^{-1} \boldsymbol{\Phi} \lambda_t (\widetilde{F} - \widehat{F}_t^i), \tag{125}$$

we can rewrite this matrix as:

$$\mathbf{T}_t = \tau_t^{-1} \underbrace{\begin{pmatrix} 1 & -\lambda_t \mathbf{\Phi}' \boldsymbol{\xi}_t^{-1} \\ -\lambda_t \boldsymbol{\xi}_t^{-1} \mathbf{\Phi} & \lambda_t^2 \boldsymbol{\xi}_t^{-1} \mathbf{\Phi} \mathbf{\Phi}' \boldsymbol{\xi}_t^{-1} \end{pmatrix}}_{\equiv \mathbf{\Omega}_t}. \tag{126}$$

Rewriting the (incremental) price signal-to-noise ratio $\tau_{P,t}$ defined in Eq. (45) as (here assuming that $\mathbf{b} \neq \mathbf{0}$ for generality):

$$-\tau_{P,t}^{1/2} \mathbf{\Phi} = \tau_m^{1/2} \left(\lambda_t' \boldsymbol{\xi}_t^{-1} - \lambda_t \boldsymbol{\xi}_t^{-1} \dot{\boldsymbol{\xi}}_t \boldsymbol{\xi}_t^{-1} + \mathbf{b} \lambda_t \boldsymbol{\xi}_t^{-1} \right) \mathbf{\Phi}, \tag{127}$$

we can in turn rewrite the filter dynamics, which hold over the two subperiods (pre- and post-announcement) as:

$$\mathrm{d}\widehat{\mathbf{z}}_t^i = \mathbf{A}_{zz} \widehat{\mathbf{z}}_t^i \mathrm{d}t + \begin{pmatrix} \tau_v^{1/2} \tau_t^{-1} & -\tau_t^{-1} \tau_{P,t}^{1/2} \mathbf{\Phi}' \\ -\lambda_t \tau_t^{-1} \tau_v^{1/2} \boldsymbol{\xi}_t^{-1} \mathbf{\Phi} & \lambda_t \tau_t^{-1} \tau_{P,t}^{1/2} \boldsymbol{\xi}_t^{-1} \mathbf{\Phi} \mathbf{\Phi}' + \tau_m^{-1/2} \mathbf{I} \end{pmatrix} \mathrm{d}\widehat{\mathbf{B}}_t^i, \quad t \in (0, \tau) \cup (\tau, T). \tag{128}$$

The Kalman filtering equation for $\mathbf{T}_t$ satisfies:

$$\dot{\mathbf{T}}_t = \mathbf{A}_{zz} \mathbf{T}_t + \mathbf{T}_t \mathbf{A}_{zz}' + \mathbf{b}_z \mathbf{b}_z' - (\mathbf{T}_t \mathbf{A}_{sz}' + \mathbf{b}_z \mathbf{b}_s')(\mathbf{b}_s \mathbf{b}_s')^{-1} (\mathbf{A}_{sz} \mathbf{T}_t + \mathbf{b}_s \mathbf{b}_z'). \tag{129}$$

Using the simplification in Eq. (126) and the definition of price informativeness gives an ODE for τ_t over each subinterval:

$$\tau_t' = \tau_{P,t} + \tau_v, \quad t \in (0, \tau) \cup (\tau, T). \tag{130}$$

Repeating these steps under $\mathscr{F}^c$ (simply set $\tau_v \equiv 0$) we obtain:

$$\mathrm{d}\widehat{\mathbf{z}}_t^c = \mathbf{A}_{zz} \widehat{\mathbf{z}}_t^c \mathrm{d}t + \begin{pmatrix} -(\tau_t^c)^{-1} \tau_{P,t}^{1/2} \mathbf{\Phi}' \\ \lambda_t (\tau_t^c)^{-1} \tau_{P,t}^{1/2} \boldsymbol{\xi}_t^{-1} \mathbf{\Phi} \mathbf{\Phi}' + \tau_m^{-1/2} \mathbf{I} \end{pmatrix} \mathrm{d}\widehat{\mathbf{B}}_{m,t}^c \quad t \in (0, \tau) \cup (\tau, T) \tag{131}$$

with $\widehat{\mathbf{B}}^c$ a $\widehat{\mathbb{P}}^c-$Brownian motion and

$$(\tau_t^c)' = \tau_{P,t} \quad t \in (0, \tau) \cup (\tau, T). \tag{132}$$

We now determine how beliefs are updated upon the announcement, that is at date τ. The announcement creates a discontinuity in the empiricist's information set, $\mathscr{F}^c$, as she not only observes an additional bulk of information (the announcement) but prices also move discontinuously to reflect this information (by $\Delta\widetilde{\mathbf{P}}_\tau \equiv \widetilde{\mathbf{P}}_\tau - \widetilde{\mathbf{P}}_{\tau-}$):

$$\mathscr{F}^c_\tau = \mathscr{F}^c_{\tau-} \bigvee \sigma\left(\{\widetilde{\mathbf{P}}_\tau, A_\tau\}\right). \tag{133}$$

More specifically, the sufficient statistic for prices immediately after the announcement jumps to reflect the lump in noise traders' demand:

$$\widetilde{\mathbf{P}}^a_\tau = \mathbf{\Phi}\lambda_\tau \widetilde{F} + \boldsymbol{\xi}_\tau(\widetilde{\mathbf{m}}_{\tau-} + \Delta\widetilde{\mathbf{m}}_\tau), \tag{134}$$

compared to its level right before the announcement:

$$\widetilde{\mathbf{P}}^a_{\tau-} = \mathbf{\Phi}\lambda_{\tau-} \widetilde{F} + \boldsymbol{\xi}_{\tau-}\widetilde{\mathbf{m}}_{\tau-}, \tag{135}$$

and thus the sufficient statistic for the price jumps according to:

$$\Delta\widetilde{\mathbf{P}}^a_\tau = \mathbf{\Phi}(\lambda_\tau - \lambda_{\tau-})\widetilde{F} + (\boldsymbol{\xi}_\tau - \boldsymbol{\xi}_{\tau-})\widetilde{\mathbf{m}}_{\tau-} + \boldsymbol{\xi}_\tau\Delta\widetilde{\mathbf{m}}_\tau. \tag{136}$$

We gather the sufficient price statistic and the announcement signal in the following vector of observables:

$$\mathbf{y}_\tau \equiv \begin{pmatrix} \widetilde{A}_\tau \\ \widetilde{\mathbf{P}}^a_\tau \end{pmatrix} = \underbrace{\begin{pmatrix} 1 & \mathbf{0} \\ \lambda_\tau \mathbf{\Phi} & \boldsymbol{\xi}_\tau \end{pmatrix}}_{\equiv \mathbf{h}_\tau} \mathbf{z}_\tau + \widetilde{\boldsymbol{\epsilon}}_\tau, \quad \widetilde{\boldsymbol{\epsilon}}_\tau \sim \mathscr{N}\left(\mathbf{0}, \underbrace{\begin{pmatrix} \tau_A^{-1/2} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} \end{pmatrix}}_{\equiv \mathbf{r}}\right), \tag{137}$$

with the vector of hidden states jumping to:

$$\mathbf{z}_\tau = \mathbf{z}_{\tau-} + \underbrace{\begin{pmatrix} 0 \\ \mathbf{I} \end{pmatrix}}_{\equiv \mathbf{b}} \Delta\widetilde{\mathbf{m}}_\tau. \tag{138}$$

Discrete-time Kalman filtering equations (e.g., Jazwinski, 1970, Theorem 7.1) imply that the empiricist's views and standard error jump according to:

$$\Delta\widehat{\mathbf{z}}^c_\tau = \mathbf{k}^c_\tau(\mathbf{y}_\tau - \mathbf{h}_\tau\widehat{\mathbf{z}}^c_{\tau-}), \tag{139}$$

$$\Delta\mathbf{T}^c_\tau = -\mathbf{k}^c_\tau\mathbf{h}_\tau\mathbf{T}^c_{\tau-} + \tau_M^{-1}(\mathbf{I} - \mathbf{k}^c_\tau\mathbf{h}_\tau)\mathbf{b}\mathbf{b}', \tag{140}$$

where $\mathbf{k}^c$ denotes the filter gain and satisfies:

$$\mathbf{k}^c_\tau = (\mathbf{T}^c_{\tau-} + \tau_M^{-1}\mathbf{b}\mathbf{b}')\mathbf{h}'_\tau(\mathbf{h}_\tau(\mathbf{T}^c_{\tau-} + \tau_M^{-1}\mathbf{b}\mathbf{b}')\mathbf{h}'_\tau + \mathbf{r})^{-1}. \tag{141}$$

Note that since $\widetilde{\mathbf{P}}^a_{\tau-} \in \mathscr{F}^c_{\tau-}$ observational equivalence still implies:

$$\mathbf{T}^c_{\tau-} = (\tau^c_{\tau-})^{-1}\boldsymbol{\Omega}_{\tau-}. \tag{142}$$

Substituting the definition of $\tau_G^{1/2}$ in Eq. (46) and simplying the Kalman filtering equations yields the updating rule for the empiricist's precision:

$$\Delta\tau^c_\tau \equiv \tau^c_\tau - \tau^c_{\tau-} = \tau_G + \tau_A, \tag{143}$$

and the updating rule for her conditional expectations:

$$\Delta\widehat{\mathbf{z}}^c_\tau = \mathbf{k}^c_\tau \begin{pmatrix} \widetilde{A}_\tau - \widehat{F}^c_{\tau-} \\ \widetilde{\mathbf{P}}^a_\tau - \boldsymbol{\Phi}\lambda_\tau \widehat{F}^c_{\tau-} - \boldsymbol{\xi}_\tau \widehat{m}^c_{\tau-} \end{pmatrix}, \tag{144}$$

where the filter gain simplifies to:

$$\mathbf{k}^c_\tau = (\tau^c_\tau)^{-1} \begin{pmatrix} \tau_A & -\tau_M^{1/2}\tau_G^{1/2}\boldsymbol{\Phi}'\boldsymbol{\xi}_\tau^{-1} \\ -\tau_A\lambda_\tau\boldsymbol{\xi}_\tau^{-1}\boldsymbol{\Phi} & (\tau_M^{1/2}\tau_G^{1/2}\lambda_\tau\boldsymbol{\xi}_\tau^{-1}\boldsymbol{\Phi}\boldsymbol{\Phi}' + \tau^c_\tau\mathbf{I})\boldsymbol{\xi}_\tau^{-1} \end{pmatrix}. \tag{145}$$

Finally, since the jump in filtration is caused by public information only, the updating rule for investors has the same form as that of the empiricist expect that the filter gain is based on their own precision. Specifically, the updating rule for investors is:

$$\Delta\tau_\tau = \tau_G + \tau_A \equiv \Delta\tau^c_\tau, \tag{146}$$

$$\Delta\widehat{\mathbf{z}}^i_\tau = \mathbf{k}_\tau \begin{pmatrix} \widetilde{A}_\tau - \widehat{F}^i_{\tau-} \\ \widetilde{\mathbf{P}}^a_\tau - \boldsymbol{\Phi}\lambda_\tau \widehat{F}^i_{\tau-} - \boldsymbol{\xi}_\tau \widehat{m}^i_{\tau-} \end{pmatrix}, \tag{147}$$

where the filter gain for investors satisfies:

$$\mathbf{k}_\tau = \tau_\tau^{-1} \begin{pmatrix} \tau_A & -\tau_M^{1/2}\tau_G^{1/2}\boldsymbol{\Phi}'\boldsymbol{\xi}_\tau^{-1} \\ -\tau_A\lambda_\tau\boldsymbol{\xi}_\tau^{-1}\boldsymbol{\Phi} & (\tau_M^{1/2}\tau_G^{1/2}\lambda_\tau\boldsymbol{\xi}_\tau^{-1}\boldsymbol{\Phi}\boldsymbol{\Phi}' + \tau_\tau\mathbf{I})\boldsymbol{\xi}_\tau^{-1} \end{pmatrix}. \tag{148}$$

This completes the description of how investors and the empiricist update their beliefs.

We now determine how investors perceive their investment opportunity set, which requires expressing the dynamics of $\widehat{F}^c_t$ under $\mathscr{F}^i$. From the definition of filter innovations, we have:

$$\mathrm{d}\widehat{\mathbf{B}}^i_{m,t} = \tau_m^{1/2}\boldsymbol{\xi}_t^{-1}\left(\mathrm{d}\widetilde{\mathbf{P}}^a_t - \begin{pmatrix} \lambda'_t\boldsymbol{\Phi} & \dot{\boldsymbol{\xi}}_t - \boldsymbol{\xi}_t\mathbf{b} \end{pmatrix}\widehat{\mathbf{z}}^i_t\mathrm{d}t\right), \tag{149}$$

$$\mathrm{d}\widehat{\mathbf{B}}^c_{m,t} = \tau_m^{1/2}\boldsymbol{\xi}_t^{-1}\left(\mathrm{d}\widetilde{\mathbf{P}}^a_t - \begin{pmatrix} \lambda'_t\boldsymbol{\Phi} & \dot{\boldsymbol{\xi}}_t - \boldsymbol{\xi}_t\mathbf{b} \end{pmatrix}\widehat{\mathbf{z}}^c_t\mathrm{d}t\right). \tag{150}$$

Comparing these two equations we obtain a relation between $\widehat{\mathbf{B}}^i_m$ and $\widehat{\mathbf{B}}^c_{m,t}$:

$$\mathrm{d}\widehat{\mathbf{B}}^c_{m,t} = \mathrm{d}\widehat{\mathbf{B}}^i_{m,t} + \tau_m^{1/2}\boldsymbol{\xi}_t^{-1}\begin{pmatrix} \lambda_t'\boldsymbol{\Phi} & \dot{\boldsymbol{\xi}}_t - \boldsymbol{\xi}_t\mathbf{b} \end{pmatrix}\begin{pmatrix} \widehat{F}^i_t - \widehat{F}^c_t \\ \widehat{\mathbf{m}}^i_t - \widehat{\mathbf{m}}^c_t \end{pmatrix}\mathrm{d}t \tag{151}$$

$$= \mathrm{d}\widehat{\mathbf{B}}^i_{m,t} + \tau_m^{1/2}\boldsymbol{\xi}_t^{-1}\begin{pmatrix} \lambda_t'\boldsymbol{\Phi} & \dot{\boldsymbol{\xi}}_t - \boldsymbol{\xi}_t\mathbf{b} \end{pmatrix}\begin{pmatrix} 1 \\ -\boldsymbol{\xi}_t^{-1}\boldsymbol{\Phi}\lambda_t \end{pmatrix}(\underbrace{\widehat{F}^i_t - \widehat{F}^c_t}_{\equiv\Delta^i_t})\mathrm{d}t \tag{152}$$

$$= \mathrm{d}\widehat{\mathbf{B}}^i_{m,t} - \tau_{P,t}^{1/2}\Delta^i_t\boldsymbol{\Phi}\mathrm{d}t \tag{153}$$

where the second line exploits observational equivalence and where the third equality is rewritten in terms of investor i's informational advantage relative to the empiricist, Δ^i. We will now show that the state variables that are investment-relevant to investor i is the $(N+1)\times 1$ vector $\boldsymbol{\Psi}^i \equiv (\ \Delta^i \quad (\widehat{\mathbf{m}}^i)'\ )'$. Since Δ^i defines the change of measure between the empiricist and investors and that it follows a Gaussian process, Example 3.a in Lipster and Shiryaev (2001), p.233 implies that the change of measure is a true martingale and thus Girsanov's theorem applies. Using this change of measure and the updating rule above we can write the dynamics of $\boldsymbol{\Psi}^i$ under $\mathscr{F}^i$ over the two subperiods $t \in (0,\tau)\cup(\tau,T)$ as:

$$\mathrm{d}\boldsymbol{\Psi}^i_t = \underbrace{\begin{pmatrix} -\tau_{P,t}/\tau^c_t & \mathbf{0} \\ \mathbf{0} & -\mathbf{b} \end{pmatrix}}_{\equiv\mathbf{A}_{\boldsymbol{\Psi},t}}\boldsymbol{\Psi}^i_t\mathrm{d}t + \underbrace{\begin{pmatrix} \tau_v^{1/2}\tau_t^{-1} & -\tau_{P,t}^{1/2}\left(\tau_t^{-1} - (\tau^c_t)^{-1}\right)\boldsymbol{\Phi}' \\ -\lambda_t\tau_t^{-1}\tau_v^{1/2}\boldsymbol{\xi}_t^{-1}\boldsymbol{\Phi} & \lambda_t\tau_t^{-1}\tau_{P,t}^{1/2}\boldsymbol{\xi}_t^{-1}\boldsymbol{\Phi}\boldsymbol{\Phi}' + \tau_m^{-1/2}\mathbf{I} \end{pmatrix}}_{\equiv\mathbf{B}_{\boldsymbol{\Psi},t}}\mathrm{d}\widehat{\mathbf{B}}^i_t. \tag{154}$$

Applying Ito's lemma to the price shows that its dynamics are Markovian in $\boldsymbol{\Psi}^i$ under $\mathscr{F}^i$:

$$\mathrm{d}\widetilde{\mathbf{P}}_t = \dot{\boldsymbol{\xi}}_{0,t}\mathbf{M}\mathrm{d}t + \underbrace{\begin{pmatrix} \boldsymbol{\Phi}(\lambda_t' + (1-\lambda_t)(\tau^c_t)^{-1}\tau_{P,t}) & \dot{\boldsymbol{\xi}}_t - \boldsymbol{\xi}_t\mathbf{b} \end{pmatrix}}_{\equiv\mathbf{A}_{\mathbf{P},t}}\boldsymbol{\Psi}^i_t\mathrm{d}t \tag{155}$$

$$+\underbrace{\begin{pmatrix} \mathbf{0} & \tau_m^{-1/2}\boldsymbol{\xi}_t - (1-\lambda_t)(\tau^c_t)^{-1}\tau_{P,t}^{1/2}\boldsymbol{\Phi}\boldsymbol{\Phi}' \end{pmatrix}}_{\equiv\mathbf{B}_{\mathbf{P},t}}\mathrm{d}\widehat{\mathbf{B}}^i_t, \quad t \in (0,\tau)\cup(\tau,T).$$

It remains to show that changes in prices on the announcement are also Markovian in $\boldsymbol{\Psi}^i$, that is both at date τ and at the liquidation date, T. As we did for continuous dynamics we need to determine how an investor i perceives the change in empiricist's beliefs $\Delta\widehat{F}^c_\tau$ on the announcement date τ. Using the updating rule above we have:

$$\Delta\widehat{\mathbf{z}}^c_\tau = \mathbf{k}^c_\tau(\mathbf{y}_\tau - \mathbf{h}_\tau\widehat{\mathbf{z}}^c_{\tau-}) = \mathbf{k}^c_\tau(\mathbf{y}_\tau - \mathbf{h}_\tau\widehat{\mathbf{z}}^i_{\tau-}) + \mathbf{k}^c_\tau\mathbf{h}_\tau(\widehat{\mathbf{z}}^i_{\tau-} - \widehat{\mathbf{z}}^c_{\tau-}) \tag{156}$$

$$= \mathbf{k}^c_\tau(\mathbf{y}_\tau - \mathbf{h}_\tau\widehat{\mathbf{z}}^i_{\tau-}) + \mathbf{k}^c_\tau\mathbf{h}_\tau \underbrace{\begin{pmatrix} 1 \\ -\boldsymbol{\xi}^{-1}_{\tau-}\boldsymbol{\Phi}\lambda_{\tau-} \end{pmatrix}}_{\equiv\boldsymbol{\omega}_{\tau-}} \Delta^i_{\tau-}. \tag{157}$$

Taking the first entry of this vector, substituting the expressions for $\mathbf{h}$ and the filter gain $\mathbf{k}^c$ above and simplifying gives:

$$\Delta\widehat{F}^c_\tau = \begin{pmatrix} \tau_A/\tau^c_\tau & -\tau_M^{1/2}\tau_G^{1/2}/\tau^c_\tau\boldsymbol{\Phi}'\boldsymbol{\xi}^{-1}_\tau \end{pmatrix}(\mathbf{y}_\tau - \mathbf{h}_\tau\widehat{\mathbf{z}}^i_{\tau-}) + (\tau_A+\tau_G)/\tau^c_\tau\Delta^i_{\tau-}. \tag{158}$$

Based on the updating rule for $\widehat{\mathbf{z}}^i_\tau$ we obtained on announcement, we conclude that the vector of investment-relevant variables $\boldsymbol{\Psi}^i$ moves discountinuously by:

$$\Delta\boldsymbol{\Psi}^i_\tau = \underbrace{\begin{pmatrix} -(\tau_A+\tau_G)/\tau^c_\tau & \mathbf{0} \\ \mathbf{0} & \mathbf{0} \end{pmatrix}}_{\equiv\mathbf{a}_{\boldsymbol{\Psi}}} \boldsymbol{\Psi}^i_{\tau-} \tag{159}$$

$$+ \underbrace{\begin{pmatrix} \tau_A(\tau^{-1}_\tau - (\tau^c_\tau)^{-1}) & -(\tau^{-1}_\tau - (\tau^c_\tau)^{-1})\tau_G^{1/2}\tau_M^{1/2}\boldsymbol{\Phi}'\boldsymbol{\xi}^{-1}_\tau \\ -\tau^{-1}_\tau\tau_A\lambda_\tau\boldsymbol{\xi}^{-1}_\tau\boldsymbol{\Phi} & \boldsymbol{\xi}^{-1}_\tau + \tau^{-1}_\tau\lambda_\tau\tau_G^{1/2}\tau_M^{1/2}\boldsymbol{\xi}^{-1}_\tau\boldsymbol{\Phi}\boldsymbol{\Phi}'\boldsymbol{\xi}^{-1}_\tau \end{pmatrix}}_{\equiv\mathbf{b}_{\boldsymbol{\Psi}}} \underbrace{(\mathbf{y}_\tau - \mathbf{h}_\tau\widehat{\mathbf{z}}^i_{\tau-})}_{\equiv\widetilde{\mathbf{y}}^i_\tau},$$

where under $\mathscr{F}^i_{\tau-}$ the innovation in $\Delta\boldsymbol{\Psi}^i$ is Gaussian $\widetilde{\mathbf{y}}^i_\tau|_{\mathscr{F}^i_{\tau-}} \sim \mathscr{N}(\mathbf{0}, \boldsymbol{\Upsilon})$ with the conditional covariance matrix of standard errors given by:

$$\boldsymbol{\Upsilon} \equiv \mathrm{Var}\left[\mathbf{y}_\tau - \mathbf{h}_\tau\widehat{\mathbf{z}}^i_{\tau-}\middle|\,\mathscr{F}^i_{\tau-}\right] \tag{160}$$

$$= \mathrm{Var}\left[\mathbf{h}_\tau(\mathbf{z}_\tau - \widehat{\mathbf{z}}^i_{\tau-}) + \widetilde{\boldsymbol{\epsilon}}_\tau\middle|\,\mathscr{F}^i_{\tau-}\right] \tag{161}$$

$$= \mathbf{h}_\tau\,\mathrm{Var}\left[\mathbf{z}_\tau\middle|\,\mathscr{F}^i_{\tau-}\right]\mathbf{h}'_\tau + \begin{pmatrix} \tau_A^{-1} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} \end{pmatrix} \tag{162}$$

$$= \mathbf{h}_\tau\left(\mathbf{T}_{\tau-} + \begin{pmatrix} 0 & \mathbf{0} \\ \mathbf{0} & \tau_M^{-1}\mathbf{I} \end{pmatrix}\right)\mathbf{h}'_\tau + \begin{pmatrix} \tau_A^{-1} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} \end{pmatrix} \tag{163}$$

$$= \begin{pmatrix} \tau^{-1}_{\tau-} + \tau^{-1}_A & -\tau^{-1}_{\tau-}\tau_G^{1/2}\tau_M^{-1/2}\boldsymbol{\Phi}'\boldsymbol{\xi}_\tau \\ -\tau^{-1}_{\tau-}\tau_G^{1/2}\tau_M^{-1/2}\boldsymbol{\xi}_\tau\boldsymbol{\Phi} & \tau_M^{-1}\boldsymbol{\xi}_\tau(\mathbf{I}+\tau^{-1}_{\tau-}\tau_G\boldsymbol{\Phi}\boldsymbol{\Phi}')\boldsymbol{\xi}_\tau \end{pmatrix}, \tag{164}$$

where the last line follows from using $\mathbf{T}_{\tau-} = \tau^{-1}_{\tau-}\boldsymbol{\Omega}_{\tau-}$, substituting $\mathbf{h}_\tau$ and simplifying using the definition of τ_G. Also we will keep in mind for later use that filter gain satisfies:

$$\mathbf{k}_\tau = (\mathbf{T}_{\tau-} + \mathbf{b}\boldsymbol{\Sigma}_m\mathbf{b}')\mathbf{h}'_\tau\boldsymbol{\Upsilon}^{-1}. \tag{165}$$

We now want to express the jump in prices on announcements in terms of $\Delta\boldsymbol{\Psi}^i$. Since $\widetilde{\mathbf{P}}_\tau \in \mathscr{F}^i_\tau$ we have:

$$\widetilde{\mathbf{P}}_\tau = \mathbf{1}\,D + \boldsymbol{\xi}_{0,\tau}\mathbf{M} + \boldsymbol{\xi}_\tau\widehat{\mathbf{m}}^i_\tau + \boldsymbol{\Phi}\left(\widehat{F}^c_\tau + \lambda_\tau\Delta^i_\tau\right). \tag{166}$$

Similarly, because $\widetilde{\mathbf{P}}_{\tau-} \in \mathscr{F}^i_{\tau-}$ it equally holds that:

$$\widetilde{\mathbf{P}}_{\tau-} = \mathbf{1}\,D + \boldsymbol{\xi}_{0,\tau}\mathbf{M} + \boldsymbol{\xi}_{\tau-}\widehat{\mathbf{m}}^i_{\tau-} + \boldsymbol{\Phi}\left(\widehat{F}^c_{\tau-} + \lambda_{\tau-}\Delta^i_{\tau-}\right). \tag{167}$$

Subtracting one from the other and simplifying yields:

$$\begin{aligned}\Delta\widetilde{\mathbf{P}}_\tau &= (\boldsymbol{\xi}_{0,\tau} - \boldsymbol{\xi}_{0,\tau-})\mathbf{M} + \begin{pmatrix} \boldsymbol{\Phi}(\lambda_\tau - \lambda_{\tau-} + (\tau_A + \tau_G)/\tau^c_\tau) & \boldsymbol{\xi}_\tau - \boldsymbol{\xi}_{\tau-} \end{pmatrix}\boldsymbol{\Psi}^i_{\tau-} \\ &\quad + \begin{pmatrix} \boldsymbol{\Phi}\lambda_\tau & \boldsymbol{\xi}_\tau \end{pmatrix}\Delta\boldsymbol{\Psi}^i_\tau + \boldsymbol{\Phi}\begin{pmatrix} \tau_A/\tau^c_\tau & -\tau_M^{1/2}\tau_G^{1/2}/\tau^c_\tau\boldsymbol{\Phi}'\boldsymbol{\xi}^{-1}_\tau \end{pmatrix}\widetilde{\mathbf{y}}^i_\tau\end{aligned} \tag{168}$$

Then substituting $\mathbf{a}_{\boldsymbol{\Psi}}$ and $\mathbf{b}_{\boldsymbol{\Psi}}$ we defined above and simplifying gives:

$$\begin{aligned}\Delta\widetilde{\mathbf{P}}_\tau &= (\boldsymbol{\xi}_{0,\tau} - \boldsymbol{\xi}_{0,\tau-})\mathbf{M} + \underbrace{\begin{pmatrix} \boldsymbol{\Phi}(\lambda_\tau - \lambda_{\tau-} + (1-\lambda_\tau)(\tau_A + \tau_G)/\tau^c_\tau) & \boldsymbol{\xi}_\tau - \boldsymbol{\xi}_{\tau-} \end{pmatrix}}_{\equiv\mathbf{a}_{\mathbf{P}}}\boldsymbol{\Psi}^i_{\tau-} \\ &\quad + \underbrace{\begin{pmatrix} (1-\lambda_\tau)\tau_A/\tau^c_\tau\boldsymbol{\Phi} & \mathbf{I} - (1-\lambda_\tau)\tau_M^{1/2}\tau_G^{1/2}/\tau^c_\tau\boldsymbol{\Phi}\boldsymbol{\Phi}'\boldsymbol{\xi}^{-1}_\tau \end{pmatrix}}_{\equiv\mathbf{b}_{\mathbf{P}}}\widetilde{\mathbf{y}}^i_\tau,\end{aligned} \tag{169}$$

which confirms that the jump in prices on announcements is also Markovian in $\boldsymbol{\Psi}^i$. Finally, at the liquidation date, T, the vector of payoffs, $\widetilde{\mathbf{D}}$, is revealed, and the vector $\boldsymbol{\Psi}^i$ jumps according to:

$$\Delta\boldsymbol{\Psi}^i_{T-} = -\begin{pmatrix} 1 \\ \mathbf{0} \end{pmatrix}\boldsymbol{\Psi}^i_{T-} + \begin{pmatrix} 0 & \mathbf{0} \\ \mathbf{0} & \mathbf{I} \end{pmatrix}\underbrace{\begin{pmatrix} \widetilde{F} - \widehat{F}^i_{T-} \\ \widetilde{\mathbf{m}} - \widehat{\mathbf{m}}^i_{T-} \end{pmatrix}}_{\equiv\widetilde{\mathbf{y}}^i_T}, \tag{170}$$

where $\widetilde{\mathbf{y}}^i_T|_{\mathscr{F}^i_{T-}} \sim \mathscr{N}(\mathbf{0}, \mathbf{T}_{T-})$. The associated price discontinuity satisfies:

$$\Delta\widetilde{\mathbf{P}}_T = \widetilde{\mathbf{D}} - \widetilde{\mathbf{P}}_{T-} \tag{171}$$

$$= \boldsymbol{\Phi}(1 - \lambda_{T-})\Delta_T + \widetilde{\boldsymbol{\epsilon}} - \boldsymbol{\xi}_{0,T-}\mathbf{M} - \boldsymbol{\xi}_{T-}\widetilde{\mathbf{m}}_T. \tag{172}$$

Since $\widetilde{\mathbf{P}}_{T-} \in \mathscr{F}^i_{T-}$ this can be written in the eyes of investor i as:

$$\Delta\widetilde{\mathbf{P}}_T = \mathbf{a}_{T-}\boldsymbol{\Psi}^i_{T-} - \boldsymbol{\xi}_{0,T-}\mathbf{M} + \begin{pmatrix} \boldsymbol{\Phi} & \mathbf{0} \end{pmatrix} \widetilde{\mathbf{y}}^i_T + \widetilde{\boldsymbol{\epsilon}}. \tag{173}$$

This shows that conditional on $\mathscr{F}^i_{T-}$ we have:

$$\Delta\widetilde{\mathbf{P}}_T\Big|_{\mathscr{F}^i_{T-}} \sim \mathscr{N}\Big(\mathbf{a}_{T-}\boldsymbol{\Psi}^i_{T-} - \boldsymbol{\xi}_{0,T-}\mathbf{M}, \underbrace{(\tau_{T-})^{-1}\boldsymbol{\Phi}\boldsymbol{\Phi}' + \tau_\epsilon^{-1}\mathbf{I}}_{\equiv\boldsymbol{\Sigma}}\Big), \tag{174}$$

where we recognize investors' covariance matrix $\boldsymbol{\Sigma}$ as given in Andrei et al. (2021). This confirms that the vector $\boldsymbol{\Psi}^i$ is the only state variable that is relevant for investor i's investment decision, which completes the description of how an investor i views this economy.

A.2 Proof of Proposition 2

In this appendix we derive a system of matrix Riccati equations that the coefficients of investor i's must satisfy, towards determining her investment decision. Within each subregion $[0,\tau)$ and $[\tau,T)$ the value function must solve the following Hamilton-Jacobi-Bellman equation:

$$\begin{aligned} 0 = \max_{\mathbf{w}} &\left\{ J_W \mathbf{w}'(\dot{\boldsymbol{\xi}}_0\mathbf{M} + \mathbf{A}_{\mathbf{P}}\boldsymbol{\Psi}) + \frac{1}{2}J_{WW}\mathbf{w}'\mathbf{B}_{\mathbf{P}}\mathbf{B}'_{\mathbf{P}}\mathbf{w} + \mathbf{w}'\mathbf{B}_{\mathbf{P}}\mathbf{B}'_{\boldsymbol{\Psi}}\mathbf{J}_{W\boldsymbol{\Psi}} \right\} \\ &+ J_t + \mathbf{J}'_{\boldsymbol{\Psi}}\mathbf{A}_{\boldsymbol{\Psi}}\boldsymbol{\Psi} + \frac{1}{2}\mathrm{tr}(\mathbf{B}_{\boldsymbol{\Psi}}\mathbf{B}'_{\boldsymbol{\Psi}}\mathbf{J}_{\boldsymbol{\Psi}\boldsymbol{\Psi}}). \end{aligned} \tag{175}$$

From the first-order condition we get the optimal investment policy at time $t \in (0,\tau)\cup(\tau,T)$:

$$\mathbf{w}_t = -\frac{J_W}{J_{WW}}(\mathbf{B}_{\mathbf{P}}\mathbf{B}'_{\mathbf{P}})^{-1}(\dot{\boldsymbol{\xi}}_0\mathbf{M} + \mathbf{A}_{\mathbf{P}}\boldsymbol{\Psi}) - \frac{1}{J_{WW}}(\mathbf{B}_{\mathbf{P}}\mathbf{B}'_{\mathbf{P}})^{-1}\mathbf{B}_{\mathbf{P}}\mathbf{B}'_{\boldsymbol{\Psi}}\mathbf{J}_{W\boldsymbol{\Psi}}, \tag{176}$$

which, when plugged back in the HJB equation, gives the following PDE, which holds at any time $t \in (0,\tau)\cup(\tau,T)$:

$$\begin{aligned} 0 = &J_t + \mathbf{J}'_{\boldsymbol{\Psi}}\mathbf{A}_{\boldsymbol{\Psi}}\boldsymbol{\Psi} + \frac{1}{2}\mathrm{tr}(\mathbf{B}_{\boldsymbol{\Psi}}\mathbf{B}'_{\boldsymbol{\Psi}}\mathbf{J}_{\boldsymbol{\Psi}\boldsymbol{\Psi}}) \\ &- \frac{1}{2J_{WW}}\Big(J_W(\dot{\boldsymbol{\xi}}_0\mathbf{M} + \mathbf{A}_{\mathbf{P}}\boldsymbol{\Psi}) + \mathbf{B}_{\mathbf{P}}\mathbf{B}'_{\boldsymbol{\Psi}}\mathbf{J}_{W\boldsymbol{\Psi}}\Big)'(\mathbf{B}_{\mathbf{P}}\mathbf{B}'_{\mathbf{P}})^{-1}\Big(J_W(\dot{\boldsymbol{\xi}}_0\mathbf{M} + \mathbf{A}_{\mathbf{P}}\boldsymbol{\Psi}) + \mathbf{B}_{\mathbf{P}}\mathbf{B}'_{\boldsymbol{\Psi}}\mathbf{J}_{W\boldsymbol{\Psi}}\Big). \end{aligned} \tag{177}$$

We now conjecture that the solution to this PDE is of the form in Eq. (28). In addition, we conjecture and will verify that $\mathbf{V}$ is a symmetric matrix. For brevity, since the scalar s does not enter into the determination of equilibrium prices, we will only focus on $\mathbf{U}$ and $\mathbf{V}$. Separating variables produces the two matrix Riccati equations in Eqs. (29)–(30)

that hold over each subinterval. Next we verify that the conjecture in Eq. (28) holds on the announcement date, τ, which in turn will provide boundary conditions for the matrix Riccati equations above in between subintervals. On the announcement date an investors' wealth jumps to:

$$W_\tau = W_{\tau-} + \mathbf{w}'_{\tau-}\Delta\widetilde{\mathbf{P}}_\tau, \tag{178}$$

and their expectations jump by $\Delta\boldsymbol{\Psi}$ (as shown above). Immediately prior to the announcement investors choose their portfolio so as to maximize:

$$\max_{\mathbf{w}} \mathbb{E}\left[J(\tau, W + \mathbf{w}'\Delta\widetilde{\mathbf{P}}, \boldsymbol{\Psi} + \Delta\boldsymbol{\Psi}) \middle| \mathscr{F}^i_{\tau-} \right], \tag{179}$$

which in turn tells us how they speculate on the outcome of the announcement. Substituting the conjectured functional form in Eq. (28) and simplifying we can write expected utility as:

$$\mathbb{E}\left[J(\tau, W + \mathbf{w}'\Delta\widetilde{\mathbf{P}}, \boldsymbol{\Psi} + \Delta\boldsymbol{\Psi}) \middle| \mathscr{F}^i_{\tau-} \right] = \tag{180}$$

$$- e^{-s_\tau - \gamma W - \frac{1}{2}(\mathbf{U}'_\tau(\mathbf{I}+\mathbf{a}_{\boldsymbol{\Psi}})\boldsymbol{\Psi} + \boldsymbol{\Psi}'(\mathbf{I}+\mathbf{a}_{\boldsymbol{\Psi}})'\mathbf{U}_\tau + \boldsymbol{\Psi}'(\mathbf{I}+\mathbf{a}_{\Psi})'\mathbf{V}_\tau(\mathbf{I}+\mathbf{a}_{\Psi})\boldsymbol{\Psi}) - \gamma\mathbf{w}'(\mathbf{a}_{\mathbf{P}}\boldsymbol{\Psi} + (\boldsymbol{\xi}_{0,\tau} - \boldsymbol{\xi}_{0,\tau-})\mathbf{M})}$$

$$\mathbb{E}\left[e^{-\frac{1}{2}\left(\left(\gamma\mathbf{b}'_{\mathbf{P}}\mathbf{w} + \mathbf{b}'_{\boldsymbol{\Psi}}\mathbf{U}_\tau + \mathbf{b}'_{\boldsymbol{\Psi}}\mathbf{V}_\tau(\mathbf{I}+\mathbf{a}_{\boldsymbol{\Psi}})\boldsymbol{\Psi}\right)'\widetilde{\mathbf{y}}_\tau + \widetilde{\mathbf{y}}'_\tau\left(\gamma\mathbf{b}'_{\mathbf{P}}\mathbf{w} + \mathbf{b}'_{\boldsymbol{\Psi}}\mathbf{U}_\tau + \mathbf{b}'_{\boldsymbol{\Psi}}\mathbf{V}_\tau(\mathbf{I}+\mathbf{a}_{\boldsymbol{\Psi}})\boldsymbol{\Psi}\right) + \widetilde{\mathbf{y}}'_\tau\mathbf{b}'_{\boldsymbol{\Psi}}\mathbf{V}_\tau\mathbf{b}_{\boldsymbol{\Psi}}\widetilde{\mathbf{y}}_\tau\right)} \middle| \mathscr{F}^i_{\tau-} \right]$$

$$\equiv -e^{-s_\tau - \gamma W - \frac{1}{2}(\mathbf{U}'_\tau(\mathbf{I}+\mathbf{a}_{\boldsymbol{\Psi}})\boldsymbol{\Psi} + \boldsymbol{\Psi}'(\mathbf{I}+\mathbf{a}_{\boldsymbol{\Psi}})'\mathbf{U}_\tau + \boldsymbol{\Psi}'(\mathbf{I}+\mathbf{a}_{\Psi})'\mathbf{V}_\tau(\mathbf{I}+\mathbf{a}_{\Psi})\boldsymbol{\Psi}) - \gamma\mathbf{w}'(\mathbf{a}_{\mathbf{P}}\boldsymbol{\Psi} + (\boldsymbol{\xi}_{0,\tau} - \boldsymbol{\xi}_{0,\tau-})\mathbf{M})}$$

$$\int_{\mathbb{R}^{N+1}} e^{-\frac{1}{2}(\mathbf{b}'\mathbf{y} + \mathbf{y}'\mathbf{b} + \mathbf{y}'\mathbf{a}\mathbf{y})} (2\pi)^{-\frac{N+1}{2}} |\boldsymbol{\Upsilon}|^{-1/2} e^{-\frac{1}{2}\mathbf{y}'\boldsymbol{\Upsilon}^{-1}\mathbf{y}} \mathrm{d}\mathbf{y} \tag{181}$$

$$= -e^{-s_\tau - \gamma W - \frac{1}{2}(\mathbf{U}'_\tau(\mathbf{I}+\mathbf{a}_{\boldsymbol{\Psi}})\boldsymbol{\Psi} + \boldsymbol{\Psi}'(\mathbf{I}+\mathbf{a}_{\boldsymbol{\Psi}})'\mathbf{U}_\tau + \boldsymbol{\Psi}'(\mathbf{I}+\mathbf{a}_{\Psi})'\mathbf{V}_\tau(\mathbf{I}+\mathbf{a}_{\Psi})\boldsymbol{\Psi}) - \gamma\mathbf{w}'(\mathbf{a}_{\mathbf{P}}\boldsymbol{\Psi} + (\boldsymbol{\xi}_{0,\tau} - \boldsymbol{\xi}_{0,\tau-})\mathbf{M})}$$

$$|\boldsymbol{\Upsilon}\mathbf{a} + \mathbf{I}|^{-1/2} e^{\frac{1}{2}\mathbf{b}'(\mathbf{a} + \boldsymbol{\Upsilon}^{-1})^{-1}\mathbf{b}}, \tag{182}$$

where the coefficients $\mathbf{a}$ and $\mathbf{b}$ in the second equality are a redefinition of the expression multiplying the linear and quadratic part in $\mathbf{y}$, respectively. Plugging these coefficients back expected utility is given explicitly by:

$$\mathbb{E}\left[J(\tau, W + \mathbf{w}'\Delta\widetilde{\mathbf{P}}, \boldsymbol{\Psi} + \Delta\boldsymbol{\Psi}) \middle| \mathscr{F}^i_{\tau-} \right] = \tag{183}$$

$$= -e^{-s_\tau - \gamma W - \frac{1}{2}(\mathbf{U}'_\tau(\mathbf{I}+\mathbf{a}_{\boldsymbol{\Psi}})\boldsymbol{\Psi} + \boldsymbol{\Psi}'(\mathbf{I}+\mathbf{a}_{\boldsymbol{\Psi}})'\mathbf{U}_\tau + \boldsymbol{\Psi}'(\mathbf{I}+\mathbf{a}_{\Psi})'\mathbf{V}_\tau(\mathbf{I}+\mathbf{a}_{\Psi})\boldsymbol{\Psi}) - \gamma\mathbf{w}'(\mathbf{a}_{\mathbf{P}}\boldsymbol{\Psi} + (\boldsymbol{\xi}_{0,\tau} - \boldsymbol{\xi}_{0,\tau-})\mathbf{M})}$$

$$|\boldsymbol{\Upsilon}\mathbf{b}'_{\boldsymbol{\Psi}}\mathbf{V}_\tau\mathbf{b}_{\boldsymbol{\Psi}} + \mathbf{I}|^{-1/2} e^{\frac{1}{2}(\gamma\mathbf{b}'_{\mathbf{P}}\mathbf{w} + \mathbf{b}'_{\boldsymbol{\Psi}}\mathbf{U}_\tau + \mathbf{b}'_{\boldsymbol{\Psi}}\mathbf{V}_\tau(\mathbf{I}+\mathbf{a}_{\boldsymbol{\Psi}})\boldsymbol{\Psi})'(\mathbf{b}'_{\boldsymbol{\Psi}}\mathbf{V}_\tau\mathbf{b}_{\boldsymbol{\Psi}} + \boldsymbol{\Upsilon}^{-1})^{-1}(\gamma\mathbf{b}'_{\mathbf{P}}\mathbf{w} + \mathbf{b}'_{\boldsymbol{\Psi}}\mathbf{U}_\tau + \mathbf{b}'_{\boldsymbol{\Psi}}\mathbf{V}_\tau(\mathbf{I}+\mathbf{a}_{\boldsymbol{\Psi}})\boldsymbol{\Psi})}.$$

From the first-order condition associated with Eq. (179) we get the optimal portfolio choice on announcements:

$$\mathbf{w}_{\tau-} = \frac{1}{\gamma}(\mathbf{b_P}\mathbf{S}_\tau\mathbf{b}'_\mathbf{P})^{-1}\left((\mathbf{a_P} - \mathbf{b_P}\mathbf{S}_\tau\mathbf{b}'_\mathbf{\Psi}\mathbf{V}_\tau(\mathbf{I}+\mathbf{a_\Psi}))\mathbf{\Psi} + (\boldsymbol{\xi}_{0,\tau} - \boldsymbol{\xi}_{0,\tau-})\mathbf{M} - \mathbf{b_P}\mathbf{S}_\tau\mathbf{b}'_\mathbf{\Psi}\mathbf{U}_\tau\right), \tag{184}$$

where

$$\mathbf{S}_\tau \equiv (\mathbf{b}'_\mathbf{\Psi}\mathbf{V}_\tau\mathbf{b_\Psi} + \mathbf{\Upsilon}^{-1})^{-1}. \tag{185}$$

Plugging back and simplifying expected utility at the optimum is:

$$\mathbb{E}\left[J(\tau, W + \mathbf{w}'\Delta\widetilde{\mathbf{P}}, \mathbf{\Psi} + \Delta\mathbf{\Psi})\middle|\mathscr{F}^i_{\tau-}\right] = -|\mathbf{\Upsilon}\mathbf{b}'_\mathbf{\Psi}\mathbf{V}_\tau\mathbf{b_\Psi} + \mathbf{I}|^{-1/2} \tag{186}$$
$$e^{-s_\tau - \gamma W - \frac{1}{2}(\mathbf{U}'_\tau(\mathbf{I}+\mathbf{a_\Psi})\mathbf{\Psi} + \mathbf{\Psi}'(\mathbf{I}+\mathbf{a_\Psi})'\mathbf{U}_\tau + \mathbf{\Psi}'(\mathbf{I}+\mathbf{a}_\Psi)'\mathbf{V}_\tau(\mathbf{I}+\mathbf{a_\Psi})\mathbf{\Psi})}$$
$$e^{-\frac{1}{2}\gamma^2\mathbf{w}'\mathbf{b_P}\mathbf{S}_\tau\mathbf{b}'_\mathbf{P}\mathbf{w} + \frac{1}{2}(\mathbf{U}_\tau + \mathbf{V}_\tau(\mathbf{I}+\mathbf{a_\Psi})\mathbf{\Psi})'\mathbf{b_\Psi}\mathbf{S}_\tau\mathbf{b}'_\mathbf{\Psi}(\mathbf{U}_\tau + \mathbf{V}_\tau(\mathbf{I}+\mathbf{a_\Psi})\mathbf{\Psi})}$$
$$= -|\mathbf{\Upsilon}\mathbf{b}'_\mathbf{\Psi}\mathbf{V}_\tau\mathbf{b_\Psi} + \mathbf{I}|^{-1/2} e^{-s_\tau - \gamma W - \frac{1}{2}(\mathbf{U}'_\tau(\mathbf{I}+\mathbf{a_\Psi})\mathbf{\Psi} + \mathbf{\Psi}'(\mathbf{I}+\mathbf{a_\Psi})'\mathbf{U}_\tau + \mathbf{\Psi}'(\mathbf{I}+\mathbf{a}_\Psi)'\mathbf{V}_\tau(\mathbf{I}+\mathbf{a}_\Psi)\mathbf{\Psi})} \tag{187}$$
$$e^{-\frac{1}{2}\left((\mathbf{a_P} - \mathbf{b_P}\mathbf{S}_\tau\mathbf{b}'_\mathbf{\Psi}\mathbf{V}_\tau(\mathbf{I}+\mathbf{a_\Psi}))\mathbf{\Psi} + \Delta\boldsymbol{\xi}_{0,\tau}\mathbf{M} - \mathbf{b_P}\mathbf{S}_\tau\mathbf{b}'_\mathbf{\Psi}\mathbf{U}_\tau\right)'\left(\mathbf{b_P}\mathbf{S}_\tau\mathbf{b}'_\mathbf{P}\right)^{-1}\left((\mathbf{a_P} - \mathbf{b_P}\mathbf{S}_\tau\mathbf{b}'_\mathbf{\Psi}\mathbf{V}_\tau(\mathbf{I}+\mathbf{a_\Psi}))\mathbf{\Psi} + \Delta\boldsymbol{\xi}_{0,\tau}\mathbf{M} - \mathbf{b_P}\mathbf{S}_\tau\mathbf{b}'_\mathbf{\Psi}\mathbf{U}_\tau\right)}$$
$$e^{\frac{1}{2}(\mathbf{U}_\tau + \mathbf{V}_\tau(\mathbf{I}+\mathbf{a_\Psi})\mathbf{\Psi})'\mathbf{b_\Psi}\mathbf{S}_\tau\mathbf{b}'_\mathbf{\Psi}(\mathbf{U}_\tau + \mathbf{V}_\tau(\mathbf{I}+\mathbf{a_\Psi})\mathbf{\Psi})},$$

where $\Delta\boldsymbol{\xi}_{0,\tau} \equiv \boldsymbol{\xi}_{0,\tau} - \boldsymbol{\xi}_{0,\tau-}$ (just for the purpose of putting everything on a single line), and where the first equality pre-multiplies the first-order condition by $\mathbf{w}'$ and uses the result to simplify the expression for expected utility, and the second equality substitutes the optimal portfolio policy. Rational anticipation then requires that:

$$J(\tau-, W, \mathbf{\Psi}) = \mathbb{E}\left[J(\tau, W + \mathbf{w}'\Delta\widetilde{\mathbf{P}}, \mathbf{\Psi} + \Delta\mathbf{\Psi})\middle|\mathscr{F}^i_{\tau-}\right], \tag{188}$$

which, after separation of variables, delivers the two systems of algebraic matrix Riccati equations for $\mathbf{U}$ and $\mathbf{V}$ in Eqs. (31)–(32) (once more we leave out the equation for s as it does not intervene in the portfolio decision). Although expected in this continuous-discrete framework, these two algebraic matrix Riccati equations are the discrete-time counterparts to the matrix differential equations in Eqs. (29) and (30). Specifically, Eq. (29) can be rewritten as:

$$-\dot{\mathbf{U}} = (\mathbf{A}'_\Psi - \mathbf{V}\mathbf{B_\Psi}\mathbf{B}'_\mathbf{\Psi})\mathbf{U} + (\mathbf{A_P} - \mathbf{B_P}\mathbf{B}'_\mathbf{\Psi}\mathbf{V})'(\mathbf{B_P}\mathbf{B}'_\mathbf{P})^{-1}(\dot{\boldsymbol{\xi}}_0\mathbf{M} - \mathbf{B_P}\mathbf{B}'_\mathbf{\Psi}\mathbf{U}) \tag{189}$$

and Eq. (30) can be rewritten as:

$$-\dot{\mathbf{V}} = \mathbf{V}\mathbf{A}_{\boldsymbol{\Psi}} + \mathbf{A}_{\boldsymbol{\Psi}}'\mathbf{V} - \mathbf{V}\mathbf{B}_{\boldsymbol{\Psi}}\mathbf{B}_{\boldsymbol{\Psi}}'\mathbf{V} + (\mathbf{A}_{\mathbf{P}} - \mathbf{B}_{\mathbf{P}}\mathbf{B}_{\boldsymbol{\Psi}}'\mathbf{V})'(\mathbf{B}_{\mathbf{P}}\mathbf{B}_{\mathbf{P}}')^{-1}(\mathbf{A}_{\mathbf{P}} - \mathbf{B}_{\mathbf{P}}\mathbf{B}_{\boldsymbol{\Psi}}'\mathbf{V}). \quad (190)$$

Finally, we determine the boundary condition on the liquidation date (when the fundamental value is revealed). Right before the fundamental is revealed an investor i selects her last portfolio position according to the customary static portfolio optimization problem:

$$\max_{\mathbf{w}} \mathbb{E}\left[-e^{-\gamma(W+\mathbf{w}'\Delta\widetilde{\mathbf{P}}_T)}\middle| \mathscr{F}^i_{T-}\right] = \max_{\mathbf{w}} -e^{-\gamma W - \gamma \mathbf{w}'\,\mathbb{E}[\Delta\widetilde{\mathbf{P}}_T|\mathscr{F}^i_{T-}] + \frac{\gamma^2}{2}\mathbf{w}'\boldsymbol{\Sigma}\mathbf{w}}, \quad (191)$$

where the second expression uses Eq. (A.1). From the first-order condition to this problem the optimal, terminal portfolio is the customary mean-variance portfolio:

$$\mathbf{w}_{T-} = \frac{1}{\gamma}\boldsymbol{\Sigma}^{-1}\,\mathbb{E}[\Delta\widetilde{\mathbf{P}}_T|\mathscr{F}^i_{T-}] = \frac{1}{\gamma}(\tau_{T-}^{-1}\boldsymbol{\Phi}\boldsymbol{\Phi}' + \tau_\epsilon^{-1}\,\mathbf{I})^{-1}(\mathbf{a}_{T-}\boldsymbol{\Psi} - \boldsymbol{\xi}_{0,T-}\mathbf{M}). \quad (192)$$

Substituting back and simplifying using the first-order condition gives:

$$\mathbb{E}\left[-e^{-\gamma(W+\mathbf{w}'\Delta\widetilde{\mathbf{P}}_T)}\middle| \mathscr{F}^i_{T-}\right] = -e^{-\gamma W - \frac{\gamma^2}{2}\mathbf{w}'\boldsymbol{\Sigma}\mathbf{w}} \quad (193)$$

$$= -e^{-\gamma W - \frac{1}{2}(\mathbf{a}_{T-}\boldsymbol{\Psi} - \boldsymbol{\xi}_{0,T-}\mathbf{M})'\boldsymbol{\Sigma}^{-1}(\mathbf{a}_{T-}\boldsymbol{\Psi} - \boldsymbol{\xi}_{0,T-}\mathbf{M})}. \quad (194)$$

Rational anticipation (namely that this equals $J(T-, W, \boldsymbol{\Psi})$), separation of variables, and using Woodbury matrix identity to rewrite $\boldsymbol{\Sigma}^{-1}$ give the wo terminal conditions for $\mathbf{U}$ and $\mathbf{V}$ in Eqs. (33)–(34) (once again leaving out that for s).

A.3 Proof of Proposition 3

In this appendix we show that the matrix coefficients $\mathbf{U}$ and $\mathbf{V}$ of Proposition 2 satisfy the form in Eq. (49). The procedure is in four steps.

1. We use the following observation to rewrite the equations of Proposition 2 for $\mathbf{U}$ and $\mathbf{V}$ in terms of $\mathbf{b}$, $\mathbf{c}$ and $\mathbf{A}_{\mathbf{P}}$ (or $\mathbf{a}_{\mathbf{P}}$). In particular, from the definition of $\mathbf{A}_{\mathbf{P}}$ in Eq. (155) we can rewrite this coefficient as:

$$\mathbf{A}_{\mathbf{P}} \equiv -\frac{\mathrm{d}}{\mathrm{d}t}\mathbf{a} - \mathbf{a}\mathbf{A}_{\boldsymbol{\Psi}}, \quad (195)$$

$$= -\left((\mathbf{b}+\mathbf{c})\mathbf{A}_{\boldsymbol{\Psi}} + \frac{\mathrm{d}}{\mathrm{d}t}(\mathbf{b}+\mathbf{c})\right), \quad (196)$$

where the second line follows from substituting the identity in Eq. (38) into the first line; from the definition of $\mathbf{a_P}$ in Eq. (169), the discrete counterpart to Eq. (195) is:

$$\mathbf{a_P} \equiv \mathbf{a}_{t-} - \mathbf{a}_t(\mathbf{I} + \mathbf{a_\Psi}), \tag{197}$$

$$= \mathbf{b}_{t-} + \mathbf{c}_{t-} - (\mathbf{b}_t + \mathbf{c}_t)(\mathbf{I} + \mathbf{a_\Psi}), \tag{198}$$

where the second line substitutes the identity in Eq. (38).

2. We then use the following observation to simplify the terms that multiply $\mathbf{b}$, $\mathbf{c}$ and $\mathbf{A_P}$ (or $\mathbf{a_P}$). Defining the vector

$$\mathbf{X}_{1,t} \equiv \tau_t^{-1} \begin{pmatrix} \tau_v^{1/2}\mathbf{\Phi} & -\tau_P^{1/2}\mathbf{\Phi}\mathbf{\Phi}' \end{pmatrix}', \tag{199}$$

the diffusion of prices and that of state variables are related as:

$$\mathbf{B_P} = -\mathbf{a}\mathbf{B_\Psi} + \mathbf{X}_1'. \tag{200}$$

Substituting the identity in Eq. (38) in this equation and splitting terms in $\mathbf{b}$ and in $\mathbf{c}$ we have:

$$\mathbf{b}\mathbf{B_\Psi} = -\mathbf{B_P} + \begin{pmatrix} (1-\ell_t)\tau_v^{1/2}\tau_t^{-1}\mathbf{\Phi} & -(1-\lambda_t)(\tau_t^c)^{-1}\tau_{P,t}^{1/2}\mathbf{\Phi}\mathbf{\Phi}' \end{pmatrix} \tag{201}$$

$$= -\mathbf{B_P} + (1-\ell_t)\mathbf{X}_1' - \ell_t \underbrace{\begin{pmatrix} \mathbf{0} & (\tau_t^c)^{-1}\tau_{P,t}^{1/2}\mathbf{\Phi}\mathbf{\Phi}' \end{pmatrix}}_{\equiv \mathbf{X}_2'}, \tag{202}$$

and

$$\mathbf{c}\mathbf{B_\Psi} = \ell_t \begin{pmatrix} \tau_v^{1/2}\tau_t^{-1}\mathbf{\Phi} & \alpha_t(\tau_t^c)^{-1}\tau_{P,t}^{1/2}\mathbf{\Phi}\mathbf{\Phi}' \end{pmatrix} \tag{203}$$

$$= \ell_t(\mathbf{X}_1 + \mathbf{X}_2)', \tag{204}$$

where the second line in each of these two equations uses $(1-\alpha)/\tau^c = \tau^{-1}$. Defining the vector:

$$\mathbf{x}_t \equiv \tau_t^{-1} \begin{pmatrix} \tau_A\mathbf{\Phi} & -\tau_M^{1/2}\tau_{G,t}^{1/2}\mathbf{\Phi}\mathbf{\Phi}'\boldsymbol{\xi}_t^{-1} \end{pmatrix}, \tag{205}$$

upon the announcement the covariance matrix of prices and that of state variables are related as:

$$\mathbf{b_P} = -\mathbf{a}\mathbf{b_\Psi} + \mathbf{x} \tag{206}$$

$$= \mathbf{1}^\star + (1-\lambda_t)\frac{\tau_t}{\tau_t^c}\mathbf{x} \tag{207}$$

which is the discrete counterpart to Eq. (200). Using the identity in Eq. (38) and simplifying using $(1-\alpha)/\tau^c = \tau^{-1}$, we can further decompose this relation into:

$$\mathbf{b}\mathbf{b_\Psi} = -\mathbf{1}^\star \tag{208}$$

and

$$\mathbf{c}\mathbf{b_\Psi} = -\mathbf{b_P} + \mathbf{1}^\star + \mathbf{x} \tag{209}$$

$$= -\alpha_t \ell_t \frac{\tau_t}{\tau_t^c}\mathbf{x}. \tag{210}$$

3. We then substitute the conjectured form for $\mathbf{A_P}$ and $\mathbf{a_P}$ of Conjecture 1 to express the equations for $\mathbf{U}$ and $\mathbf{V}$ just in terms of $\mathbf{b}$ and $\mathbf{c}$.

4. We exploit the relation in Eqs. (43) and (44) to obtain equations for the linear combinations in Eqs. (51) and (53). Regarding boundary conditions, a key identity in simplifying the resulting equations is (defining $\beta \equiv (\tau_t^c - \tau_{t-}^c)/\tau_t^c$ and $\bar{\mathbf{x}} \equiv \mathbf{\Phi}'\mathbf{x}$):

$$(\mathbf{S}^{-1} + \mathbf{b}_\Psi'(\mathbf{b}'\mathbf{v} + v_3\mathbf{c}')\mathbf{b_P})\mathbf{y} = -\beta(v - \alpha\bar{v}_1)\mathbf{b}_\mathbf{P}'\mathbf{\Phi} + \left(\frac{v - 2\alpha\bar{v}_1 + \alpha^2\bar{v}}{1-\alpha}\beta + \tau_{t-}\right)\bar{\mathbf{x}}'. \tag{211}$$

We start by applying these steps to $\mathbf{V}$ and then repeat these steps on $\mathbf{U}$. For brevity in what follows we apply steps 1-3 at once, computing each term separately for each equation. We start with the matrix Riccati equation for $\mathbf{V}$ in Eq. (30), which is easier to handle. First, step 1 and 2 allow us to write (using also the conjecture for $\mathbf{V}$ in Eq. (49)):

$$\mathbf{V}(\mathbf{B_\Psi}\mathbf{B}_\mathbf{P}'(\mathbf{B_P}\mathbf{B}_\mathbf{P}')^{-1}\mathbf{A_P} - \mathbf{A_\Psi}) = -(\mathbf{v}\mathbf{b} + v_3\mathbf{c})'(\mathbf{A_P} + \mathbf{b}\mathbf{A_\Psi}) - (v_3\mathbf{b} + v_4\mathbf{c})'\mathbf{c}\mathbf{A_\Psi} \tag{212}$$
$$+ (((1-\ell)\mathbf{X}_1 - \ell\mathbf{X}_2)(\mathbf{v}\mathbf{b} + v_3\mathbf{c}) + \ell(\mathbf{X}_1 + \mathbf{X}_2)(v_3\mathbf{b} + v_4\mathbf{c}))'\mathbf{B}_\mathbf{P}'(\mathbf{B_P}\mathbf{B}_\mathbf{P}')^{-1}\mathbf{A_P}$$
$$= ((v - v_3)\mathbf{b} + (v_3 - v_4)\mathbf{c})'\mathbf{c}\mathbf{A_\Psi} + (\mathbf{v}\mathbf{b} + v_3\mathbf{c})'\frac{\mathrm{d}}{\mathrm{d}t}(\mathbf{b} + \mathbf{c}) \tag{213}$$
$$+ (\mathbf{X}_1(\bar{v}_1\mathbf{b} + \bar{v}_2\mathbf{c}) + \ell\mathbf{X}_2((v_3 - v)\mathbf{b} + (v_4 - v_3)\mathbf{c}))'\mathbf{B}_\mathbf{P}'(\mathbf{B_P}\mathbf{B}_\mathbf{P}')^{-1}\mathbf{A_P},$$

where the first equality substitutes Eqs. (201) and (203) and the second equality substitutes

Eq. (196). Further moving to step 3 and thus using Conjecture 1, part A the second line can be rewritten, after simplifications, as:

$$
\begin{aligned}
&(\mathbf{X}_1(\bar{v}_1\mathbf{b}+\bar{v}_2\mathbf{c})+\ell\mathbf{X}_2((v_3-v)\mathbf{b}+(v_4-v_3)\mathbf{c}))'\mathbf{B}_\mathbf{P}'(\mathbf{B}_\mathbf{P}\mathbf{B}_\mathbf{P}')^{-1}\mathbf{A}_\mathbf{P} &(214)\\
&=(\tau^c)^{-1}\tau_P^{1/2}\left((\alpha\bar{v}_1-v)\mathbf{b}+(\alpha\bar{v}_2-v_3)\mathbf{c}\right)'\boldsymbol{\Phi}\boldsymbol{\Phi}'\boldsymbol{\Sigma}_\mathbf{P}^{-1}\mathbf{A}_\mathbf{P}\\
&=(\tau^c)^{-1}\tau_P^{1/2}\left((\alpha\bar{v}_1-v)\mathbf{b}+(\alpha\bar{v}_2-v_3)\mathbf{c}\right)'\boldsymbol{\Phi}\boldsymbol{\Phi}'((\Pi_1+\Pi_2)\mathbf{b}+\Pi_3\mathbf{c}), &(215)
\end{aligned}
$$

where the first equality substitutes $\mathbf{X}_1$ and $\mathbf{X}_2$ and simplifies. Substituting back in the expression above along with $\mathbf{A}_\mathbf{\Psi}$ we get:

$$
\begin{aligned}
\mathbf{V}(\mathbf{B}_\mathbf{\Psi}\mathbf{B}_\mathbf{P}'(\mathbf{B}_\mathbf{P}\mathbf{B}_\mathbf{P}')^{-1}\mathbf{A}_\mathbf{P}-\mathbf{A}_\mathbf{\Psi}) &= \frac{\tau_P}{\tau^c}((v_3-v)\mathbf{b}+(v_4-v_3)\mathbf{c})'\mathbf{c}+(\mathbf{v}\mathbf{b}+v_3\mathbf{c})'\frac{\mathrm{d}}{\mathrm{d}t}(\mathbf{b}+\mathbf{c})\\
&+\frac{\tau_P^{1/2}}{\tau^c}\left((\alpha\bar{v}_1-v)\mathbf{b}+(\alpha\bar{v}_2-v_3)\mathbf{c}\right)'\boldsymbol{\Phi}\boldsymbol{\Phi}'((\Pi_1+\Pi_2)\mathbf{b}+\Pi_3\mathbf{c}). \qquad (216)
\end{aligned}
$$

An immediate simplification in Eq. (30) then follows since differentiating Eq. (49) gives:

$$
\begin{aligned}
\dot{\mathbf{V}} &= \left(\frac{\mathrm{d}}{\mathrm{d}t}\mathbf{b}\right)'(\mathbf{v}\mathbf{b}+v_3\mathbf{c})+(\mathbf{v}\mathbf{b}+v_3\mathbf{c})'\frac{\mathrm{d}}{\mathrm{d}t}\mathbf{b}+\left(\frac{\mathrm{d}}{\mathrm{d}t}\mathbf{c}\right)'(v_3\mathbf{b}+v_4\mathbf{c})+(v_3\mathbf{b}+v_4\mathbf{c})'\frac{\mathrm{d}}{\mathrm{d}t}\mathbf{c} \qquad (217)\\
&+\mathbf{b}'\dot{\mathbf{v}}\mathbf{b}+v_3'(\mathbf{b}'\mathbf{c}+\mathbf{c}'\mathbf{b})+v_4'\mathbf{c}'\mathbf{c},
\end{aligned}
$$

where we can re-express the time derivative of $\mathbf{c}$ as:

$$
\frac{\mathrm{d}}{\mathrm{d}t}\mathbf{c}=\ell^{-1}\frac{\mathrm{d}}{\mathrm{d}t}\ell\mathbf{c}. \qquad (218)
$$

Conjecture 1, part A (step 3) also allows us to write the squared Sharpe ratio as:

$$
\mathbf{A}_\mathbf{P}'\boldsymbol{\Sigma}_\mathbf{P}^{-1}\boldsymbol{\Sigma}_\mathbf{P}^{-1}\mathbf{A}_\mathbf{P}=\mathbf{b}'(((\Pi_1+\Pi_2)^2-\Pi_2^2)\boldsymbol{\Phi}\boldsymbol{\Phi}'+\Pi_2^2\mathbf{I})\mathbf{b}+\Pi_3(\Pi_1+\Pi_2)(\mathbf{b}'\mathbf{c}+\mathbf{c}'\mathbf{b})+\Pi_3^2\mathbf{c}'\mathbf{c}. \qquad (219)
$$

Moving on to the last term term in Eq. (30), it can be obtained by direct substitution of the relevant matrices:

$$
\mathbf{B}_\mathbf{\Psi}(\mathbf{I}-\mathbf{B}_\mathbf{P}'(\mathbf{B}_\mathbf{P}\mathbf{B}_\mathbf{P}')^{-1}\mathbf{B}_\mathbf{P})\mathbf{B}_\mathbf{\Psi}'=\tau_v\tau_t^{-2}\boldsymbol{\Omega}_t. \qquad (220)
$$

and by further noting that (in particular, $\mathbf{a}_t\cdot\boldsymbol{\omega}_t=\boldsymbol{\Phi}$)

$$
\mathbf{b}\boldsymbol{\omega}=(1-\ell)\boldsymbol{\Phi}\quad\text{and}\quad\mathbf{c}\boldsymbol{\omega}=\ell\boldsymbol{\Phi}, \qquad (221)
$$

so we can write $\mathbf{V}\boldsymbol{\omega}$ as a weighted sum of two vectors:

$$\begin{aligned}\mathbf{V}\boldsymbol{\omega} &= (1-\ell)(\mathbf{v}\mathbf{b}+v_3\mathbf{c})'\mathbf{\Phi}+\ell(v_3\mathbf{b}+v_4\mathbf{c})'\mathbf{\Phi} && (222)\\ &= (\bar{v}_1\mathbf{b}+\bar{v}_2\mathbf{c})'\mathbf{\Phi}, && (223)\end{aligned}$$

where the weight is given by the relative wedge, ℓ, hence the relevance of $\bar{v}_1$ and $\bar{v}_2$ in Eqs. (51) and (53). This property, that the problem "wants" to aggregate in weighted sums, is also apparent in Eq. (43). This allows us to write:

$$\mathbf{V}\mathbf{B}_{\mathbf{\Psi}}(\mathbf{I}-\mathbf{B}_{\mathbf{P}}(\mathbf{B}_{\mathbf{P}}\mathbf{B}_{\mathbf{P}}')^{-1}\mathbf{B}_{\mathbf{P}}')\mathbf{B}_{\mathbf{\Psi}}'\mathbf{V} = \tau_v\tau^{-2}\left(\bar{v}_1^2\mathbf{b}'\mathbf{\Phi}\mathbf{\Phi}'\mathbf{b}+\bar{v}_2^2\mathbf{c}'\mathbf{c}+\bar{v}_1\bar{v}_2(\mathbf{b}'\mathbf{c}+\mathbf{c}'\mathbf{b})\right). \quad (224)$$

As desired, substituting these expressions back into Eq. (30) and separating terms in $\mathbf{a}'\mathbf{a}$, $\mathbf{a}'\mathbf{\Phi}\mathbf{\Phi}'\mathbf{a}$, $\mathbf{b}'\mathbf{c}$, $\mathbf{c}'\mathbf{b}$ and in $\mathbf{c}'\mathbf{c}$, gives the following system of four ODEs:

$$\begin{aligned}v_1' &= 2\frac{\tau_P^{1/2}}{\tau^c}(\Pi_1+\Pi_2)(\alpha\bar{v}_1-v)+\frac{\tau_v}{\tau^2}\bar{v}_1^2-(\Pi_1+\Pi_2)^2+\Pi_2^2 && (225)\\ v_2' &= -\Pi_2^2 && (226)\\ v_3' &= (v-v_3)\left(\ell^{-1}\frac{\mathrm{d}}{\mathrm{d}t}\ell-\frac{\tau_P}{\tau^c}\right)+\frac{\tau_v}{\tau^2}\bar{v}_1\bar{v}_2-(\Pi_1+\Pi_2)\Pi_3 && (227)\\ &\quad+\frac{\tau_P^{1/2}}{\tau^c}(\Pi_3(\alpha\bar{v}_1-v)+(\Pi_1+\Pi_2)(\alpha\bar{v}_2-v_3))\\ v_4' &= 2(v_3-v_4)\left(\ell^{-1}\frac{\mathrm{d}}{\mathrm{d}t}\ell-\frac{\tau_P}{\tau^c}\right)+\frac{\tau_v}{\tau^2}\bar{v}_2^2+2\Pi_3\frac{\tau_P^{1/2}}{\tau^c}(\alpha\bar{v}_2-v_3)-\Pi_3^2, && (228)\end{aligned}$$

over each subinterval $(0,\tau)$ and (τ,T). We will see that v_2 can be solved independently of the other coefficients. Thus, we obtain an ODE for the sum v by adding the two first ODEs, Eqs. (225) and (226), which gives Eq. (54). This concludes step 1-3. Under step 4 we want to further combine the ODE for v with those for v_3 and v_4 into two ODEs for the weighted sums $\bar{v}_1$ and $\bar{v}_2$. Differentiating $\bar{v}_1$:

$$\bar{v}_1' = (1-\ell)v'+\ell v_3'+(v_3-v)\frac{\mathrm{d}}{\mathrm{d}t}\ell, \quad (229)$$

and substitute Eqs. (54) and (227) to obtain:

$$\begin{aligned}\bar{v}_1' &= -\ell\frac{\tau_P}{\tau^c}(v-v_3)+\frac{\tau_P^{1/2}}{\tau^c}(\Pi_1+\Pi_2)(\alpha\bar{v}-\bar{v}_1)+\frac{\tau_v}{\tau^2}\bar{v}\bar{v}_1 && (230)\\ &\quad+(\ell\Pi_3+(1-\ell)(\Pi_1+\Pi_2))\left(\frac{\tau_P^{1/2}}{\tau^c}(\alpha\bar{v}_1-v)-(\Pi_1+\Pi_2)\right),\end{aligned}$$

where the second line substitutes Eq. (43) from Conjecture 1 and simplifying gives Eq. (56). Repeating the operations above for $\bar{v}_2$ we get:

$$\bar{v}_2' = (\bar{v}_1 - \bar{v}_2)\left(\ell^{-1}\frac{\mathrm{d}}{\mathrm{d}t}\ell - \frac{\tau_P}{\tau^c}\right) + \frac{\tau_P^{1/2}}{\tau^c}\left(\Pi_3(\alpha\bar{v} - \bar{v}_1) + \tau_P^{1/2}(1-\alpha)\bar{v}_2\right) + \tau_P^{1/2}\Pi_3 + \frac{\tau_v}{\tau^2}\bar{v}_2\bar{v}. \tag{231}$$

Finally, combining $\bar{v}_1$ and $\bar{v}_2$ into the weighted sum $\bar{v}$ we obtain the ODE in Eq. (57), which uses that $(1-\alpha)/\tau^c = \tau^{-1}$.

We now repeat step 1-4 on the matrix equation associated with the boundary condition for $\mathbf{V}$ in Eq. (32). Starting with step 1-3 we compute each of the two terms in Eq. (32) separately. Using Eq. (197) under step 1 along with Eq. (49) we can first write:

$$(\mathbf{I}+\mathbf{a}_\Psi)\mathbf{V}_t = (\mathbf{b}_{t-} - \mathbf{a}_\mathbf{P})'(\mathbf{v}\mathbf{b}_t + v_3\mathbf{c}_t) + \mathbf{c}_{t-}'\left(\widetilde{v}_1\mathbf{b}_t + \widetilde{v}_2\mathbf{c}_t\right), \tag{232}$$

where $\widetilde{v}_{1,t} \equiv \left(1 - \frac{\ell_t}{\ell_{t-}}\frac{\tau_t^c}{\tau_{t-}^c}\right)v + \frac{\ell_t}{\ell_{t-}}\frac{\tau_t^c}{\tau_{t-}^c}v_3$ and $\widetilde{v}_{2,t} \equiv \left(1 - \frac{\ell_t}{\ell_{t-}}\frac{\tau_t^c}{\tau_{t-}^c}\right)v_3 + \frac{\ell_t}{\ell_{t-}}\frac{\tau_t^c}{\tau_{t-}^c}v_4$. Using the relations in Eqs. (206)–(209) under step 2 we can also write:

$$\mathbf{V}_t\mathbf{b}_\Psi = -(\mathbf{b}_t'\mathbf{v}_t + v_{3,t}\mathbf{c}_t)\mathbf{b}_\mathbf{P} + \left(\frac{v_t - \alpha_t\bar{v}_{1,t}}{1-\alpha_t}\mathbf{b}_t' + \frac{v_{3,t} - \alpha\bar{v}_{2,t}}{1-\alpha_t}\mathbf{c}_t'\right)\mathbf{x}. \tag{233}$$

These two expressions in turn allow us to write the first term in Eq. (32) as:

$$\begin{aligned}
&(\mathbf{I}+\mathbf{a}_\Psi)(\mathbf{V}_t(\mathbf{I}+\mathbf{a}_\Psi) - \mathbf{V}_t\mathbf{b}_\Psi\mathbf{S}\mathbf{b}_\Psi'\mathbf{V}_t(\mathbf{I}+\mathbf{a}_\Psi)) \qquad (234)\\
&= -(\mathbf{I}+\mathbf{a}_\Psi)(\mathbf{b}_t'\mathbf{v}_t + v_{3,t}\mathbf{c}_t')(\mathbf{a}_\mathbf{P} - \mathbf{b}_\mathbf{P}\mathbf{S}\mathbf{b}_\Psi'\mathbf{V}_t(\mathbf{I}+\mathbf{a}_\Psi))\\
&+ (\mathbf{I}+\mathbf{a}_\Psi)\left(\begin{array}{c}(\mathbf{b}_t'\mathbf{v}_t + v_{3,t}\mathbf{c}_t')\mathbf{b}_{t-} + (\widetilde{v}_{1,t}\mathbf{b}_t' + \widetilde{v}_{2,t}\mathbf{c}_t')\mathbf{c}_{t-}\\ -\left(\frac{v_t-\alpha_t\bar{v}_{1,t}}{1-\alpha_t}\mathbf{b}_t' + \frac{v_{3,t}-\alpha_t\bar{v}_{2,t}}{1-\alpha_t}\mathbf{c}_t'\right)\mathbf{x}\mathbf{S}\mathbf{b}_\Psi'\left(\begin{array}{c}(\mathbf{b}_t'\mathbf{v}_t + v_{3,t}\mathbf{c}_t')(\mathbf{b}_{t-} - \mathbf{a}_\mathbf{P})\\ +(\widetilde{v}_{1,t}\mathbf{b}_t' + \widetilde{v}_{2,t}\mathbf{c}_t')\mathbf{c}_{t-}\end{array}\right)\end{array}\right).
\end{aligned}$$

Focussing on the second term in the expression above and using once more the relations under step 1-2 we can further write:

$$(\mathbf{I}+\mathbf{a}_\Psi)(\mathbf{b}_t'\mathbf{v}_t + v_{3,t}\mathbf{c}_t') = (\mathbf{b}_{t-} - \mathbf{a}_\mathbf{P})'\mathbf{v}_t + \widetilde{v}_{1,t}\mathbf{c}_{t-}' \tag{235}$$

$$(\mathbf{I}+\mathbf{a}_\Psi)(\widetilde{v}_{1,t}\mathbf{b}_t' + \widetilde{v}_{2,t}\mathbf{c}_t') = (\mathbf{b}_{t-} - \mathbf{a}_\mathbf{P})'\widetilde{v}_{1,t} + \widetilde{v}_{3,t}\mathbf{c}_{t-}' \tag{236}$$

$$(\mathbf{I}+\mathbf{a}_\Psi)\left(\frac{v_t - \alpha_t\bar{v}_{1,t}}{1-\alpha_t}\mathbf{b}_t' + \frac{v_{3,t} - \alpha_t\bar{v}_{2,t}}{1-\alpha_t}\mathbf{c}_t'\right) = (\mathbf{b}_{t-} - \mathbf{a}_\mathbf{P})'\frac{v_t - \alpha_t\bar{v}_{1,t}}{1-\alpha_t} + \frac{\widetilde{v}_{1,t} - \alpha_t\widetilde{v}_{4,t}}{1-\alpha_t}\mathbf{c}_{t-}', \tag{237}$$

where $\widetilde{v}_{3,t} \equiv \left(1 - \frac{\ell_t}{\ell_{t-}}\frac{\tau_t^c}{\tau_{t-}^c}\right)\widetilde{v}_{1,t} + \frac{\ell_t}{\ell_{t-}}\frac{\tau_t^c}{\tau_{t-}^c}\widetilde{v}_{3,t}$ and $\widetilde{v}_{4,t} \equiv \left(1 - \frac{\ell_t}{\ell_{t-}}\frac{\tau_t^c}{\tau_{t-}^c}\right)\bar{v}_{1,t} + \frac{\ell_t}{\ell_{t-}}\frac{\tau_t^c}{\tau_{t-}^c}\bar{v}_{2,t}$. Substituting back into the second term of Eq. (234) and now moving to step 3, that is substituting Conjecture 1, part A, we obtain:

$$
\begin{aligned}
&(\mathbf{I}+\mathbf{a}_{\boldsymbol{\Psi}})(\mathbf{V}_t(\mathbf{I}+\mathbf{a}_{\boldsymbol{\Psi}})-\mathbf{V}_t\mathbf{b}_{\boldsymbol{\Psi}}\mathbf{S}\mathbf{b}_{\boldsymbol{\Psi}}'\mathbf{V}_t(\mathbf{I}+\mathbf{a}_{\boldsymbol{\Psi}})) \\
&=-(\mathbf{b}_{t-}'(\mathbf{I}-\boldsymbol{\pi}_b'\mathbf{b}_{\mathbf{P}}')\mathbf{v}_t+\mathbf{c}_{t-}'(\widetilde{v}_{1,t}-\boldsymbol{\pi}_c'\mathbf{b}_{\mathbf{P}}'\mathbf{v}_t))(\mathbf{a}_{\mathbf{P}}-\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\boldsymbol{\Psi}}'\mathbf{V}_t(\mathbf{I}+\mathbf{a}_{\boldsymbol{\Psi}})) \\
&+\left(\begin{array}{c}
(\mathbf{b}_{t-}'(\mathbf{I}-\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b)'\mathbf{v}_t+\mathbf{c}_{t-}'(\widetilde{v}_{1,t}-\mathbf{v}_t\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_c)')\mathbf{b}_{t-} \\
+(\mathbf{b}_{t-}'(\mathbf{I}-\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b)'\widetilde{v}_{1,t}+\mathbf{c}_{t-}'(\widetilde{v}_{3,t}-\widetilde{v}_{1,t}\boldsymbol{\pi}_c'\mathbf{b}_{\mathbf{P}}'))\mathbf{c}_{t-} \\
-\left(\begin{array}{c}
\frac{v_t-\alpha_t\bar{v}_{1,t}}{1-\alpha_t}\mathbf{b}_{t-}'(\mathbf{I}-\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b)' \\
+\mathbf{c}_{t-}'\left(\frac{\widetilde{v}_{1,t}-\alpha_t\widetilde{v}_{4,t}}{1-\alpha_t}-\frac{v_t-\alpha_t\bar{v}_{1,t}}{1-\alpha_t}\boldsymbol{\pi}_c'\mathbf{b}_{\mathbf{P}}'\right)
\end{array}\right)\mathbf{x}\mathbf{S}\mathbf{b}_{\boldsymbol{\Psi}}'\left(\begin{array}{c}
(\mathbf{b}_t'\mathbf{v}_t+v_{3,t}\mathbf{c}_t')(\mathbf{I}-\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b)\mathbf{b}_{t-} \\
+\left(\begin{array}{c}
\mathbf{b}_t'(\widetilde{v}_{1,t}-v_t\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_c) \\
+\mathbf{c}_t'(\widetilde{v}_{2,t}-v_{3,t}\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_c)
\end{array}\right)\mathbf{c}_{t-}
\end{array}\right)
\end{array}\right).
\end{aligned}
\tag{238}
$$

Now focus on the first term of Eq. (234), which applying step 1-3 and factoring $\mathbf{b}_{\mathbf{P}}\mathbf{S}$ allow us to rewrite as:

$$
\mathbf{a}_{\mathbf{P}}-\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\boldsymbol{\Psi}}'\mathbf{V}_t(\mathbf{I}+\mathbf{a}_{\boldsymbol{\Psi}})=\mathbf{b}_{\mathbf{P}}\mathbf{S}\left(\begin{array}{c}
(\mathbf{S}^{-1}\boldsymbol{\pi}_b+\mathbf{b}_{\boldsymbol{\Psi}}'(\mathbf{b}_t'\mathbf{v}_t+v_{3,t}\mathbf{c}_t')(\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b-\mathbf{I}))\,\mathbf{b}_{t-} \\
+\left(\begin{array}{c}
(\mathbf{S}^{-1}+\mathbf{b}_{\boldsymbol{\Psi}}'(\mathbf{b}_t'\mathbf{v}_t+v_{3,t}\mathbf{c}_t')\mathbf{b}_{\mathbf{P}})\,\boldsymbol{\pi}_c \\
-\mathbf{b}_{\boldsymbol{\Psi}}'(\widetilde{v}_{1,t}\mathbf{b}_t'+\widetilde{v}_{2,t}\mathbf{c}_t')
\end{array}\right)\mathbf{c}_{t-}
\end{array}\right). \tag{239}
$$

This expression also takes care of the second term in Eq. (32). We then plug everything back into Eq. (32) and separate terms into $\mathbf{b}_{t-}'\mathbf{b}_{t-}$, $\mathbf{b}_{t-}'\mathbf{c}_{t-}$, $\mathbf{c}_{t-}'\mathbf{b}_{t-}$ and $\mathbf{c}_{t-}'\mathbf{c}_{t-}$, which produces three equations for $\mathbf{v}_{t-}$, $v_{3,t-}$ and $v_{4,t-}$, respectively:

$$
\begin{aligned}
\mathbf{v}_{t-}&=(\mathbf{I}-\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b)'\left(\begin{array}{c}
\mathbf{v}_t-\frac{v_t-\alpha_t\bar{v}_{1,t}}{1-\alpha_t}\mathbf{x}\mathbf{S}\mathbf{b}_{\boldsymbol{\Psi}}'(\mathbf{b}_t'\mathbf{v}_t+v_{3,t}\mathbf{c}_t')(\mathbf{I}-\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b) \\
-\mathbf{v}_t\mathbf{b}_{\mathbf{P}}\mathbf{S}\,(\mathbf{S}^{-1}\boldsymbol{\pi}_b+\mathbf{b}_{\boldsymbol{\Psi}}'(\mathbf{b}_t'\mathbf{v}_t+v_{3,t}\mathbf{c}_t')(\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b-\mathbf{I}))
\end{array}\right) \qquad (240)\\
&+\left(\begin{array}{c}
\mathbf{S}^{-1}\boldsymbol{\pi}_b+ \\
\mathbf{b}_{\boldsymbol{\Psi}}'(\mathbf{b}_t'\mathbf{v}_t+v_{3,t}\mathbf{c}_t')(\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b-\mathbf{I})
\end{array}\right)'\mathbf{S}\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\mathbf{S}\left(\begin{array}{c}
\mathbf{S}^{-1}\boldsymbol{\pi}_b+ \\
\mathbf{b}_{\boldsymbol{\Psi}}'(\mathbf{b}_t'\mathbf{v}_t+v_{3,t}\mathbf{c}_t')(\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b-\mathbf{I})
\end{array}\right) \\
v_{3,t-}&=(1-\pi_b)\left(\begin{array}{c}
\widetilde{v}_{1,t}-\frac{v_t-\alpha_t\bar{v}_{1,t}}{1-\alpha_t}\bar{\mathbf{x}}\mathbf{S}\mathbf{b}_{\boldsymbol{\Psi}}'(\mathbf{b}_t'(\widetilde{v}_{1,t}-v_t\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_c)+\mathbf{c}_t'(\widetilde{v}_{2,t}-v_{3,t}\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_c))\boldsymbol{\Phi} \\
-v_t\boldsymbol{\Phi}'\mathbf{b}_{\mathbf{P}}\mathbf{S}\left(\begin{array}{c}
(\mathbf{S}^{-1}+\mathbf{b}_{\boldsymbol{\Psi}}'(\mathbf{b}_t'\mathbf{v}_t+v_{3,t}\mathbf{c}_t')\mathbf{b}_{\mathbf{P}})\boldsymbol{\pi}_c \\
-\mathbf{b}_{\boldsymbol{\Psi}}'(\widetilde{v}_{1,t}\mathbf{b}_t'+\widetilde{v}_{2,t}\mathbf{c}_t')
\end{array}\right)\boldsymbol{\Phi}
\end{array}\right) \qquad (241)\\
&+\boldsymbol{\Phi}'\left(\begin{array}{c}
\mathbf{S}^{-1}\boldsymbol{\pi}_b+ \\
\mathbf{b}_{\boldsymbol{\Psi}}'(\mathbf{b}_t'\mathbf{v}_t+v_{3,t}\mathbf{c}_t')(\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b-\mathbf{I})
\end{array}\right)'\mathbf{S}\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\mathbf{S}\left(\begin{array}{c}
(\mathbf{S}^{-1}+\mathbf{b}_{\boldsymbol{\Psi}}'(\mathbf{b}_t'\mathbf{v}_t+v_{3,t}\mathbf{c}_t')\mathbf{b}_{\mathbf{P}})\,\boldsymbol{\pi}_c \\
-\mathbf{b}_{\boldsymbol{\Psi}}'(\widetilde{v}_{1,t}\mathbf{b}_t'+\widetilde{v}_{2,t}\mathbf{c}_t')
\end{array}\right)\boldsymbol{\Phi} \\
v_{4,t-}&=-(\widetilde{v}_{1,t}-\pi_c v_t)\boldsymbol{\Phi}'\left(\begin{array}{c}
(\mathbf{S}^{-1}+\mathbf{b}_{\boldsymbol{\Psi}}'(\mathbf{b}_t'\mathbf{v}_t+v_{3,t}\mathbf{c}_t')\mathbf{b}_{\mathbf{P}})\,\boldsymbol{\pi}_c \\
-\mathbf{b}_{\boldsymbol{\Psi}}'(\widetilde{v}_{1,t}\mathbf{b}_t'+\widetilde{v}_{2,t}\mathbf{c}_t')
\end{array}\right)\boldsymbol{\Phi} \qquad (242)\\
&+\widetilde{v}_{3,t}-\widetilde{v}_{1,t}\pi_c-\left(\frac{\widetilde{v}_{1,t}-\alpha_t\widetilde{v}_{4,t}}{1-\alpha_t}-\frac{v_t-\alpha_t\bar{v}_{1,t}}{1-\alpha_t}\pi_c\right)\bar{\mathbf{x}}\mathbf{S}\mathbf{b}_{\boldsymbol{\Psi}}'\left(\begin{array}{c}
\mathbf{b}_t'(\widetilde{v}_{1,t}-v_t\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_c) \\
+\mathbf{c}_t'(\widetilde{v}_{2,t}-v_{3,t}\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_c)
\end{array}\right)\boldsymbol{\Phi}
\end{aligned}
$$

$$+\boldsymbol{\Phi}'\begin{pmatrix}(\mathbf{S}^{-1}+\mathbf{b}_{\boldsymbol{\Psi}}'(\mathbf{b}_t'\mathbf{v}_t+v_{3,t}\mathbf{c}_t')\mathbf{b}_{\mathbf{P}})\,\boldsymbol{\pi}_c\\ -\mathbf{b}_{\boldsymbol{\Psi}}'(\widetilde{v}_{1,t}\mathbf{b}_t'+\widetilde{v}_{2,t}\mathbf{c}_t')\end{pmatrix}'\mathbf{S}\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\mathbf{S}\begin{pmatrix}(\mathbf{S}^{-1}+\mathbf{b}_{\boldsymbol{\Psi}}'(\mathbf{b}_t'\mathbf{v}_t+v_{3,t}\mathbf{c}_t')\mathbf{b}_{\mathbf{P}})\,\boldsymbol{\pi}_c\\ -\mathbf{b}_{\boldsymbol{\Psi}}'(\widetilde{v}_{1,t}\mathbf{b}_t'+\widetilde{v}_{2,t}\mathbf{c}_t')\end{pmatrix}\boldsymbol{\Phi}.$$

where $\pi_. \equiv \boldsymbol{\Phi}'\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_.\boldsymbol{\Phi}$ and where we use that $\mathbf{x}$ can be rewritten as:

$$\mathbf{x}=\tau_t^{-1}\boldsymbol{\Phi}\begin{pmatrix}\tau_A & -\tau_M^{1/2}\tau_G^{1/2}\boldsymbol{\Phi}'\boldsymbol{\xi}_t^{-1}\end{pmatrix}\equiv\boldsymbol{\Phi}\bar{\mathbf{x}}, \tag{243}$$

so that $\boldsymbol{\Phi}'\mathbf{x}=\bar{\mathbf{x}}$; when performing the separation for the last two equations we have also used that $\mathbf{c}\equiv\boldsymbol{\Phi}\boldsymbol{\Phi}'\mathbf{c}$ and then pre- and post-multiplied each equation by $\boldsymbol{\Phi}$' and $\boldsymbol{\Phi}$, respectively, which gives scalar equations for $v_{3,t-}$ and $v_{4,t-}$. The first equation is a matrix equation, which we can transform into two equations for the scalars v_{t-} and $v_{2,t-}$. Specifically, isolating terms in $\mathbf{I}$ gives the boundary condition for v_2 in Eq. (61). To get the boundary condition for v_{t-} first re-arrange the first equation using the identities under step 2, which imply that:

$$(\mathbf{v}_t\mathbf{b}_t+v_{3,t}\mathbf{c}_t)\mathbf{b}_{\boldsymbol{\Psi}}=-\mathbf{v}_t\mathbf{b}_{\mathbf{P}}+\frac{v_t-\alpha_t\bar{v}_{1,t}}{1-\alpha_t}\mathbf{x}, \tag{244}$$

and which allows to rewrite the first equation as:

$$\begin{aligned}\mathbf{v}_{t-}&=(\mathbf{I}-\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b)'\left(\mathbf{v}_t+(\mathbf{v}_t\mathbf{b}_t+v_{3,t}\mathbf{c}_t)\mathbf{b}_{\boldsymbol{\Psi}}\mathbf{Q}\mathbf{b}_{\boldsymbol{\Psi}}'(\mathbf{v}_t\mathbf{b}_t+v_{3,t}\mathbf{c}_t)'\right)(\mathbf{I}-\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b)\\&-(\mathbf{I}-\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b)'(\mathbf{v}_t\mathbf{b}_t+v_{3,t}\mathbf{c}_t)\mathbf{b}_{\boldsymbol{\Psi}}\mathbf{S}\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b+\boldsymbol{\pi}_b'\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b\\&-\boldsymbol{\pi}_b'\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\boldsymbol{\Psi}}'(\mathbf{v}_t\mathbf{b}_t+v_{3,t}\mathbf{c}_t)'(\mathbf{I}-\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b),\end{aligned} \tag{245}$$

where $\mathbf{Q}$ denotes the projection:

$$\mathbf{Q}\equiv\mathbf{S}\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\mathbf{S}-\mathbf{S}. \tag{246}$$

Using the property that $\mathbf{b}_{\mathbf{P}}\mathbf{Q}=\mathbf{Q}\mathbf{b}_{\mathbf{P}}'=\mathbf{0}$ along with Eq. (244) this equation simplifies to:

$$\begin{aligned}\mathbf{v}_{t-}&=\mathbf{v}_t+\boldsymbol{\pi}_b'\mathbf{b}_{\mathbf{P}}'((\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}-\mathbf{v}_t)\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b+\left(\frac{v_t-\alpha_t\bar{v}_{1,t}}{1-\alpha_t}\right)^2(\mathbf{I}-\boldsymbol{\pi}_b'\mathbf{b}_{\mathbf{P}}')\mathbf{x}\mathbf{Q}\mathbf{x}'(\mathbf{I}-\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b)\\&-\frac{v_t-\alpha_t\bar{v}_{1,t}}{1-\alpha_t}\left((\mathbf{I}-\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b)'\mathbf{x}\mathbf{S}\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b+\boldsymbol{\pi}_b'\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{x}'(\mathbf{I}-\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b)\right).\end{aligned} \tag{247}$$

We then pre- and post-multiply this equation by $\boldsymbol{\Phi}$' and $\boldsymbol{\Phi}$, respectively, and using the definition of $\bar{\mathbf{x}}$ and π_b gives the boundary condition in Eq. (58). This concludes step 1-3. Turning to step 4 we now want to take weighted combinations of the boundary conditions for v_{t-}, $v_{3,t-}$ and $v_{4,t-}$, and to this end the identity in Eq. (211) is crucial. Thus we first elaborate on how we obtain this identity. Exploiting the definition of $\mathbf{S}$ and Eqs. (208) and

(209) we can write:

$$\mathbf{S}^{-1} = \boldsymbol{\Upsilon}^{-1} + \mathbf{b}'_{\boldsymbol{\Psi}}\left(\mathbf{b}'_t\left(\frac{v_t - \alpha_t \bar{v}_{1,t}}{1-\alpha_t}\mathbf{x} - \mathbf{v}_t\mathbf{b}_{\mathbf{P}}\right) + \mathbf{c}'_t\left(\frac{v_{3,t} - \alpha_t \bar{v}_{2,t}}{1-\alpha_t}\mathbf{x} - v_{3,t}\mathbf{b}_{\mathbf{P}}\right)\right). \tag{248}$$

Adding $\mathbf{b}'_{\boldsymbol{\Psi}}(\mathbf{b}'\mathbf{v} + v_3\mathbf{c}')\mathbf{b}_{\mathbf{P}}$, post-multiplying by $\mathbf{y}$ and using once more the identities in step 2 we can then write:

$$(\mathbf{S}^{-1} + \mathbf{b}'_{\boldsymbol{\Psi}}(\mathbf{b}'_t\mathbf{v}_t + v_{3,t}\mathbf{c}'_t)\mathbf{b}_{\mathbf{P}})\mathbf{y} = \boldsymbol{\Upsilon}^{-1}\mathbf{y} - \frac{v_t - \alpha_t\bar{v}_{1,t}}{1-\alpha_t}\mathbf{b}'_{\mathbf{P}}\mathbf{x}\mathbf{y} + \frac{v_t - 2\alpha_t\bar{v}_{1,t} + \alpha_t^2\bar{v}_t}{(1-\alpha_t)^2}\mathbf{x}'\mathbf{x}\mathbf{y} \tag{249}$$

Furthermore, note that

$$\mathbf{x}\mathbf{y} = \tau_t^{-1}(\tau_A + \tau_{G,t})\boldsymbol{\Phi} \equiv \beta(1-\alpha_t)\boldsymbol{\Phi}, \tag{250}$$

with $\tau_t - \tau_{t-} = \tau_A + \tau_{G,t}$ and that, using block matrix inversion we can write:

$$\boldsymbol{\Upsilon}^{-1} = \begin{pmatrix} \tau_t^{-1}\tau_A(\tau_{t-} + \tau_{G,t}) & \tau_t^{-1}\tau_A\tau_{G,t}^{1/2}\tau_M^{1/2}\boldsymbol{\Phi}'\boldsymbol{\xi}_t^{-1} \\ \tau_t^{-1}\tau_{G,t}^{1/2}\tau_M^{1/2}\tau_A\boldsymbol{\xi}_t^{-1}\boldsymbol{\Phi} & \tau_M\boldsymbol{\xi}_t^{-1}(\mathbf{I} - \tau_{G,t}\tau_t^{-1}\boldsymbol{\Phi}\boldsymbol{\Phi}')\boldsymbol{\xi}_t^{-1} \end{pmatrix}, \tag{251}$$

and this gives after simplifications:

$$\boldsymbol{\Upsilon}^{-1}\mathbf{y} = \tau_{t-}\mathbf{x}'\boldsymbol{\Phi}. \tag{252}$$

Substituting back in the above gives Eq. (211). Now to take linear combinations of the $v.$ coefficients we exploit Eq. (44):

$$\mathbf{b}_{\mathbf{P}}(\ell_{t-}\boldsymbol{\pi}_c + (1-\ell_{t-})\boldsymbol{\pi}_b) = \mathbf{b}_{\mathbf{P}}\mathbf{y}. \tag{253}$$

Combining the first and second equation in Eq. (240) (pre- and post-multiply the first equation by $\boldsymbol{\Phi}$), using the relation above along with the definition of $\mathbf{Q}$ gives:

$$\begin{aligned}\bar{v}_{1,t-} = {} & \boldsymbol{\Phi}'\boldsymbol{\pi}'_b\mathbf{b}'_{\mathbf{P}}(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}'_{\mathbf{P}})^{-1}\mathbf{b}_{\mathbf{P}}\mathbf{S}\begin{pmatrix} (\mathbf{S}^{-1} + \mathbf{b}'_{\boldsymbol{\Psi}}(\mathbf{v}_t\mathbf{b}_t + v_{3,t}\mathbf{c}_t)'\mathbf{b}_{\mathbf{P}})\mathbf{y} - \\ \mathbf{b}'_{\boldsymbol{\Psi}}\begin{pmatrix} (\ell_{t-}\widetilde{v}_{1,t} + (1-\ell_{t-})v_t)\mathbf{b}'_t \\ (\ell_{t-}\widetilde{v}_{2,t} + (1-\ell_{t-})v_{3,t})\mathbf{c}'_t \end{pmatrix}\end{pmatrix}\boldsymbol{\Phi} + \\ & + \boldsymbol{\Phi}'(\mathbf{I} - \boldsymbol{\pi}'_b\mathbf{b}'_{\mathbf{P}})\begin{pmatrix} \ell_{t-}\widetilde{v}_{1,t} + (1-\ell_{t-})v_t - \mathbf{v}_t\mathbf{b}_{\mathbf{P}}\mathbf{y} - \\ (\mathbf{v}_t\mathbf{b}_t + v_{3,t}\mathbf{c}_t)\mathbf{b}_{\boldsymbol{\Psi}}\mathbf{Q}\begin{pmatrix} (\mathbf{S}^{-1} + \mathbf{b}'_{\boldsymbol{\Psi}}(\mathbf{v}_t\mathbf{b}_t + v_{3,t}\mathbf{c}_t)'\mathbf{b}_{\mathbf{P}})\mathbf{y} - \\ \mathbf{b}'_{\boldsymbol{\Psi}}\begin{pmatrix} (\ell_{t-}\widetilde{v}_{1,t} + (1-\ell_{t-})v_t)\mathbf{b}'_t + \\ (\ell_{t-}\widetilde{v}_{2,t} + (1-\ell_{t-})v_{3,t})\mathbf{c}'_t \end{pmatrix}\end{pmatrix}\end{pmatrix}\boldsymbol{\Phi} \\ & - \boldsymbol{\Phi}'(\mathbf{I} - \boldsymbol{\pi}'_b\mathbf{b}'_{\mathbf{P}})(\mathbf{v}_t\mathbf{b}_t + v_{3,t}\mathbf{c}_t)\mathbf{b}_{\boldsymbol{\Psi}}\mathbf{y}\boldsymbol{\Phi}.\end{aligned} \tag{254}$$

Using the identities under step 2 further allow us to write:

$$\ell_{t-}\widetilde{v}_{1,t} + (1-\ell_{t-})v_t = \beta v_t + (1-\beta)\bar{v}_{1,t} \tag{255}$$

and

$$\mathbf{b}_{\mathbf{\Psi}}' \begin{pmatrix} (\ell_{t-}\widetilde{v}_{1,t} + (1-\ell_{t-})v_t)\mathbf{b}_t \\ +(\ell_{t-}\widetilde{v}_{2,t} + (1-\ell_{t-})v_{3,t})\mathbf{c}_t' \end{pmatrix} = -(\beta v_t + (1-\beta)\bar{v}_{1,t})\mathbf{b}_{\mathbf{P}}' \tag{256}$$
$$+ \frac{\beta v_t + (1-\beta)\bar{v}_{1,t} - \alpha_t(\beta\bar{v}_{1,t} + (1-\beta)\bar{v}_t)}{1-\alpha_t}\mathbf{x}'.$$

Substituting these expressions back along with Eq. (244) and the key identity in Eq. (211), and using the property that $\mathbf{b}_{\mathbf{P}}\mathbf{Q} = 0$ and simplifying gives:

$$\bar{v}_{1,t-} = \left((1+\beta+\alpha_t\beta)\frac{v_t - \alpha_t\bar{v}_{1,t}}{1-\alpha_t}\beta + \tau_{t-}\right)\mathbf{\Phi}'\boldsymbol{\pi}_b'\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\mathbf{S}\bar{\mathbf{x}}' \tag{257}$$
$$+ (1+\beta+\alpha_t\beta)\bar{v}_{1,t} - (1-\pi_b)\frac{v_t - \alpha_t\bar{v}_{1,t}}{1-\alpha_t}\left(\tau_{t-} + (1+\beta+\alpha_t\beta)\frac{\alpha_t\bar{v}_t - \bar{v}_{1,t}}{1-\alpha_t}\right)\bar{\mathbf{x}}\mathbf{Q}\bar{\mathbf{x}}'.$$

Further noting that

$$\alpha_t\beta + 1 - \beta = \tau_{t-}/\tau_t, \tag{258}$$

and simplifying gives the boundary condition in Eq. (59). Combining the first and second equation in Eq. (240), using Eq. (253) and the definition of $\mathbf{Q}$ further gives:

$$\bar{v}_{2,t-} = \mathbf{\Phi}' \begin{pmatrix} \begin{pmatrix} (\mathbf{S}^{-1} + \mathbf{b}_{\mathbf{\Psi}}'(\mathbf{v}_t\mathbf{b}_t + v_{3,t}\mathbf{c}_t)\mathbf{b}_{\mathbf{P}})\mathbf{y} \\ -\mathbf{b}_{\mathbf{\Psi}}' \begin{pmatrix} ((1-\ell_{t-})v_t + \ell_{t-}\widetilde{v}_{1,t})\mathbf{b}_t' \\ ((1-\ell_{t-})v_{3,t} + \ell_{t-}\widetilde{v}_{2,t})\mathbf{c}_t' \end{pmatrix} \end{pmatrix} \mathbf{S}\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1} \\ -((1-\ell_{t-})v_t + \ell_{t-}\widetilde{v}_{1,t} - \mathbf{y}'\mathbf{b}_{\mathbf{P}}\mathbf{v}_t) \end{pmatrix} \mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_c\mathbf{\Phi} \tag{259}$$
$$+ \mathbf{\Phi}' \begin{pmatrix} \begin{pmatrix} (\mathbf{S}^{-1} + \mathbf{b}_{\mathbf{\Psi}}'(\mathbf{v}_t\mathbf{b}_t + v_{3,t}\mathbf{c}_t)\mathbf{b}_{\mathbf{P}})\mathbf{y} \\ -\mathbf{b}_{\mathbf{\Psi}}' \begin{pmatrix} ((1-\ell_{t-})v_t + \ell_{t-}\widetilde{v}_{1,t})\mathbf{b}_t' \\ ((1-\ell_{t-})v_{3,t} + \ell_{t-}\widetilde{v}_{2,t})\mathbf{c}_t' \end{pmatrix} \end{pmatrix} \mathbf{S}\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}} \\ -((1-\ell_{t-})v_t + \ell_{t-}\widetilde{v}_{1,t} - \mathbf{y}'\mathbf{b}_{\mathbf{P}}\mathbf{v}_t)\mathbf{b}_{\mathbf{P}} \\ + \left(\frac{(1-\ell_{t-})v_t + \ell_{t-}\widetilde{v}_{1,t} - \alpha_t((1-\ell_{t-})\bar{v}_{1,t} + \ell_{t-}\widetilde{v}_{4,t})}{1-\alpha_t} - \frac{v_t - \alpha_t\bar{v}_{1,t}}{1-\alpha_t}\mathbf{y}'\mathbf{b}_{\mathbf{P}}'\right)\mathbf{x} \end{pmatrix} \mathbf{S}\mathbf{b}_{\mathbf{\Psi}}' \begin{pmatrix} (\mathbf{b}_t'\mathbf{v}_t + v_{3,t}\mathbf{c}_t')\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_c \\ -\widetilde{v}_{1,t}\mathbf{b}_t' - \widetilde{v}_{2,t}\mathbf{c}_t' \end{pmatrix} \mathbf{\Phi}$$
$$+ (1-\ell_{t-})\widetilde{v}_{1,t} + \ell_{t-}\widetilde{v}_{3,t} - \widetilde{v}_{1,t}\mathbf{\Phi}'\mathbf{y}'\mathbf{b}_{\mathbf{P}}'\mathbf{\Phi}.$$

Now observing that $\ell_t\widetilde{v}_{1,t} + (1-\ell_{t-})\widetilde{v}_{2,t} = \widetilde{v}_{4,t}$ allows us to write:

$$\frac{(1-\ell_{t-})v_t + \ell_{t-}\widetilde{v}_{1,t} - \alpha_t((1-\ell_{t-})\bar{v}_{1,t} + \ell_{t-}\widetilde{v}_{4,t})}{1-\alpha_t}\mathbf{x} = ((1-\ell_{t-})v_t + \ell_{t-}\widetilde{v}_{1,t})\mathbf{b_P} + \begin{pmatrix} ((1-\ell_{t-})v_t + \ell_{t-}\widetilde{v}_{1,t})\mathbf{b}_t \\ +((1-\ell_{t-})v_{3,t} + \ell_{t-}\widetilde{v}_{2,t})\mathbf{c}_t \end{pmatrix}\mathbf{b_\Psi}. \tag{260}$$

Substituting this expression, using Eq. (244) and adding substracting $\mathbf{y}'\mathbf{S}^{-1}$ and simplifying the equation above becomes:

$$\begin{aligned}\bar{v}_{2,t-} = {} & \mathbf{\Phi}' \begin{pmatrix} \begin{pmatrix} (\mathbf{S}^{-1} + \mathbf{b}'_{\mathbf{\Psi}}(\mathbf{v}_t\mathbf{b}_t + v_{3,t}\mathbf{c}_t)\mathbf{b_P})\mathbf{y} \\ -\mathbf{b}'_{\mathbf{\Psi}} \begin{pmatrix} ((1-\ell_{t-})v_t + \ell_{t-}\widetilde{v}_{1,t})\mathbf{b}'_t \\ ((1-\ell_{t-})v_{3,t} + \ell_{t-}\widetilde{v}_{2,t})\mathbf{c}'_t \end{pmatrix} \end{pmatrix} \mathbf{S}\mathbf{b}'_{\mathbf{P}}(\mathbf{b_P}\mathbf{S}\mathbf{b}'_{\mathbf{P}})^{-1} \\ -((1-\ell_{t-})v_t + \ell_{t-}\widetilde{v}_{1,t} - \mathbf{y}'\mathbf{b_P}\mathbf{v}_t) \end{pmatrix} \mathbf{b_P}\boldsymbol{\pi}_c\mathbf{\Phi} \\ & + (1-\ell_{t-})\widetilde{v}_{1,t} + \ell_{t-}\widetilde{v}_{3,t} + \mathbf{\Phi}'\mathbf{y}'\left(\mathbf{b}'_{\mathbf{\Psi}}((\mathbf{v}_t\mathbf{b}_t + v_{3,t}\mathbf{c}_t)'\mathbf{b_P}\boldsymbol{\pi}_c - \widetilde{v}_{1,t}\mathbf{b}'_t - \widetilde{v}_{2,t}\mathbf{c}'_t) - \widetilde{v}_{1,t}\mathbf{b}'_{\mathbf{P}}\right)\mathbf{\Phi} \\ & + \mathbf{\Phi}' \begin{pmatrix} \mathbf{y}'(\mathbf{b}'_{\mathbf{P}}(\mathbf{v}_t\mathbf{b}_t + v_{3,t}\mathbf{c}_t)\mathbf{b_\Psi} + \mathbf{S}^{-1}) \\ -\begin{pmatrix} ((1-\ell_{t-})v_t + \ell_{t-}\widetilde{v}_{1,t})\mathbf{b}_t \\ +((1-\ell_{t-})v_{3,t} + \ell_{t-}\widetilde{v}_{2,t})\mathbf{c}_t \end{pmatrix}\mathbf{b_\Psi} \end{pmatrix} \mathbf{Q}\mathbf{b}'_{\mathbf{\Psi}} \begin{pmatrix} (\mathbf{v}_t\mathbf{b}_t + v_{3,t}\mathbf{c}_t)'\mathbf{b_P}\boldsymbol{\pi}_c \\ -\widetilde{v}_{1,t}\mathbf{b}'_t - \widetilde{v}_{2,t}\mathbf{c}_t \end{pmatrix}\mathbf{\Phi}.\end{aligned} \tag{261}$$

We further compute the following terms:

$$(1-\ell_{t-})\widetilde{v}_{1,t} + \ell_{t-}\widetilde{v}_{3,t} = \beta\widetilde{v}_{1,t} + (1-\beta)\widetilde{v}_t \tag{262}$$

$$(1-\ell_{t-})v_t + \ell_{t-}\widetilde{v}_{1,t} = \beta v_t + (1-\beta)\bar{v}_{1,t} \tag{263}$$

$$(1-\ell_{t-})v_{3,t} + \ell_{t-}\widetilde{v}_{2,t} = \beta v_{3,t} + (1-\beta)\bar{v}_{2,t} \tag{264}$$

along with (again using the identities under step 2):

$$\mathbf{b}'_{\mathbf{\Psi}}\begin{pmatrix} (\mathbf{b}'_t\mathbf{v}_t + v_{3,t}\mathbf{c}'_t)\mathbf{b_P}\boldsymbol{\pi}_c \\ -\widetilde{v}_{1,t}\mathbf{b}'_t - \widetilde{v}_{2,t}\mathbf{c}'_t \end{pmatrix} = \left(\frac{v_t - \alpha_t\bar{v}_{1,t}}{1-\alpha_t}\mathbf{x} - \mathbf{v}_t\mathbf{b_P}\right)'\mathbf{b_P}\boldsymbol{\pi}_c + \widetilde{v}_{1,t}\mathbf{b}'_{\mathbf{P}} - \frac{\widetilde{v}_{1,t} - \alpha_t\widetilde{v}_t}{1-\alpha_t}\mathbf{x}' \tag{265}$$

and

$$\begin{pmatrix} ((1-\ell_{t-})v_t + \ell_{t-}\widetilde{v}_t)\mathbf{b}_t \\ +((1-\ell_{t-})v_{3,t} + \ell_{t-}\widetilde{v}_{2,t})\mathbf{c}_t \end{pmatrix}\mathbf{b_\Psi} = -(\beta v_t + (1-\beta)\bar{v}_{1,t})\mathbf{b_P} + \left(\beta\frac{v_t - \alpha_t\bar{v}_{1,t}}{1-\alpha_t} + (1-\beta)\frac{\bar{v}_{1,t} - \alpha_t\bar{v}_t}{1-\alpha_t}\right)\mathbf{x}. \tag{266}$$

Substituting these expressions back along with the key identity in Eq. (211) and that $\mathbf{b_P Q} = 0$ we get after simplifications:

$$\bar{v}_{2,t-} = \beta\widetilde{v}_{1,t} + (1-\beta)\widetilde{v}_t - \beta(v_t - \alpha_t\bar{v}_{1,t})\pi_c + \left(\frac{v_t - \alpha_t\bar{v}_{1,t}}{1-\alpha_t}\pi_c - \frac{\widetilde{v}_{1,t} - \alpha_t\widetilde{v}_t}{1-\alpha_t}\right)\mathbf{\Phi}'\mathbf{y}'\bar{\mathbf{x}}' \quad (267)$$
$$+\left(\frac{\alpha_t\bar{v}_t - \alpha_t\bar{v}_{1,t}}{1-\alpha_t}(1-\beta+\alpha_t\beta) + \tau_{t-}\right)\left(\begin{array}{c}\bar{\mathbf{x}}\mathbf{S}\mathbf{b_P}(\mathbf{b_P}\mathbf{S}\mathbf{b}'_\mathbf{P})^{-1}\mathbf{b_P}\boldsymbol{\pi}_c\mathbf{\Phi} \\ +\left(\frac{v_t-\alpha_t\bar{v}_{1,t}}{1-\alpha_t}\pi_c - \frac{\widetilde{v}_{1,t}-\alpha_t\widetilde{v}_t}{1-\alpha_t}\right)\bar{\mathbf{x}}\mathbf{Q}\bar{\mathbf{x}}'\end{array}\right).$$

Further substituting Eq. (250) and Eq. (258) and simplifying gives:

$$\bar{v}_{2,t-} = \frac{\tau_{t-}}{\tau_t}\widetilde{v}_t + \tau_{t-}\left(\frac{\alpha_t\bar{v}_t - \bar{v}_{1,t}}{1-\alpha_t}\tau_t^{-1} + 1\right)\left(\begin{array}{c}\bar{\mathbf{x}}\mathbf{S}\mathbf{b_P}(\mathbf{b_P}\mathbf{S}\mathbf{b}'_\mathbf{P})^{-1}\mathbf{b_P}\boldsymbol{\pi}_c\mathbf{\Phi} \\ +\left(\frac{v_t-\alpha_t\bar{v}_{1,t}}{1-\alpha_t}\pi_c - \frac{\widetilde{v}_{1,t}-\alpha_t\widetilde{v}_t}{1-\alpha_t}\right)\bar{\mathbf{x}}\mathbf{S}\bar{\mathbf{x}}'\end{array}\right). \quad (268)$$

We now take the further combination of $\bar{v}_{1,t-}$ and $\bar{v}_{2,t-}$, which gives:

$$\bar{v}_{t-} = \frac{\tau_{t-}}{\tau_t}((1-\ell_{t-})\bar{v}_{1,t} + \ell_{t-}\widetilde{v}_t) \quad (269)$$
$$+\tau_{t-}\left(1 + \tau_t^{-1}\frac{\alpha_t\bar{v}_t - \bar{v}_{1,t}}{1-\alpha_t}\right)\left(\begin{array}{c}\mathbf{\Phi}'\mathbf{y}'\mathbf{b}'_\mathbf{P}(\mathbf{b_P}\mathbf{S}\mathbf{b}'_\mathbf{P})^{-1}\mathbf{b_P}\mathbf{S}\bar{\mathbf{x}}' \\ +\left(\begin{array}{c}\frac{v_t-\alpha_t\bar{v}_{1,t}}{1-\alpha_t}\mathbf{\Phi}'\mathbf{b_P}\mathbf{y}\mathbf{\Phi} \\ -\frac{(1-\ell_{t-})v_t + \ell_{t-}\widetilde{v}_{1,t} - \alpha_t((1-\ell_{t-})\bar{v}_{1,t} + \ell_{t-}\widetilde{v}_t)}{1-\alpha_t}\end{array}\right)\bar{\mathbf{x}}\mathbf{Q}\bar{\mathbf{x}}'\end{array}\right).$$

Using the definition of $\mathbf{Q}$ we can write:

$$\frac{v_t - \alpha_t\bar{v}_{1,t}}{1-\alpha_t}\mathbf{\Phi}'\mathbf{b_P}\mathbf{y}\mathbf{\Phi}\bar{\mathbf{x}}\mathbf{Q}\bar{\mathbf{x}}' + \mathbf{\Phi}'\mathbf{y}'\mathbf{b}'_\mathbf{P}(\mathbf{b_P}\mathbf{S}\mathbf{b}'_\mathbf{P})^{-1}\mathbf{b_P}\mathbf{S}\bar{\mathbf{x}}' = -\frac{v_t - \alpha_t\bar{v}_{1,t}}{1-\alpha_t}\mathbf{\Phi}'\mathbf{b_P}\mathbf{y}\mathbf{\Phi}\bar{\mathbf{x}}\mathbf{S}\bar{\mathbf{x}}' \quad (270)$$
$$+\mathbf{\Phi}'\mathbf{y}'\left(\frac{v_t - \alpha_t\bar{v}_{1,t}}{1-\alpha_t}\mathbf{b}'_\mathbf{P}\mathbf{x} + \mathbf{S}^{-1}\right)\mathbf{S}\mathbf{b}'_\mathbf{P}(\mathbf{b_P}\mathbf{S}\mathbf{b}'_\mathbf{P})^{-1}\mathbf{b_P}\bar{\mathbf{x}}'.$$

Add and subtract $-\mathbf{b_P}\mathbf{v}_t\mathbf{b_P}$ inside the bracket and use the identities under step 2 to get:

$$\frac{v_t - \alpha_t\bar{v}_{1,t}}{1-\alpha_t}\mathbf{\Phi}'\mathbf{b_P}\mathbf{y}\mathbf{\Phi}\bar{\mathbf{x}}\mathbf{Q}\bar{\mathbf{x}}' + \mathbf{\Phi}'\mathbf{y}'\mathbf{b}'_\mathbf{P}(\mathbf{b_P}\mathbf{S}\mathbf{b}'_\mathbf{P})^{-1}\mathbf{b_P}\mathbf{S}\bar{\mathbf{x}}' = -\frac{v_t - \alpha_t\bar{v}_{1,t}}{1-\alpha_t}\mathbf{\Phi}'\mathbf{b_P}\mathbf{y}\mathbf{\Phi}\bar{\mathbf{x}}\mathbf{S}\bar{\mathbf{x}}' \quad (271)$$
$$+\mathbf{\Phi}'\mathbf{y}'\left(\mathbf{b}'_\mathbf{P}(\mathbf{b}_t\mathbf{v}_t + v_{3,t}\mathbf{c}_t)\mathbf{b_\Psi} + \mathbf{S}^{-1} + \mathbf{b_P}\mathbf{v}_t\mathbf{b}'_\mathbf{P}\right)\mathbf{S}\mathbf{b}'_\mathbf{P}(\mathbf{b_P}\mathbf{S}\mathbf{b}'_\mathbf{P})^{-1}\mathbf{b_P}\bar{\mathbf{x}}'.$$

From the key identity in Eq. (211) we can write:

$$(\mathbf{b}'_\mathbf{\Psi}(\mathbf{b}_t\mathbf{v}_t + v_{3,t}\mathbf{c}_t)'\mathbf{b_P} + \mathbf{S}^{-1})\mathbf{y} = \left(\frac{v_t - 2\alpha_t\bar{v}_{1,t} + \alpha_t^2\bar{v}_t}{1-\alpha_t}\beta + \tau_{t-}\right)\bar{\mathbf{x}}' - \beta(v_t - \alpha_t\bar{v}_{1,t})\mathbf{b}'_\mathbf{P}\mathbf{\Phi}. \quad (272)$$

Substituting this expression back in the above and using once more the identities under step

2 and the definition of $\mathbf{Q}$ gives:

$$\begin{aligned} &\frac{v_t - \alpha_t \bar{v}_{1,t}}{1-\alpha_t} \mathbf{\Phi}' \mathbf{b_P} \mathbf{y} \mathbf{\Phi} \bar{\mathbf{x}} \mathbf{Q} \bar{\mathbf{x}}' + \mathbf{\Phi}' \mathbf{y}' \mathbf{b}'_{\mathbf{P}} (\mathbf{b_P} \mathbf{S} \mathbf{b}'_{\mathbf{P}})^{-1} \mathbf{b_P} \mathbf{S} \bar{\mathbf{x}}' \\ &= \left(\frac{v_t - 2\alpha_t \bar{v}_{1,t} + \alpha_t^2 \bar{v}_t}{1-\alpha_t} \beta + \tau_{t-} \right) \bar{\mathbf{x}} \mathbf{Q} \bar{\mathbf{x}}' + (1-\alpha_t)\beta. \end{aligned} \tag{273}$$

Substituting in turn this expression back into the boundary condition for $\bar{v}_{t-}$ along with Eq. (263) and:

$$(1-\ell_{t-})\bar{v}_{1,t} + \ell_{t-}\widetilde{v}_t = \beta \bar{v}_{1,t} + (1-\beta)\bar{v}_t, \tag{274}$$

gives:

$$\begin{aligned} \bar{v}_{t-} &= \tau_{t-}(\tau_t^{-1}(1-\beta+\alpha_t\beta)\bar{v}_t + (1-\alpha_t)\beta) \\ &+ \tau_{t-} \left(1 + \tau_t^{-1} \frac{\alpha_t \bar{v}_t - \bar{v}_{1,t}}{1-\alpha_t} \right) \left(\tau_{t-} + \frac{\alpha_t \bar{v}_t - \bar{v}_{1,t}}{1-\alpha_t} (1-\beta+\alpha_t\beta) \right) \bar{\mathbf{x}} \mathbf{Q} \bar{\mathbf{x}}'. \end{aligned} \tag{275}$$

Then substituting Eq. (258) gives Eq. (60), which concludes step 4. Finally, we obtain boundary conditions at the liquidation date by substituting the identity in Eq. (38) into the boundary conditions in Eqs. (34) and by comparing the result to the conjecture in Eq. (49):

$$v_{1,T-} = -\tau_\epsilon^2 (\tau_{T-} + \tau_\epsilon)^{-1} \tag{276}$$

$$v_{2,T-} = \tau_\epsilon \tag{277}$$

$$v_{3,T-} = v_{4,T-} = \tau_\epsilon \tau_{T-} (\tau_{T-} + \tau_\epsilon)^{-1}. \tag{278}$$

Adding the first two together gives Eq. (62). Similarly, the boundary conditions for the weighted sums $\bar{v}_1$ and $\bar{v}_2$ are:

$$\bar{v}_{1,T-} = \bar{v}_{2,T-} = \frac{\tau_\epsilon \tau_{T-}}{\tau_{T-} + \tau_\epsilon}. \tag{279}$$

We now repeat steps 1-3 on $\mathbf{U}$ to verify the identity in Eq. (63) (step 4 is unnecessary in this case). Just like for the $v_\cdot$ coefficients we define the sum $u \equiv u_1 + u_2$ and will further need the weighted combination:

$$\bar{u} \equiv (1-\ell)u + \ell u_3. \tag{280}$$

Now taking each term in Eq. (29) separately, computations similar to those on which Eq.

(219) is based show that

$$(\mathbf{B}_{\mathbf{\Psi}}\mathbf{B}_{\mathbf{P}}'(\mathbf{B}_{\mathbf{P}}\mathbf{B}_{\mathbf{P}}')^{-1}\mathbf{A}_{\mathbf{P}} - \mathbf{A}_{\mathbf{\Psi}})'\mathbf{U} \tag{281}$$

$$= \left(\mathbf{u}\frac{\mathrm{d}}{\mathrm{d}t}(\mathbf{b}+\mathbf{c}) - (u-u_3)\frac{\tau_P}{\tau^c}\mathbf{c} + \frac{\tau_P^{1/2}}{\tau^c}(\alpha\bar{u}-u)\mathbf{\Phi}\mathbf{\Phi}'((\Pi_1+\Pi_2)\mathbf{b}+\Pi_3\mathbf{c})\right)'\boldsymbol{\xi}_0\mathbf{M}.$$

and from computations on which Eq. (224) is based we have:

$$\mathbf{V}\mathbf{B}_{\mathbf{\Psi}}(\mathbf{I}-\mathbf{B}_{\mathbf{P}}'(\mathbf{B}_{\mathbf{P}}\mathbf{B}_{\mathbf{P}}')^{-1}\mathbf{B}_{\mathbf{P}})\mathbf{B}_{\mathbf{\Psi}}'\mathbf{U} = \tau_v\tau^{-2}\bar{u}(\bar{v}_1\mathbf{b}+\bar{v}_2\mathbf{c})'\mathbf{\Phi}\mathbf{\Phi}'\boldsymbol{\xi}_0\mathbf{M}. \tag{282}$$

Furthermore, differentiating Eq. (49) gives:

$$\dot{\mathbf{U}} = \left(\mathbf{u}\frac{\mathrm{d}}{\mathrm{d}t}\mathbf{b} + u_3\frac{\mathrm{d}}{\mathrm{d}t}\mathbf{c} + \dot{\mathbf{u}}\mathbf{b} + u_3'\mathbf{c}\right)'\boldsymbol{\xi}_0\mathbf{M} + (\mathbf{u}\mathbf{b}+u_3\mathbf{c})'\dot{\boldsymbol{\xi}}_0\mathbf{M}. \tag{283}$$

Finally, Eqs. (201) and (203) imply that

$$\mathbf{b}\mathbf{B}_{\mathbf{\Psi}}\mathbf{B}_{\mathbf{P}}'(\mathbf{B}_{\mathbf{P}}\mathbf{B}_{\mathbf{P}}')^{-1} = -\mathbf{I} - \tau_P^{1/2}\left((1-\ell)\tau^{-1}+\ell(\tau^c)^{-1}\right)\mathbf{\Phi}\mathbf{\Phi}'\mathbf{\Sigma}_{\mathbf{P}}^{-1} \tag{284}$$

$$\mathbf{c}\mathbf{B}_{\mathbf{\Psi}}\mathbf{B}_{\mathbf{P}}'(\mathbf{B}_{\mathbf{P}}\mathbf{B}_{\mathbf{P}}')^{-1} = \tau_P^{1/2}\ell\alpha(\tau^c)^{-1}\mathbf{\Phi}\mathbf{\Phi}'\mathbf{\Sigma}_{\mathbf{P}}^{-1}, \tag{285}$$

which allows us to write:

$$(\mathbf{B}_{\mathbf{P}}\mathbf{B}_{\mathbf{\Psi}}'\mathbf{V} - \mathbf{A}_{\mathbf{P}})'(\mathbf{B}_{\mathbf{P}}\mathbf{B}_{\mathbf{P}}')^{-1}\dot{\boldsymbol{\xi}}_0\mathbf{M} \tag{286}$$

$$= \left(-(\mathbf{v}\mathbf{b}+v_3\mathbf{c})' + \frac{\tau_P^{1/2}}{\tau^c}\left((\alpha\bar{v}_1-v)\mathbf{b}+(\alpha\bar{v}_2-v_3)\mathbf{c}\right)'\mathbf{\Phi}\mathbf{\Phi}'\mathbf{\Sigma}_{\mathbf{P}}^{-1} - \mathbf{A}_{\mathbf{P}}\mathbf{\Sigma}_{\mathbf{P}}^{-1}\right)\dot{\boldsymbol{\xi}}_0\mathbf{M}$$

$$= -(\mathbf{v}\mathbf{b}+v_3\mathbf{c})'\dot{\boldsymbol{\xi}}_0\mathbf{M} - \frac{\tau_P^{1/2}}{\tau^c}(\Pi_1+\Pi_2)\left((\alpha\bar{v}_1-v)\mathbf{b}+(\alpha\bar{v}_2-v_3)\mathbf{c}\right)'\mathbf{\Phi}\mathbf{\Phi}'\boldsymbol{\xi}_0\mathbf{M} \tag{287}$$

$$+ (\mathbf{b}'(((\Pi_1+\Pi_2)^2-\Pi_2^2)\mathbf{\Phi}\mathbf{\Phi}' + \Pi_2^2\,\mathbf{I}) + \Pi_3(\Pi_1+\Pi_2)\mathbf{c}')\boldsymbol{\xi}_0\mathbf{M}.$$

where the last equality uses Conjecture 1, part A and B. Substituting these expressions back into Eq. (29) and simplifying gives:

$$(\dot{\mathbf{u}}\mathbf{a} + u_3'\mathbf{c})'\boldsymbol{\xi}_0\mathbf{M} = \tau_v\tau^{-2}\bar{u}(\bar{v}_1\mathbf{b}+\bar{v}_2\mathbf{c})'\mathbf{\Phi}\mathbf{\Phi}'\boldsymbol{\xi}_0\mathbf{M} - ((\mathbf{v}+\mathbf{u})\mathbf{b}+(v_3+u_3)\mathbf{c})'\dot{\boldsymbol{\xi}}_0\mathbf{M} \tag{288}$$

$$+ \left((u-u_3)\left(\ell^{-1}\frac{\mathrm{d}}{\mathrm{d}t}\ell - \frac{\tau_P}{\tau^c}\right)\mathbf{c} + \frac{\tau_P^{1/2}}{\tau^c}(\alpha\bar{u}-u)\mathbf{\Phi}\mathbf{\Phi}'((\Pi_1+\Pi_2)\mathbf{b}+\Pi_3\mathbf{c})\right)'\boldsymbol{\xi}_0\mathbf{M}$$

$$- \frac{\tau_P^{1/2}}{\tau^c}(\Pi_1+\Pi_2)\left((\alpha\bar{v}_1-v)\mathbf{b}+(\alpha\bar{v}_2-v_3)\mathbf{c}\right)'\mathbf{\Phi}\mathbf{\Phi}'\boldsymbol{\xi}_0\mathbf{M}$$

$$+ (\mathbf{b}'(((\Pi_1+\Pi_2)^2-\Pi_2^2)\mathbf{\Phi}\mathbf{\Phi}' + \Pi_2^2\,\mathbf{I}) + \Pi_3(\Pi_1+\Pi_2)\mathbf{c}')\boldsymbol{\xi}_0\mathbf{M}.$$

We can now verify that the solution is as in Eq. (63) in between announcements. Suppose this is true and separate terms in $\mathbf{b}'\mathbf{\Phi}\mathbf{\Phi}'\boldsymbol{\xi}_0\mathbf{M}$, $\mathbf{b}'\boldsymbol{\xi}_0\mathbf{M}$ and $\mathbf{c}'\boldsymbol{\xi}_0\mathbf{M}$ in the above, which produces the following system of three ODEs:

$$u_1' = \frac{\tau_P^{1/2}}{\tau^c}(\Pi_1 + \Pi_2)(\alpha\bar{u} - u - (\alpha\bar{v}_1 - v)) + \frac{\tau_v}{\tau^2}\bar{u}\bar{v}_1 + (\Pi_1 + \Pi_2)^2 - \Pi_2^2 \tag{289}$$

$$u_2' = \Pi_2^2 + \Pi_2(v_2 + u_2) \tag{290}$$

$$\begin{aligned} u_3' = (u - u_3)\left(\ell^{-1}\frac{\mathrm{d}}{\mathrm{d}t}\ell - \frac{\tau_P}{\tau^c}\right) + \frac{\tau_P^{1/2}}{\tau^c}((\alpha\bar{u} - u)\Pi_3 - (\alpha\bar{v}_2 - v_3)(\Pi_1 + \Pi_2)) \\ + \frac{\tau_v}{\tau^2}\bar{u}\bar{v}_2 + \Pi_3(\Pi_1 + \Pi_2), \end{aligned} \tag{291}$$

with terminal conditions given by:

$$u_{1,T-} = -\frac{\tau_\epsilon^2}{\tau_\epsilon + \tau_{T-}} \equiv -v_{1,T-} \tag{292}$$

$$u_{2,T-} = -\tau_\epsilon \equiv -v_{2,T-} \tag{293}$$

$$u_{3,T-} = -\frac{\tau_\epsilon\tau_{T-}}{\tau_\epsilon + \tau_{T-}} \equiv -v_{3,T-}. \tag{294}$$

We can readily verify that the identification in Eq. (63) holds at the horizon date, and substituting Eq. (63) into Eq. (289) shows that this system is identical to that in Eqs. (225)–(227), which indeed verifies Eq. (63) holds in between announcements. We now verify that it holds at the announcement. Start by rewriting Eq. (31) as:

$$\begin{aligned} \mathbf{U}_{t-} = (\mathbf{I} + \mathbf{a}_{\mathbf{\Psi}})\mathbf{U}_t + (\mathbf{I} + \mathbf{a}_{\mathbf{\Psi}})\mathbf{V}_t\mathbf{b}_{\mathbf{\Psi}}\mathbf{Q}\mathbf{b}_{\mathbf{\Psi}}'\mathbf{U}_t + \mathbf{a}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{\Psi}}')^{-1}(\boldsymbol{\xi}_{0,t} - \boldsymbol{\xi}_{0,t-})\mathbf{M} \\ - \mathbf{a}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{\Psi}}'\mathbf{U}_t - (\mathbf{I} + \mathbf{a}_{\mathbf{\Psi}})\mathbf{V}_t\mathbf{b}_{\mathbf{\Psi}}\mathbf{S}\mathbf{b}_{\mathbf{P}}'(\boldsymbol{\xi}_{0,t} - \boldsymbol{\xi}_{0,t-})\mathbf{M}. \end{aligned} \tag{295}$$

Next we substitute the unconditional premium in Eq. (48) and $\mathbf{U}$ in Eq. (49) (step 3), and after separating terms we obtain:

$$\begin{aligned} \mathbf{b}_{t-}'\mathbf{u}_{t-} + u_{3,t-}\mathbf{c}_{t-}' = {} & (\mathbf{I} + \mathbf{a}_{\mathbf{\Psi}})(\mathbf{b}_t'\mathbf{u}_t + u_{3,t}\mathbf{c}_t')(\mathbf{I} - \mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b) - \mathbf{a}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b \\ & + (\mathbf{I} + \mathbf{a}_{\mathbf{\Psi}})\mathbf{V}_t\mathbf{b}_{\mathbf{\Psi}}\mathbf{Q}\mathbf{b}_{\mathbf{\Psi}}'(\mathbf{b}_t'\mathbf{u}_t + u_{3,t}\mathbf{c}_t')(\mathbf{I} - \mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b) \\ & - \mathbf{a}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{\Psi}}'(\mathbf{b}_t'\mathbf{u}_t + u_{3,t}\mathbf{c}_t')(\mathbf{I} - \mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b) \\ & + (\mathbf{I} + \mathbf{a}_{\mathbf{\Psi}})\mathbf{V}_t\mathbf{b}_{\mathbf{\Psi}}\mathbf{S}\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b. \end{aligned} \tag{296}$$

Next we use the two observations in Eqs. (197) and (206) (step 1-2) to write:

$$
\begin{aligned}
(\mathbf{I}+\mathbf{a}_{\boldsymbol{\Psi}})(\mathbf{b}_t'\mathbf{u}_t+u_{3,t}\mathbf{c}_t') &= \mathbf{b}_{t-}'(\mathbf{I}-\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b)'\mathbf{u}_t+\mathbf{c}_{t-}'(\boldsymbol{\pi}_c'\mathbf{u}_t+\widetilde{u}_1) && (297)\\
\mathbf{b}_{\boldsymbol{\Psi}}'(\mathbf{b}_t'\mathbf{u}_t+u_{3,t}\mathbf{c}_t') &= -\mathbf{b}_{\mathbf{P}}'\mathbf{u}_t+\frac{u_t-\alpha_t\bar{u}_t}{1-\alpha_t}\mathbf{x}' && (298)\\
(\mathbf{I}+\mathbf{a}_{\boldsymbol{\Psi}})\mathbf{V}_t\mathbf{b}_{\boldsymbol{\Psi}} &= \mathbf{b}_{t-}'(\mathbf{I}+\boldsymbol{\pi}_b'\mathbf{b}_{\mathbf{P}}')\left(\frac{v-\alpha_t\bar{v}_1}{1-\alpha_t}\mathbf{x}-\mathbf{v}\mathbf{b}_{\mathbf{P}}\right) && (299)\\
&\quad+\mathbf{c}_{t-}'\left(\left(\frac{\widetilde{v}_1-\alpha_t\widetilde{v}}{1-\alpha_t}-\frac{v_1-\alpha_t\bar{v}_1}{1-\alpha_t}\boldsymbol{\pi}_c'\mathbf{b}_{\mathbf{P}}'\right)\mathbf{x}+(\boldsymbol{\pi}_c'\mathbf{b}_{\mathbf{P}}'\mathbf{v}-\widetilde{v}_1)\mathbf{b}_{\mathbf{P}}\right),
\end{aligned}
$$

where the first and last lines also use Eq. (42). Substituting back and separating terms in **b** and **c** we get two boundary conditions for **u** and u_3:

$$
\begin{aligned}
\mathbf{u}_{t-} &= (\mathbf{I}-\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b)'\mathbf{u}_t(\mathbf{I}-\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b)-\boldsymbol{\pi}_b'\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b && (300)\\
&\quad-\boldsymbol{\pi}_b'\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\mathbf{S}\left(\frac{u-\alpha_t\bar{u}}{1-\alpha_t}\mathbf{x}'-\mathbf{b}_{\mathbf{P}}'\mathbf{u}_t\right)(\mathbf{I}-\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b)\\
&\quad+(\mathbf{I}-\boldsymbol{\pi}_b'\mathbf{b}_{\mathbf{P}}')\left(\frac{v-\alpha_t\bar{v}_1}{1-\alpha_t}\left(\mathbf{x}\mathbf{S}\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b+\frac{u-\alpha_t\bar{u}}{1-\alpha_t}\mathbf{x}\mathbf{Q}\mathbf{x}'(\mathbf{I}-\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b)\right)\right)\\
u_{3,t-} &= \boldsymbol{\Phi}'(\mathbf{u}_t\boldsymbol{\pi}_c'+\widetilde{u}_1)(\mathbf{I}-\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b)-\boldsymbol{\Phi}'\boldsymbol{\pi}_c'\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b\boldsymbol{\Phi} && (301)\\
&\quad-\boldsymbol{\Phi}\boldsymbol{\pi}_c'\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\mathbf{S}\left(\frac{u-\alpha_t\bar{u}}{1-\alpha_t}\mathbf{x}'-\mathbf{b}_{\mathbf{P}}'\mathbf{u}_t\right)(\mathbf{I}-\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b)\boldsymbol{\Phi}+\boldsymbol{\Phi}'(\boldsymbol{\pi}_c'\mathbf{b}_{\mathbf{P}}'\mathbf{v}_t-\widetilde{v}_1)\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b\boldsymbol{\Phi}\\
&\quad+\boldsymbol{\Phi}'\left(\frac{\widetilde{v}_1-\alpha_t\widetilde{v}}{1-\alpha_t}-\frac{v-\alpha_t\bar{v}_1}{1-\alpha_t}\boldsymbol{\pi}_c'\mathbf{b}_{\mathbf{P}}'\right)\left(\mathbf{x}\mathbf{S}\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b+\frac{u-\alpha_t\bar{u}}{1-\alpha_t}\mathbf{x}\mathbf{Q}\mathbf{x}'(\mathbf{I}-\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b)\right)\boldsymbol{\Phi}.
\end{aligned}
$$

By isolating the terms in **I** in the first equation and by pre- and post-multiplying this equation by $\boldsymbol{\Phi}'$ and $\boldsymbol{\Phi}$, respectively, and using the notation introduced above these equations can be further rearranged as:

$$
\begin{aligned}
u_{t-} &= u_t-\boldsymbol{\Phi}'\boldsymbol{\pi}_b'\mathbf{b}_{\mathbf{P}}'((\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}+\mathbf{u}_t)\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b\boldsymbol{\Phi}+\frac{v-\alpha_t\bar{v}_1}{1-\alpha_t}\frac{u-\alpha_t\bar{u}}{1-\alpha_t}(1-\pi_b)^2\bar{\mathbf{x}}\mathbf{Q}\bar{\mathbf{x}}' && (302)\\
&\quad+(1-\pi_b)\left(\frac{v-\alpha_t\bar{v}_1}{1-\alpha_t}-\frac{u-\alpha_t\bar{u}}{1-\alpha_t}\right)\bar{\mathbf{x}}\mathbf{S}\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b\boldsymbol{\Phi}-\boldsymbol{\Phi}'\boldsymbol{\pi}_b'\mathbf{b}_{\mathbf{P}}'(\mathbf{v}+\mathbf{u})(\mathbf{I}-\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b)\boldsymbol{\Phi}\\
u_{2,t-} &= u_{2,t}-\tau_M/\xi_{2,t}^2\pi_2^2-\pi_2(u_{2,t}+v_{2,t}) && (303)\\
u_{3,t-} &= \widetilde{u}_1-\boldsymbol{\Phi}'\boldsymbol{\pi}_b'\mathbf{b}_{\mathbf{P}}'((\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}+\mathbf{u}_t)\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_c\boldsymbol{\Phi}-(1-\pi_b)\frac{u-\alpha_t\bar{u}}{1-\alpha_t}\boldsymbol{\Phi}'\boldsymbol{\pi}_c'\mathbf{b}_{\mathbf{P}}'(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\mathbf{S}\bar{\mathbf{x}}' && (304)\\
&\quad+\left(\frac{\widetilde{v}_1-\alpha_t\widetilde{v}}{1-\alpha_t}-\pi_c\frac{v-\alpha_t\bar{v}_1}{1-\alpha_t}\right)\left((1-\pi_b)\frac{u-\alpha_t\bar{u}}{1-\alpha_t}\bar{\mathbf{x}}\mathbf{Q}\bar{\mathbf{x}}'+\bar{\mathbf{x}}\mathbf{S}\mathbf{b}_{\mathbf{P}}(\mathbf{b}_{\mathbf{P}}\mathbf{S}\mathbf{b}_{\mathbf{P}}')^{-1}\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_b\boldsymbol{\Phi}\right)\\
&\quad-(\widetilde{v}_1+\widetilde{u}_1)\pi_b+\boldsymbol{\Phi}'\boldsymbol{\pi}_b'(\mathbf{u}_t+\mathbf{v}_t)\mathbf{b}_{\mathbf{P}}\boldsymbol{\pi}_c\boldsymbol{\Phi}.
\end{aligned}
$$

Clearly, if Eq. (63) holds then the first two equations are identical to Eqs. (58) and (61), respectively. Furthermore, using the identities under step 2 Eq. (242) can be reexpressed as:

$$v_{3,t-} = \widetilde{v}_1 + \mathbf{\Phi}'\boldsymbol{\pi}_b'\mathbf{b}_\mathbf{P}'((\mathbf{b}_\mathbf{P}\mathbf{S}\mathbf{b}_\mathbf{P}')^{-1} - v)\mathbf{b}_\mathbf{P}\boldsymbol{\pi}_c\mathbf{\Phi} - \frac{v - \alpha_t\bar{v}_1}{1-\alpha_t}(1-\pi_b)\bar{\mathbf{x}}\mathbf{S}\mathbf{b}_\mathbf{P}'(\mathbf{b}_\mathbf{P}\mathbf{S}\mathbf{b}_\mathbf{P}')^{-1}\mathbf{b}_\mathbf{P}\boldsymbol{\pi}_c\mathbf{\Phi}$$
$$+ \left(\frac{\widetilde{v}_1 - \alpha_t\widetilde{v}}{1-\alpha_t} - \frac{v-\alpha_t\bar{v}_1}{1-\alpha_t}\pi_c\right)\left(\frac{v-\alpha_t\bar{v}_1}{1-\alpha_t}(1-\pi_b)\bar{\mathbf{x}}\mathbf{Q}\bar{\mathbf{x}}' - \bar{\mathbf{x}}\mathbf{S}\mathbf{b}_\mathbf{P}'(\mathbf{b}_\mathbf{P}\mathbf{S}\mathbf{b}_\mathbf{P}')^{-1}\mathbf{b}_\mathbf{P}\boldsymbol{\pi}_b\mathbf{\Phi}\right). \quad (305)$$

If Eq. (63) holds the third equation is identical to this equation and the claim holds.

Finally, regarding the portfolio formulation in Eq. (64) in the main text, substituting the conjecture in Eq. (28) in Eq. (176) implies that investor i's optimal portfolio on the post-announcement subperiod take the form:

$$\mathbf{w}^i = \frac{1}{\gamma}(\mathbf{B}_\mathbf{P}\mathbf{B}_\mathbf{P}')^{-1}\left(\dot{\boldsymbol{\xi}}_0\mathbf{M} - \mathbf{B}_\mathbf{P}\mathbf{B}_\mathbf{\Psi}'\mathbf{U} + (\mathbf{A}_\mathbf{P} - \mathbf{B}_\mathbf{P}\mathbf{B}_\mathbf{\Psi}'\mathbf{V})\mathbf{\Psi}^i\right) \quad (306)$$
$$= \underbrace{\frac{1}{\gamma}\mathbf{\Sigma}_\mathbf{P}^{-1}\left(\Pi_1\mathbf{\Phi}\mathbf{\Phi}' + \Pi_2\,\mathbf{I} + \mathbf{\Sigma}_\mathbf{P}\mathbf{v} - \frac{\tau_P^{1/2}}{\tau^c}(\alpha\bar{v}_1 - v)\mathbf{\Phi}\mathbf{\Phi}'\right)(\mathbf{b}\mathbf{\Psi}^i - \boldsymbol{\xi}_0\mathbf{M})}_{\text{traditional demand in a REE absent residual uncertainty}} \quad (307)$$
$$+ \underbrace{\frac{1}{\gamma}\mathbf{\Sigma}_\mathbf{P}^{-1}\left(\Pi_3\mathbf{\Phi}\mathbf{\Phi}' + v_3\mathbf{\Sigma}_\mathbf{P} - \frac{\tau_P^{1/2}}{\tau^c}(\alpha\bar{v}_2 - v_3)\mathbf{\Phi}\mathbf{\Phi}'\right)\mathbf{c}\mathbf{\Psi}^i}_{\text{speculation on the wedge } \ell}.$$

We obtain Eq. (64) by substituting the conjectured form for $\mathbf{U}$ and $\mathbf{V}$ in Eq. (49) and the identity in Eq. (63) in the first equality; the second equality further substitutes Eq. (284) and the conditional and unconditional risk premia of Conjecture 1, and regroups terms as follows: the first line corresponds to the traditional portfolio structure in a NRE absent residual uncertainty in final payoffs; the second term arises when $\ell \neq 0$ and is the part of the demand through which investors speculate on this wedge.

A.4 Proof of Proposition 4

In this appendix we aggregate individual portfolios and clear the market, which produces fixed-point equations for the price coefficients. The procedure is in four steps:

1. Derive the dynamics of state variables at the population level and aggregate to obtain equilibrium conditions.

2. Show that $\boldsymbol{\xi}$ and $\boldsymbol{\xi}_0$ take the form in Eq. (67) and obtain ODEs for the equilibrium coefficients ℓ and ξ, and algebraic equations for the equilibrium speed of information revelation, $\tau_P^{1/2}$ and τ_G.

3. Verify Conjecture 1, which in turn gives expressions for the unknown market prices of risk, Π. and $\boldsymbol{\pi}$..

4. Substitute these coefficients and simplify to obtain the equations in the proposition.

We start with the dynamics of state variables at the population level. Specifically, an application of Ito's lemma gives:

$$\mathrm{d}\tau_t^c \widehat{F}_t^c = \tau_{P,t}\widehat{F}_t^i \mathrm{d}t - \tau_{P,t}^{1/2}\boldsymbol{\Phi}^\top \mathrm{d}\widehat{\mathbf{B}}_{m,t}^i + (\tau_t \boldsymbol{\Phi}'\mathbf{x}_t'\widetilde{\mathbf{y}}_t^i + (\tau_A + \tau_{G,t})\widehat{F}_{t-}^i)\,\mathbf{1}_{t=\tau}, \tag{308}$$

where the matrix $\mathbf{x}$ is defined in Eq. (205) below. Similarly, we have:

$$\mathrm{d}\tau_t \widehat{F}_t^i = (\tau_{P,t} + \tau_v)\widehat{F}_t^i \mathrm{d}t - \tau_{P,t}^{1/2}\boldsymbol{\Phi}^\top \mathrm{d}\widehat{\mathbf{B}}_{m,t}^i + \tau_v^{1/2}\mathrm{d}\widehat{B}_t^i + (\underbrace{\tau_t \Delta \widehat{F}_t^i + \Delta\tau_t \widehat{F}_{t-}^i}_{\equiv \tau_t \boldsymbol{\Phi}'\mathbf{x}_t'\widetilde{\mathbf{y}}_t^i + (\tau_A + \tau_{G,t})\widehat{F}_{t-}^i})\,\mathbf{1}_{t=\tau}\,. \tag{309}$$

Subtracting one from the other we obtain:

$$\mathrm{d}\tau_t \widehat{F}_t^i - \mathrm{d}\tau_t^c \widehat{F}_t^c = \tau_v \widehat{F}_t^i \mathrm{d}t + \tau_v^{1/2}\mathrm{d}\widehat{B}_t^i. \tag{310}$$

That is, the difference between an investor's and the econometrician's views scaled by their respective precision does not jump upon announcements. From the innovation process we further have:

$$\mathrm{d}\widehat{B}_t^i = \tau_v^{1/2}(\mathrm{d}\widetilde{V}_t^i - \widehat{F}_t^i \mathrm{d}t), \tag{311}$$

which, after substituting in the previous equation, gives:

$$\mathrm{d}\tau_t \widehat{F}_t^i - \mathrm{d}\tau_t^c \widehat{F}_t^c = \tau_v \mathrm{d}\widetilde{V}_t^i = \tau_v \widetilde{F}\mathrm{d}t + \tau_v^{1/2}\mathrm{d}B_t^i. \tag{312}$$

Integrating, taking into account the initial signals in Eq. (15), yields:

$$\tau_t \widehat{F}_t^i = \tau_t^c \widehat{F}_t^c + (\tau_V + \tau_v t)\widetilde{F} + \tau_v^{1/2}(\widetilde{\epsilon}^i + B_{v,t}^i). \tag{313}$$

Denoting average market expectations at time t by $\widehat{F}_t = \int_0^1 \widehat{F}_t^i \mathrm{d}i$ and using the law of large numbers (Duffie and Sun, 2007) whereby:

$$\int_0^1 B_t^i \mathrm{d}i = \int_0^1 \widetilde{\epsilon}^i \mathrm{d}i = 0, \tag{314}$$

we can write average market expectations of the common factor as a linear combination of its true value, $\widetilde{F}$, and econometrician's expectations, $\widehat{F}^c$:

$$\widehat{F}_t = \frac{\tau_t^c}{\tau_t}\widehat{F}_t^c + \underbrace{\frac{\tau_t - \tau_t^c}{\tau_t}}_{\equiv \alpha_t}\widetilde{F}. \tag{315}$$

It follows that the average informational advantage relative to the econometrician is:

$$\int_0^1 \Delta_t^i \mathrm{d}i = \alpha_t(\widetilde{F} - \widehat{F}_t^c) \equiv \alpha_t \Delta_t, \tag{316}$$

and, by observational equivalence, that:

$$\int_0^1 \widehat{\mathbf{m}}_t^i \mathrm{d}i = \widetilde{\mathbf{m}}_t + (1-\alpha_t)\lambda_t \boldsymbol{\xi}_t^{-1}\mathbf{\Phi}\Delta_t. \tag{317}$$

Concatenating these two expressions finally delivers the desired aggregation result:

$$\int_0^1 \mathbf{\Psi}_t^i \mathrm{d}i = \underbrace{\begin{pmatrix} \alpha_t & \mathbf{0} \\ (1-\alpha_t)\lambda_t \boldsymbol{\xi}_t^{-1}\mathbf{\Phi} & \mathbf{I} \end{pmatrix}}_{\equiv \mathbf{\Gamma}_t} \mathbf{\Psi}_t. \tag{318}$$

Note that this aggregation result holds at any date, including announcement dates. We now use this aggregation result to clear the market and obtain equilibrium equations at each date. We start with the equilibrium equations that hold in between announcements. Substituting optimal demands in Eq. (64) in the market-clearing equation and separating variables yields the following fixed-point equations in between announcements:

$$\left(\dot{\boldsymbol{\xi}}_0 - \mathbf{B_P}\mathbf{B}_{\mathbf{\Psi}}'(\mathbf{ub} + u_3\mathbf{c})'\boldsymbol{\xi}_0\right)\mathbf{M} = \gamma \mathbf{B_P}\mathbf{B}_{\mathbf{P}}'\mathbf{M}, \tag{319}$$

$$(\mathbf{A_P} - \mathbf{B_P}\mathbf{B}_{\mathbf{\Psi}}'(\mathbf{b}'\mathbf{vb} + v_3(\mathbf{b}'\mathbf{c} + \mathbf{c}'\mathbf{b}) + v_4\mathbf{c}'\mathbf{c}))\mathbf{\Gamma} = \gamma \mathbf{B_P}\mathbf{B}_{\mathbf{P}}'\,\mathbf{1}^\star. \tag{320}$$

We now repeat this operation immediately prior to the announcement date, τ. For simplicity we let t be the announcement date and $t-$ the time right before the announcement is made. Substituting the conjectured forms in Eq. (49) in an investor i's optimal portfolio immediately prior to the announcement date, which we obtained in Eq. (184), gives:

$$\begin{aligned}\mathbf{w}_{t-}^i = &\frac{1}{\gamma}(\mathbf{b_P}\mathbf{S}_t\mathbf{b}_{\mathbf{P}}')^{-1}\left(\boldsymbol{\xi}_{0,t} - \boldsymbol{\xi}_{0,t-} - \mathbf{b_P}\mathbf{S}_t\mathbf{b}_{\mathbf{\Psi}}'(\mathbf{b}_t'\mathbf{u}_t + u_{3,t}\mathbf{c}')\boldsymbol{\xi}_{0,t}\right)\mathbf{M} \\ &+ \frac{1}{\gamma}(\mathbf{b_P}\mathbf{S}_t\mathbf{b}_{\mathbf{P}}')^{-1}\left(\mathbf{a_P} - \mathbf{b_P}\mathbf{S}_t\mathbf{b}_{\mathbf{\Psi}}'((\mathbf{v}_t\mathbf{b}_t + v_{3,t}\mathbf{c}_t)'\mathbf{b}_t + (v_{3,t}\mathbf{b}_t + v_{4,t}\mathbf{c}_t)'\mathbf{c}_t)(\mathbf{I} + \mathbf{a}_{\mathbf{\Psi}})\right)\mathbf{\Psi}_{t-}.\end{aligned} \tag{321}$$

Imposing the market-clearing condition:

$$\int_0^1 \mathbf{w}^i_{t_k-}\mathrm{d}i = \mathbf{M} + \widetilde{\mathbf{m}}_{t_k-}, \tag{322}$$

and separating variables yields the following fixed-point equations:

$$(\boldsymbol{\xi}_{0,t} - \boldsymbol{\xi}_{0,t-} - \mathbf{b_P}\mathbf{S}_t\mathbf{b}'_{\boldsymbol{\Psi}}(\mathbf{b}'_t\mathbf{u}_t + u_{3,t}\mathbf{c}'_t)\boldsymbol{\xi}_{0,t})\mathbf{M} = \gamma\mathbf{b_P}\mathbf{S}_t\mathbf{b}'_{\mathbf{P}}\mathbf{M}, \tag{323}$$

$$(\mathbf{a_P} - \mathbf{b_P}\mathbf{S}_t\mathbf{b}'_{\boldsymbol{\Psi}}((\mathbf{v}_t\mathbf{b}_t + v_{3,t}\mathbf{c}_t)'\mathbf{b}_t + (v_{3,t}\mathbf{b}_t + v_{4,t}\mathbf{c}_t)'\mathbf{c}_t)(\mathbf{I} + \mathbf{a}_{\boldsymbol{\Psi}}))\boldsymbol{\Gamma}_{t-} = \gamma\mathbf{b_P}\mathbf{S}_t\mathbf{b}'_{\mathbf{P}}\mathbf{1}^\star. \tag{324}$$

Finally, we obtain terminal conditions for the post-announcement subperiod by aggregating portfolios at the terminal date (those in Eq. (192)) and imposing market clearing:

$$\int_0^1 \mathbf{w}^i_{T-}\mathrm{d}i = \frac{1}{\gamma}(\tau_{T-}^{-1}\boldsymbol{\Phi}\boldsymbol{\Phi}' + \tau_\epsilon^{-1}\,\mathbf{I})^{-1}(-\boldsymbol{\xi}_{0,T-}\mathbf{M} + \mathbf{a}_{T-}\boldsymbol{\Gamma}_{T-}\boldsymbol{\Psi}_{T-}) \tag{325}$$

$$= \mathbf{M} + \widetilde{\mathbf{m}}_T. \tag{326}$$

Separating variables produces the desired terminal conditions:

$$\boldsymbol{\xi}_{0,T-} = \boldsymbol{\xi}_{T-} = -\gamma(\tau_{T-}^{-1}\boldsymbol{\Phi}\boldsymbol{\Phi}' + \tau_\epsilon^{-1}\,\mathbf{I}), \tag{327}$$

$$\equiv -\gamma\mathbf{v}_{T-}^{-1} \tag{328}$$

$$\lambda_{T-} = \alpha_{T-}, \tag{329}$$

where Eq. (329) shows that the wedge $\ell_{T-} = 0$ vanishes at the horizon date, as reported in Eqs. (76)–(77).

In step 2 we now obtain an equation for ℓ and verify that the solution for $\boldsymbol{\xi}_0$ and $\boldsymbol{\xi}$ has the form in Eq. (67), which gives two ODEs for ξ and ξ_2. We then combine these equations to obtain algebraic equations for $\tau_P^{1/2}$ and $\tau_G^{1/2}$. We start by separating the first column in Eq. (320) from the other N columns, which gives the following system of equations:

$$0 = (\mathbf{A_P} - \mathbf{B_P}\mathbf{B}'_{\boldsymbol{\Psi}}\mathbf{V})(\mathbf{1}^{\star\prime}\,\lambda\boldsymbol{\xi}^{-1}\boldsymbol{\Phi} + \alpha\boldsymbol{\omega}) \tag{330}$$

$$\dot{\boldsymbol{\xi}} = \mathbf{B_P}(\mathbf{B}'_{\boldsymbol{\Psi}}\mathbf{V}\,\mathbf{1}^{\star\prime} + \gamma\mathbf{B}'_{\mathbf{P}}). \tag{331}$$

The first equation determines λ (equivalently, ℓ) and the second equation determines $\boldsymbol{\xi}$. From the second equation we can verify Eq. (67) holds in between announcements. Using Eqs.

(200) and (203) we rewrite this equation as:

$$\dot{\boldsymbol{\xi}} = \boldsymbol{\Sigma}_{\mathbf{P}} \left(\boldsymbol{\Sigma}_{\mathbf{P}} (\mathbf{v}\boldsymbol{\xi} + \gamma) + \tau_P^{1/2} \frac{v - \alpha \bar{v}_1}{\tau^c} \boldsymbol{\Phi}\boldsymbol{\Phi}' \boldsymbol{\xi} \right). \tag{332}$$

Now substitute Eq. (67) and isolate terms in $\mathbf{I}$, which gives an ODE for ξ_2

$$\xi_2' = \tau_m^{-1} \xi_2^2 (v_2 \xi_2 + \gamma), \tag{333}$$

and proceeding similarly with Eq. (327) we obtain a boundary condition for it:

$$\xi_{2,T-} = -\gamma / \tau_\epsilon \equiv -\gamma / v_{2,T-}. \tag{334}$$

The remaining terms are proprotional to $\boldsymbol{\Phi}\boldsymbol{\Phi}'$. In particular, pre- and post-multiplying Eq. (332) by $\boldsymbol{\Phi}'$ and $\boldsymbol{\Phi}$, respectively, gives and ODE for ξ:

$$\xi' = \Sigma_{\mathbf{P}} \left(\Sigma_{\mathbf{P}} (v\xi + \gamma) + \tau_P^{1/2} \frac{v - \alpha \bar{v}_1}{\tau^c} \xi \right) \tag{335}$$

$$= \Sigma_{\mathbf{P}} \left(\left(\tau_m^{-1/2} \xi v - \alpha \ell \frac{\tau_P^{1/2}}{\tau^c} v_3 \right) \xi + \gamma \Sigma_{\mathbf{P}} \right), \tag{336}$$

where the second equality uses the definition of $\Sigma_{\mathbf{P}}$ in Eq. (71). Repeating this operation on the boundary condition in Eq. (327) we get Eq. (76). We further show that $\boldsymbol{\xi} \equiv \boldsymbol{\xi}_0$. Start from the equilibrium condition in Eq. (319), which can be rewritten as:

$$\dot{\boldsymbol{\xi}}_0 = \mathbf{B}_{\mathbf{P}} \mathbf{B}_{\boldsymbol{\Psi}}' (\mathbf{u}\mathbf{b} + u_3 \mathbf{c})' \boldsymbol{\xi}_0 + \gamma \mathbf{B}_{\mathbf{P}} \mathbf{B}_{\mathbf{P}}' \tag{337}$$

$$= \boldsymbol{\Sigma}_{\mathbf{P}} \left(\boldsymbol{\Sigma}_{\mathbf{P}} (-\mathbf{u}\boldsymbol{\xi}_0 + \gamma) - \tau_P^{1/2} \frac{u - \alpha \bar{u}}{\tau^c} \boldsymbol{\xi}_0 \right). \tag{338}$$

Since we have shown in Eq. (63) that $\mathbf{u} \equiv -\mathbf{v}$ and $u_3 = -v_3$, if $\boldsymbol{\xi}_0 \equiv \boldsymbol{\xi}$ this equation is identical to Eq. (332) and given the terminal condition in Eq. (327) this proves the claim, and thus proves the conjecture in Eq. (67) holds in between announcements. We now turn to Eq. (330), which represents an equation for λ. Note, however, that it is in fact more convenient to turn it into an algebraic equation for $\tau_P^{1/2}$ and instead use the definition of $\tau_P^{1/2}$ as an equation for λ. We first write:

$$(\mathbf{A}_{\mathbf{P}} - \mathbf{B}_{\mathbf{P}} \mathbf{B}_{\boldsymbol{\Psi}}' \mathbf{V}) \, \mathbf{1}^{\star'} = \dot{\boldsymbol{\xi}} - \mathbf{B}_{\mathbf{P}} \mathbf{B}_{\boldsymbol{\Psi}}' \mathbf{V} \, \mathbf{1}^{\star'} \tag{339}$$

$$= \gamma \boldsymbol{\Sigma}_{\mathbf{P}} \boldsymbol{\Sigma}_{\mathbf{P}}, \tag{340}$$

where the second line follows from Eq. (331), which we plug back into Eq. (330):

$$\gamma\lambda\mathbf{\Sigma_P}\mathbf{\Sigma_P}\boldsymbol{\xi}^{-1}\mathbf{\Phi} + \alpha(\mathbf{A_P} - \mathbf{B_P}\mathbf{B}'_{\mathbf{\Psi}}\mathbf{V})\boldsymbol{\omega} = 0. \tag{341}$$

Post-multiplying the definition of $\mathbf{A_P}$ in Eq. (155) by $\boldsymbol{\omega}$ gives:

$$\mathbf{A_P}\boldsymbol{\omega} = -\tau_{P,t}^{1/2}\mathbf{\Sigma_P}\mathbf{\Phi}, \tag{342}$$

which is a central result that underlies many properties of this kind of settings (e.g., Eq. (43)). Substituting back we obtain:

$$\gamma\lambda\mathbf{\Sigma_P}\mathbf{\Sigma_P}\boldsymbol{\xi}^{-1}\mathbf{\Phi} - \alpha(\tau_{P,t}^{1/2}\mathbf{\Sigma_P}\mathbf{\Phi} + \mathbf{B_P}\mathbf{B}'_{\mathbf{\Psi}}\mathbf{V}\boldsymbol{\omega}) = 0. \tag{343}$$

Using Eqs. (200) and (203) we can write:

$$\mathbf{B_P}\mathbf{B}'_{\mathbf{\Psi}}\mathbf{V}\boldsymbol{\omega} = \mathbf{B_P}\mathbf{B}'_{\mathbf{\Psi}}(\bar{v}_1\mathbf{b}' + \bar{v}_2\mathbf{c}')\mathbf{\Phi} \tag{344}$$

$$= -\bar{v}_1\mathbf{\Sigma_P}\mathbf{\Sigma_P}\mathbf{\Phi} + \tau_{P,t}^{1/2}\frac{\alpha\bar{v} - \bar{v}_1}{\tau^c}\mathbf{\Sigma_P}\mathbf{\Phi}, \tag{345}$$

which we plug back into the previous equation and after pre-multiplying by $\mathbf{\Sigma_P}^{-1}$ and dividing by α we get:

$$\gamma(1-\ell)\mathbf{\Sigma_P}\boldsymbol{\xi}^{-1}\mathbf{\Phi} + \bar{v}_1\mathbf{\Sigma_P}\mathbf{\Phi} - \tau_{P,t}^{1/2}\left(1 + \frac{\alpha\bar{v} - \bar{v}_1}{\tau^c}\right)\mathbf{\Phi} = 0. \tag{346}$$

After pre-multiplying this equation by $\mathbf{\Phi}'$ we obtain an algebraic equation for $\tau_P^{1/2}$, which is reported in Eq. (78). Finally, we obtain an ODE for λ by using the definition of $\tau_P^{1/2}$ in Eq. (45) and by plugging Eq. (332) into it and pre-multiplying by $\mathbf{\Phi}'$:

$$\frac{\mathrm{d}}{\mathrm{d}t}\lambda = -\tau_P^{1/2}\tau_m^{-1/2}\xi + \lambda\Sigma_{\mathbf{P}}\left(\Sigma_{\mathbf{P}}\frac{v\xi + \gamma}{\xi} + \tau_{P,t}^{1/2}\frac{v - \alpha_t\bar{v}_1}{\tau^c}\right), \tag{347}$$

which concludes the second step.

We have shown that the equilibrium computation now boils down to computing λ, ξ, ξ_2 and τ_P. However, the ODEs we obtained for them in Eqs. (347), (372), (333) and (78) are not explicit as they depend on the $v_.$ coefficients, which solve the ODEs in Eqs. (225)–(228), which themselves depend on the unknown coefficients, $\Pi_.$. Hence, in a third step, we must find these coefficients by verifying Conjecture 1, and more specifically part A. We start by proving Eq. (43), which can be done without knowledge of the $\Pi_.$ coefficients. Suppose that Eq. (41) in Conjecture 1 holds true and post-multiply it by $\boldsymbol{\omega}$ and use Eq. (221), which gives:

$$\mathbf{A_P}\boldsymbol{\omega} = ((1-\ell)(\Pi_1 + \Pi_2) + \ell\Pi_3)\boldsymbol{\Sigma}_\mathbf{P}\boldsymbol{\Phi}. \tag{348}$$

Comparing the result with Eq. (342) gives Eq. (43). Next, we prove that Eq. (41) in Conjecture 1 holds true. From Eq. (320) and observing that

$$\mathbf{1}^\star \boldsymbol{\Gamma}^{-1} = -\boldsymbol{\xi}^{-1}\mathbf{b}, \tag{349}$$

we know that:

$$\mathbf{A_P} = \mathbf{B_P}(\mathbf{B}'_{\boldsymbol{\Psi}}\mathbf{V} - \gamma\mathbf{B}'_\mathbf{P}\boldsymbol{\xi}^{-1}\mathbf{b}). \tag{350}$$

Using the relations in Eqs. (200) and (203), we can write:

$$\mathbf{B_P}\mathbf{B}'_{\boldsymbol{\Psi}}\mathbf{V} = \boldsymbol{\Sigma}_\mathbf{P}\left(\tau_P^{1/2}\boldsymbol{\Phi}\boldsymbol{\Phi}'\left(\frac{\alpha\bar{v}_1 - v}{\tau^c}\mathbf{b} + \frac{\alpha\bar{v}_2 - v_3}{\tau^c}\mathbf{c}\right) - \boldsymbol{\Sigma}_\mathbf{P}(\mathbf{v}\mathbf{b} + v_3\mathbf{c})\right), \tag{351}$$

which plugged back into the previous equation gives:

$$\mathbf{A_P} = \boldsymbol{\Sigma}_\mathbf{P}\left(\tau_P^{1/2}\boldsymbol{\Phi}\boldsymbol{\Phi}'\left(\frac{\alpha\bar{v}_1 - v}{\tau^c}\mathbf{b} + \frac{\alpha\bar{v}_2 - v_3}{\tau^c}\mathbf{c}\right) - \boldsymbol{\Sigma}_\mathbf{P}((\mathbf{v} + \gamma\boldsymbol{\xi}^{-1})\mathbf{b} + v_3\mathbf{c})\right). \tag{352}$$

This expression verifies the conjectured form in Eq. (41) with the identification:

$$\Pi_1 + \Pi_2 = \tau_P^{1/2}\frac{\alpha\bar{v}_1 - v}{\tau^c} - \Sigma_\mathbf{P}\frac{v\xi + \gamma}{\xi} \tag{353}$$

$$\Pi_2 = -\tau_m^{-1/2}(\xi_2 v_2 + \gamma) \tag{354}$$

$$\Pi_3 = \tau_P^{1/2}\frac{\alpha\bar{v}_2 - v_3}{\tau^c} - \Sigma_\mathbf{P} v_3, \tag{355}$$

where the first equation is reported in Eq. (70). To prove part B of Conjecture 1 we start from Eq. (319) and rewrite it as:

$$\dot{\boldsymbol{\xi}}_0\mathbf{M} = \mathbf{B_P}((-\mathbf{B_P} + (1-\ell)\mathbf{X}_1 - \ell\mathbf{X}_2)'\mathbf{u} + u_3\ell(\mathbf{X}_1 + \mathbf{X}_2) + \gamma\mathbf{B}'_\mathbf{P}\boldsymbol{\xi}_0^{-1})\boldsymbol{\xi}_0\mathbf{M} \tag{356}$$

$$= \boldsymbol{\Sigma}_\mathbf{P}\underbrace{\left(-\tau_m^{-1/2}\boldsymbol{\xi}\mathbf{u} + u_3\frac{\tau_P^{1/2}}{\tau^c}\alpha\ell\boldsymbol{\Phi}\boldsymbol{\Phi}' + \gamma\boldsymbol{\Sigma}_\mathbf{P}\boldsymbol{\xi}_0^{-1}\right)}_{\equiv -(\Pi_1\boldsymbol{\Phi}\boldsymbol{\Phi}' + \Pi_2\mathbf{I})}\boldsymbol{\xi}_0\mathbf{M} \tag{357}$$

where the first equality uses Eqs. (200) and (203), the second equality substitutes the relevant matrices and simplifies, and the underbrace uses Eq. (63) and $\boldsymbol{\xi}_0 \equiv \boldsymbol{\xi}$; Eq. (47)

follows.

In step 4 we substitute the expressions in Eq. (70) into the ODEs for $v.$ in Eqs. (225)–(228) to obtain explicit equations and in those for ξ and λ to obtain simpler ODEs. This first reveals that v_2 and ξ_2 can be solved for independently of the other coefficients; in particular they solve the two coupled ODEs with constant coefficients:

$$v_2' = -\tau_m^{-1}(\gamma + \xi_2 v_2)^2, \quad v_{2,T-} = \tau_\epsilon^{-1} \tag{358}$$

$$\xi_2' = \tau_m^{-1}\xi_2^2(v_2\xi_2 + \gamma), \quad \xi_{2,T-} = -\gamma/v_{2,T-}. \tag{359}$$

Clearly, one solution to this system of equation is:

$$v_{2,t} = \tau_\epsilon^{-1} \tag{360}$$

$$\xi_{2,t} = -\gamma\tau_\epsilon, \tag{361}$$

which implies that $\Pi_2 \equiv 0$. Since Eq. (78) gives us τ_P, this brings the equilibrium construction down to the computation of λ and ξ and the associated $v.$ coefficients; the system of ODEs for these coefficients is autonomous in λ, ξ, v and $\bar{v}_1$: once we know v and $\bar{v}_1$, we can recover v_3, and since we know $\bar{v}$ we can recover v_4. This gives a system of four ODEs, which using the expression we obtained for $\Pi_1 + \Pi_2 \equiv \Pi$ in Eq. (70) is written as:

$$\lambda' = -\tau_P^{1/2}\tau_m^{-1/2}\xi - \lambda\Sigma_{\mathbf{P}}\Pi \tag{362}$$

$$v' = \Pi\left(2\frac{\tau_P^{1/2}}{\tau^c}(\alpha\bar{v}_1 - v) - \Pi\right) + \frac{\tau_v}{\tau^2}\bar{v}_1^2 \tag{363}$$

$$= \tau_P\left(\frac{\alpha\bar{v}_1 - v}{\tau^c}\right)^2 - \Sigma_{\mathbf{P}}^2\left(\frac{v\xi + \gamma}{\xi}\right)^2 + \frac{\tau_v}{\tau^2}\bar{v}_1^2 \tag{364}$$

$$\bar{v}_1' = \frac{\tau_P}{\tau}\bar{v}_1 + \tau_P^{1/2}\Pi\left(1 + \frac{\alpha\bar{v} - \bar{v}_1}{\tau^c}\right) + \frac{\tau_v}{\tau^2}\bar{v}\bar{v}_1, \tag{365}$$

and Eq. (69). Finally, to obtain Eq. (68) we substitute the first equation above in the identity:

$$\ell' = -\lambda'/\alpha - (1 - \ell)\tau_P/\tau. \tag{366}$$

We now repeat step 1-4 on the equilibrium equations in Eqs. (323) and (324) that hold immediately prior to the announcement. We separate the first column in Eq. (324) from the other N columns, which gives the following system of equations:

$$0 = (\mathbf{a_P} - \mathbf{b_P S b'_\Psi V}_t(\mathbf{I} + \mathbf{a_\Psi}))(\mathbf{1}^{\star\prime}\,\lambda_{t-}\boldsymbol{\xi}_{t-}^{-1}\boldsymbol{\Phi} + \alpha_{t-}\boldsymbol{\omega}_{t-}) \tag{367}$$

$$\boldsymbol{\xi}_t - \boldsymbol{\xi}_{t-} = \mathbf{b_P S}(\mathbf{b'_\Psi V}_t(\mathbf{I} + \mathbf{a_\Psi})\,\mathbf{1}^{\star\prime} + \gamma\mathbf{b'_P}). \tag{368}$$

From the second equation we can verify Eq. (67) holds upon the announcement. Using Eqs. (206) and (209) we rewrite this equation as:

$$\boldsymbol{\xi}_t - \boldsymbol{\xi}_{t-} = \mathbf{b_P S}\left(\mathbf{b'_P}(\mathbf{v}_t\boldsymbol{\xi}_t + \gamma) - \frac{v_t - \alpha_t\bar{v}_{1,t}}{1-\alpha_t}\mathbf{x}'\boldsymbol{\xi}_t\right). \tag{369}$$

Now substitute Eq. (67) and isolate terms in $\mathbf{I}$, which gives an ODE for ξ_2

$$\xi_{2,t-} = \xi_{2,t}\frac{\tau_M - \gamma\xi_{2,t}}{\tau_M + v_{2,t}\xi_{2,t}^2} \tag{370}$$

$$= \xi_{2,t-}, \tag{371}$$

where the second equality substitutes the solution post-announcement in Eq. (360). The remaining terms are proprotional to $\boldsymbol{\Phi\Phi}'$. In particular, pre- and post-multiplying Eq. (516) by $\boldsymbol{\Phi}'$ and $\boldsymbol{\Phi}$, respectively, gives an equation for ξ:

$$\xi_t - \xi_{t-} = \sigma_{\mathbf{P}}(v_t\xi_t + \gamma) + \frac{v_t - \alpha_t\bar{v}_{1,t}}{1-\alpha_t}\xi_t\boldsymbol{\Phi}'\mathbf{b_P S}\bar{\mathbf{x}}'. \tag{372}$$

We further show that $\boldsymbol{\xi} \equiv \boldsymbol{\xi}_0$ on the announcement. Start from the equilibrium condition in Eq. (323), which can be rewritten as:

$$\boldsymbol{\xi}_{0,t} - \boldsymbol{\xi}_{0,t-} = \mathbf{b_P S}\left(\mathbf{b'_\Psi}(\mathbf{b}'_t\mathbf{u}_t + u_{3,t}\mathbf{c}'_t)\boldsymbol{\xi}_{0,t} + \gamma\mathbf{b'_P}\right) \tag{373}$$

$$= \mathbf{b_P S}\left(\mathbf{b_P}(-\mathbf{u}_t\boldsymbol{\xi}_{0,t} + \gamma) + \frac{u_t - \alpha\bar{u}_t}{1-\alpha_t}\mathbf{x}'\boldsymbol{\xi}_{0,t}\right). \tag{374}$$

Since we have shown in Eq. (63) that $\mathbf{u} \equiv -\mathbf{v}$ and $u_3 = -v_3$, if $\boldsymbol{\xi}_0 \equiv \boldsymbol{\xi}$ this equation is identical to Eq. (516) and thus the conjecture in Eq. (67) holds at all dates. We now turn to Eq. (367), and first observe that:

$$(\mathbf{a_P} - \mathbf{b_P S b'_\Psi V}_t(\mathbf{I} + \mathbf{a_\Psi}))\,\mathbf{1}^{\star\prime} = \boldsymbol{\xi}_t - \boldsymbol{\xi}_{t-} - \mathbf{b_P S b'_\Psi V}_t(\mathbf{I} + \mathbf{a_\Psi})\,\mathbf{1}^{\star\prime} \tag{375}$$

$$= \gamma\mathbf{b_P S b'_P}, \tag{376}$$

where the second line follows from Eq. (368), which we plug back into Eq. (367):

$$\lambda_{t-}\gamma \mathbf{b_P}\mathbf{S}\mathbf{b}'_\mathbf{P}\boldsymbol{\xi}_{t-}^{-1}\boldsymbol{\Phi} + \alpha_{t-}(\mathbf{a_P} - \mathbf{b_P}\mathbf{S}\mathbf{b}'_{\boldsymbol{\Psi}}\mathbf{V}_t(\mathbf{I} + \mathbf{a}_{\boldsymbol{\Psi}}))\boldsymbol{\omega}_{t-} = 0. \tag{377}$$

Post-multiplying the definition of $\mathbf{a_P}$ in Eq. (169) by $\boldsymbol{\omega}_{t-}$ to obtain:

$$\mathbf{a_P}\boldsymbol{\omega}_{t-} = \mathbf{b_P}\mathbf{y}, \tag{378}$$

which is the discrete counterpart to Eq. (342). Substituting back we obtain:

$$\lambda_{t-}\gamma \mathbf{b_P}\mathbf{S}\mathbf{b}'_\mathbf{P}\boldsymbol{\xi}_{t-}^{-1}\boldsymbol{\Phi} + \alpha_{t-}(\mathbf{b_P}\mathbf{y} - \mathbf{b_P}\mathbf{S}\mathbf{b}'_{\boldsymbol{\Psi}}\mathbf{V}_t(\mathbf{I} + \mathbf{a}_{\boldsymbol{\Psi}}))\boldsymbol{\omega}_{t-} = 0. \tag{379}$$

Using Eqs. (206) and (209) we can write:

$$\begin{aligned}\mathbf{V}_t(\mathbf{I} + \mathbf{a}_{\boldsymbol{\Psi}})\boldsymbol{\omega}_{t-} &= ((\mathbf{b}'_t\mathbf{v}_t + v_{3,t}\mathbf{c}'_t)(\mathbf{b}_{t-} - \mathbf{a_P}) + (\widetilde{v}_{1,t}\mathbf{b}'_t + \widetilde{v}_{2,t}\mathbf{c}'_t)\mathbf{c}_{t-})\boldsymbol{\omega}_{t-} &(380)\\ &= -(\mathbf{b}'_t\mathbf{v}_t + v_{3,t}\mathbf{c}'_t)\mathbf{b_P}\mathbf{y} + ((\beta v_t + (1-\beta)\bar{v}_{1,t})\mathbf{b}'_t + (\beta v_{3,t} + (1-\beta)\bar{v}_{2,t})\mathbf{c}'_t)\boldsymbol{\Phi}, &(381)\end{aligned}$$

which we plug back into the previous equation to obtain

$$\lambda_{t-}\gamma \mathbf{b_P}\mathbf{S}\mathbf{b}'_\mathbf{P}\boldsymbol{\xi}_{t-}^{-1}\boldsymbol{\Phi} + \alpha_{t-}\mathbf{b_P}\mathbf{S}\begin{pmatrix} \mathbf{S}^{-1}\mathbf{y} + \mathbf{b}'_{\boldsymbol{\Psi}}(\mathbf{b}'_t\mathbf{v}_t + v_{3,t}\mathbf{c}'_t)\mathbf{b_P}\mathbf{y} \\ -\mathbf{b}'_{\boldsymbol{\Psi}}((\beta v_t + (1-\beta)\bar{v}_{1,t})\mathbf{b}'_t + (\beta v_{3,t} + (1-\beta)\bar{v}_{2,t})\mathbf{c}'_t)\boldsymbol{\Phi}\end{pmatrix} = 0. \tag{382}$$

Using Eq. (248) this equation simplifies to:

$$\lambda_{t-}\gamma \mathbf{b_P}\mathbf{S}\mathbf{b}'_\mathbf{P}\boldsymbol{\xi}_{t-}^{-1}\boldsymbol{\Phi} + \alpha_{t-}\mathbf{b_P}\mathbf{S}\begin{pmatrix} \boldsymbol{\Upsilon}^{-1}\mathbf{y} + \mathbf{b}'_{\boldsymbol{\Psi}}\left(\mathbf{b}'_t\frac{v_t - \alpha_t\bar{v}_{1,t}}{1-\alpha_t} + \mathbf{c}'_t\frac{v_{3,t} - \alpha_t\bar{v}_{2,t}}{1-\alpha_t}\right)\mathbf{x}'\mathbf{y} \\ -\mathbf{b}'_{\boldsymbol{\Psi}}((\beta v_t + (1-\beta)\bar{v}_{1,t})\mathbf{b}'_t + (\beta v_{3,t} + (1-\beta)\bar{v}_{2,t})\mathbf{c}'_t)\boldsymbol{\Phi}\end{pmatrix} = 0. \tag{383}$$

Furthermore, substituting Eqs. (250)–(252) back the equilibrium equation becomes:

$$\lambda_{t-}\gamma \mathbf{b_P}\mathbf{S}\mathbf{b}'_\mathbf{P}\boldsymbol{\xi}_{t-}^{-1}\boldsymbol{\Phi} + \alpha_{t-}\mathbf{b_P}\mathbf{S}\left(\tau_{t-}\mathbf{x}' - (\alpha_t\beta + 1 - \beta)\,\mathbf{b}'_{\boldsymbol{\Psi}}\left(\bar{v}_{1,t}\mathbf{b}'_t + \bar{v}_{2,t}\mathbf{c}'_t\right)\right)\boldsymbol{\Phi} = 0. \tag{384}$$

Given Eq. (258) and that

$$\mathbf{b}'_{\boldsymbol{\Psi}}\left(\bar{v}_{1,t}\mathbf{b}'_t + \bar{v}_{2,t}\mathbf{c}'_t\right) = \frac{\bar{v}_{1,t} - \alpha_t\bar{v}_t}{1-\alpha_t}\mathbf{x}' - \bar{v}_{1,t}\mathbf{b}'_\mathbf{P}, \tag{385}$$

this ultimately gives after dividing by α_{t-}:

$$\mathbf{b_P}\mathbf{S}\mathbf{b}'_{\mathbf{P}}\left((1-\ell_{t-})\gamma\boldsymbol{\xi}_{t-}^{-1}+\tau_{t-}/\tau_t\bar{v}_{1,t}\right)\mathbf{\Phi}-\tau_{t-}\left(\frac{\bar{v}_{1,t}-\alpha_t\bar{v}_t}{\tau_t^c}-1\right)\mathbf{b_P}\mathbf{S}\mathbf{x}'\mathbf{\Phi}=0. \tag{386}$$

After pre-multiplying this equation by $\mathbf{\Phi}'$ we obtain an algebraic equation for $\tau_G^{1/2}$, which is reported in Eq. (79). Finally, we obtain an equation for ℓ by using the definition of $\tau_G^{1/2}$ in Eq. (46) and by plugging Eq. (516) into it and pre-multiplying by $\mathbf{\Phi}'$:

$$(1-\ell_{t-})\mathbf{\Phi}=\tau_G^{1/2}\tau_M^{-1/2}\boldsymbol{\xi}_{t-}\mathbf{\Phi}/\alpha_{t-}+(1-\ell_t)\left(1-\mathbf{b_P}\mathbf{S}\left(\mathbf{b}'_{\mathbf{P}}(\mathbf{v}_t+\gamma\boldsymbol{\xi}_t^{-1})-\frac{v_t-\alpha_t\bar{v}_{1,t}}{1-\alpha_t}\mathbf{x}'\right)\right)\mathbf{\Phi}, \tag{387}$$

which concludes the second step.

In a third step, we must verify Conjecture 1, part A. We start by proving Eq. (44), which can be done without knowledge of the $\boldsymbol{\pi}$. coefficients. Suppose that Eq. (42) in Conjecture 1 holds true and post-multiply it by $\boldsymbol{\omega}_{t-}$ and use Eq. (221), which gives:

$$\mathbf{a_P}\boldsymbol{\omega}_{t-}=\mathbf{b_P}\begin{pmatrix}(1-\ell_{t-})\pi_1^A+\ell_{t-}\pi_2^A\\((1-\ell_{t-})(\pi_1+\pi_2)+\ell_{t-}\pi_3)\mathbf{\Phi}\end{pmatrix}. \tag{388}$$

Comparing the result with Eq. (342) gives Eq. (44). Next, we prove that Eq. (42) in Conjecture 1 holds true. We start from the market-clearing condition in Eq. (324), in which we substitute Eq. (349):

$$\mathbf{a_P}-\mathbf{b_P}\mathbf{S}\mathbf{b}'_{\mathbf{\Psi}}\mathbf{V}_t(\mathbf{I}+\mathbf{a_\Psi})=-\gamma\mathbf{b_P}\mathbf{S}\mathbf{b}'_{\mathbf{P}}\boldsymbol{\xi}_{t-}^{-1}\mathbf{b}_{t-}. \tag{389}$$

Now substitute Eq. (197) in this equation, rearrange and get:

$$\mathbf{b}_t(\mathbf{I}+\mathbf{a_\Psi})=(\mathbf{I}+\mathbf{b_P}\mathbf{S}\mathbf{b}'_{\mathbf{\Psi}}(\mathbf{v}_t\mathbf{b}_t+v_{3,t}\mathbf{c}_t)')^{-1}\begin{pmatrix}\mathbf{a}_{t-}+\gamma\mathbf{b_P}\mathbf{S}\mathbf{b}'_{\mathbf{P}}\boldsymbol{\xi}_{t-}^{-1}\mathbf{b}_{t-}\\-(\mathbf{I}+\mathbf{b_P}\mathbf{S}\mathbf{b}'_{\mathbf{\Psi}}(v_{3,t}\mathbf{b}_t+v_{4,t}\mathbf{c}_t)')\mathbf{c}_t(\mathbf{I}+\mathbf{a_\Psi})\end{pmatrix} \tag{390}$$

$$=(\mathbf{I}+\mathbf{b_P}\mathbf{S}\mathbf{b}'_{\mathbf{\Psi}}(\mathbf{v}_t\mathbf{b}_t+v_{3,t}\mathbf{c}_t)')^{-1}\begin{pmatrix}(\mathbf{I}-\frac{\ell_t}{\ell_{t-}}\frac{\tau_{t-}^c}{\tau_t^c}(\mathbf{I}+\mathbf{b_P}\mathbf{S}\mathbf{b}'_{\mathbf{\Psi}}(v_{3,t}\mathbf{b}_t+v_{4,t}\mathbf{c}_t)'))\mathbf{c}_{t-}\\+(\mathbf{I}+\gamma\mathbf{b_P}\mathbf{S}\mathbf{b}'_{\mathbf{P}}\boldsymbol{\xi}_{t-}^{-1})\mathbf{b}_{t-}\end{pmatrix}, \tag{391}$$

where the second line uses Eq. (38), $\mathbf{c}_{t-}=\ell_t/\ell_{t-}\mathbf{c}_t$ and $\mathbf{c}_t(\mathbf{I}+\mathbf{a_\Psi})=\tau_{t-}^c/\tau_t^c\mathbf{c}_t$. Furthermore, reorganizing Eq. (516) implies:

$$(\mathbf{I} + \mathbf{b_P}\mathbf{S}\mathbf{b}'_{\boldsymbol{\Psi}}(\mathbf{v}_t\mathbf{b}_t + v_{3,t}\mathbf{c}_t)')\boldsymbol{\xi}_t\boldsymbol{\xi}_{t-}^{-1} = \mathbf{I} + \gamma\mathbf{b_P}\mathbf{S}\mathbf{b}'_{\mathbf{P}}\boldsymbol{\xi}_{t-}^{-1}, \tag{392}$$

which substituted in the above gives:

$$\begin{aligned}\mathbf{b}_t(\mathbf{I} + \mathbf{a}_{\boldsymbol{\Psi}}) &= \boldsymbol{\xi}_t\boldsymbol{\xi}_{t-}^{-1}\mathbf{b}_{t-} \\ &+ (\mathbf{I} + \mathbf{b_P}\mathbf{S}\mathbf{b}'_{\boldsymbol{\Psi}}(\mathbf{v}_t\mathbf{b}_t + v_{3,t}\mathbf{c}_t)')^{-1}(\mathbf{I} - \frac{\ell_t}{\ell_{t-}}\frac{\tau^c_{t-}}{\tau^c_t}(\mathbf{I} + \mathbf{b_P}\mathbf{S}\mathbf{b}'_{\boldsymbol{\Psi}}(v_{3,t}\mathbf{b}_t + v_{4,t}\mathbf{c}_t)'))\mathbf{c}_{t-}.\end{aligned} \tag{393}$$

Proceeding similarly with Eq. (367) we can reorganize it as:

$$\begin{aligned}&(\mathbf{I} + \mathbf{b_P}\mathbf{S}\mathbf{b}'_{\boldsymbol{\Psi}}(\mathbf{v}_t\mathbf{b}_t + v_{3,t}\mathbf{c}_t)')(\mathbf{b_P}\mathbf{y} + (1 - \ell_{t-})\boldsymbol{\xi}_t\boldsymbol{\xi}_{t-}^{-1}\boldsymbol{\Phi} - \boldsymbol{\Phi})) \\ &= -\ell_{t-}\left(\mathbf{I} - \frac{\ell_t}{\ell_{t-}}\frac{\tau^c_{t-}}{\tau^c_t}(\mathbf{I} + \mathbf{b_P}\mathbf{S}\mathbf{b}'_{\boldsymbol{\Psi}}(v_{3,t}\mathbf{b}_t + v_{4,t}\mathbf{c}_t)') + \frac{\ell_t}{\ell_{t-}}\frac{\tau^c_{t-}}{\tau^c_t}(\mathbf{I} + \mathbf{b_P}\mathbf{S}\mathbf{b}'_{\boldsymbol{\Psi}}(\mathbf{v}_t\mathbf{b}_t + v_{3,t}\mathbf{c}_t)')\right)\boldsymbol{\Phi},\end{aligned} \tag{394}$$

and thus:

$$(\mathbf{I} + \mathbf{b_P}\mathbf{S}\mathbf{b}'_{\boldsymbol{\Psi}}(\mathbf{v}_t\mathbf{b}_t + v_{3,t}\mathbf{c}_t)')^{-1}\left(\mathbf{I} - \frac{\ell_t}{\ell_{t-}}\frac{\tau^c_{t-}}{\tau^c_t}(\mathbf{I} + \mathbf{b_P}\mathbf{S}\mathbf{b}'_{\boldsymbol{\Psi}}(v_{3,t}\mathbf{b}_t + v_{4,t}\mathbf{c}_t)')\right)\boldsymbol{\Phi} \tag{395}$$

$$= \frac{1}{\ell_{t-}}\left(\left(1 - \ell_t\frac{\tau^c_{t-}}{\tau^c_t}\right)\boldsymbol{\Phi} - (1 - \ell_{t-})\boldsymbol{\xi}_t\boldsymbol{\xi}_{t-}^{-1}\boldsymbol{\Phi} - \mathbf{b_P}\mathbf{y}\right)$$

$$= \frac{1}{\ell_{t-}}\left((1 - \ell_t)\frac{\tau_{t-}}{\tau_t}\boldsymbol{\Phi} - (1 - \ell_{t-})\boldsymbol{\xi}_t\boldsymbol{\xi}_{t-}^{-1}\boldsymbol{\Phi} - \mathbf{1}^\star\mathbf{y}\right), \tag{396}$$

where the second equality uses Eq. (206). Since $\mathbf{c} \equiv \boldsymbol{\Phi}\boldsymbol{\Phi}'\mathbf{c}$, substituting back into Eq. (393) gives:

$$\mathbf{b}_t(\mathbf{I} + \mathbf{a}_{\boldsymbol{\Psi}}) = \boldsymbol{\xi}_t\boldsymbol{\xi}_{t-}^{-1}\mathbf{b}_{t-} + \frac{1}{\ell_{t-}}\left((1 - \ell_t)\frac{\tau_{t-}}{\tau_t} - (1 - \ell_{t-})\boldsymbol{\xi}_t\boldsymbol{\xi}_{t-}^{-1} + \tau_{G,t}^{1/2}\tau_M^{-1/2}\boldsymbol{\xi}_t\right)\mathbf{c}_{t-}, \tag{397}$$

which uses the definition of $\mathbf{y}$. Finally, using the definition of τ_G and the fact that $\tau_t - \tau_{t-} = \tau^c_t - \tau^c_{t-}$ shows that:

$$-\tau_M^{-1/2}\tau_{G,t}^{1/2}\boldsymbol{\Phi} = \alpha_{t-}\left((1 - \ell_t)\frac{\tau_{t-}}{\tau_t}\boldsymbol{\xi}_t^{-1} - (1 - \ell_{t-})\boldsymbol{\xi}_{t-}^{-1}\right)\boldsymbol{\Phi}, \tag{398}$$

from which it follows that:

$$\mathbf{b}_t(\mathbf{I} + \mathbf{a}_{\boldsymbol{\Psi}}) = \boldsymbol{\xi}_t\left(\boldsymbol{\xi}_{t-}^{-1}\mathbf{b}_{t-} - \frac{1 - \alpha_{t-}}{\alpha_{t-}\ell_{t-}}\tau_{G,t}^{1/2}\tau_M^{-1/2}\mathbf{c}_{t-}\right). \tag{399}$$

Now take Eq. (324) and substitute Eq. (349) and Eq. (399) in it, and rearrange to get:

$$\mathbf{a_P} = \mathbf{b_P S}\left(\frac{v_t - \alpha_t \bar{v}_{1,t}}{1-\alpha_t}\mathbf{x}'\boldsymbol{\xi}_t - \mathbf{b}'_\mathbf{P}(\gamma + \mathbf{v}_t\boldsymbol{\xi}_t)\right)\boldsymbol{\xi}_{t-}^{-1}\mathbf{b}_{t-} \tag{400}$$
$$+\frac{1}{\ell_{t-}}\mathbf{b_P S}\left(\begin{array}{c}\mathbf{x}'\left(\frac{v_t-\alpha_t\bar{v}_{1,t}}{1-\alpha_t}\frac{\alpha_{t-}-1}{\alpha_{t-}}\tau_G^{1/2}\tau_M^{-1/2}\xi_t + \ell_t(1-\beta)\frac{v_{3,t}-\alpha_t\bar{v}_{2,t}}{1-\alpha_t}\right)\\ -\mathbf{b}'_\mathbf{P}\left(v_t\frac{\alpha_{t-}-1}{\alpha_{t-}}\tau_G^{1/2}\tau_M^{-1/2}\xi_t + \ell_t(1-\beta)v_{3,t}\right)\end{array}\right)\mathbf{c}_{t-}.$$

This expression verifies the conjectured form in Eq. (42) with the identification:

$$\mathbf{b_P}\boldsymbol{\pi}_b = \mathbf{b_P S}\left(\frac{v_t - \alpha_t \bar{v}_{1,t}}{1-\alpha_t}\mathbf{x}'\boldsymbol{\xi}_t - \mathbf{b}'_\mathbf{P}(\gamma + \mathbf{v}_t\boldsymbol{\xi}_t)\right)\boldsymbol{\xi}_{t-}^{-1} \tag{401}$$

$$\pi_2 = -\frac{\xi_{2,t}v_{2,t}+\gamma}{v_{2,t}+\tau_M/\xi_{2,t}}\xi_{2,t-}^{-1} \tag{402}$$

$$\mathbf{b_P}\boldsymbol{\pi}_c = \frac{1}{\ell_{t-}}\mathbf{b_P S}\left(\begin{array}{c}\mathbf{x}'\left(\frac{v_t-\alpha_t\bar{v}_{1,t}}{1-\alpha_t}\frac{\alpha_{t-}-1}{\alpha_{t-}}\tau_G^{1/2}\tau_M^{-1/2}\xi_t + \ell_t(1-\beta)\frac{v_{3,t}-\alpha_t\bar{v}_{2,t}}{1-\alpha_t}\right)\\ -\mathbf{b}'_\mathbf{P}\left(v_t\frac{\alpha_{t-}-1}{\alpha_{t-}}\tau_G^{1/2}\tau_M^{-1/2}\xi_t + \ell_t(1-\beta)v_{3,t}\right)\end{array}\right)\mathbf{c}_{t-}, \tag{403}$$

where the first equation is reported in Eq. (74) (after pre- and post-multiplication by $\mathbf{\Phi}$). Finally, to prove part B of Conjecture 1 we start from Eq. (**??**) and rewrite it as:

$$\boldsymbol{\xi}_{0,t} - \boldsymbol{\xi}_{0,t-} = -\mathbf{b_P S}\left(\frac{v_t - \alpha_t \bar{v}_{1,t}}{1-\alpha_t}\mathbf{x}'\boldsymbol{\xi}_t - \mathbf{b}'_\mathbf{P}(\gamma + \mathbf{v}_t\boldsymbol{\xi}_t)\right) \tag{404}$$

$$= -\mathbf{b_P}\boldsymbol{\pi}_b\boldsymbol{\xi}_{t-}, \tag{405}$$

where the second equality follows from comparing this equation to Eqs. (400) and (42); Eq. (48) follows.

In a last step we substitute the expressions in Eq. (74) into the equations for $v.$ in Eqs. (58)–(60) to obtain explicit equations and in those for ξ and λ to obtain simpler equations. As in the continuous case, this first reveals that v_2 and ξ_2 can be solved for independently of the other coefficients; in particular subsituting the solution post-announcement in Eq. (360) into Eq. (61) gives:

$$v_{2,t-} = v_{2,t}, \tag{406}$$

which given Eq. (370) shows that the solution post-announcement continues to hold pre-announcement and which implies from Eq. (402) that $\pi_2 \equiv 0$. Further substituting the expression we obtained for $\mathbf{b_P}\boldsymbol{\pi}_b$ in Eq. (74) readily delivers Eqs. (72)–(73).

Since Eq. (79) gives us τ_G, this brings the equilibrium construction down to the computation of λ and ξ and the associated $v.$ coefficients; the system of ODEs for these coefficients is autonomous in λ, ξ, v and $\bar{v}_1$: once we know v and $\bar{v}_1$, we can recover v_3, and since we know $\bar{v}$ we can recover v_4. This gives a system of four ODEs, which using the expression we obtained for $\Pi_1 + \Pi_2 \equiv \Pi$ in Eq. (70) is written as:

$$\lambda' = -\tau_P^{1/2}\tau_m^{-1/2}\xi - \lambda\Sigma_{\mathbf{P}}\Pi \tag{407}$$

$$v' = \Pi\left(2\frac{\tau_P^{1/2}}{\tau^c}(\alpha\bar{v}_1 - v) - \Pi\right) + \frac{\tau_v}{\tau^2}\bar{v}_1^2 \tag{408}$$

$$= \tau_P\left(\frac{\alpha\bar{v}_1 - v}{\tau^c}\right)^2 - \Sigma_{\mathbf{P}}^2\left(\frac{v\xi + \gamma}{\xi}\right)^2 + \frac{\tau_v}{\tau^2}\bar{v}_1^2 \tag{409}$$

$$\bar{v}_1' = \frac{\tau_P}{\tau}\bar{v}_1 + \tau_P^{1/2}\Pi\left(1 + \frac{\alpha\bar{v} - \bar{v}_1}{\tau^c}\right) + \frac{\tau_v}{\tau^2}\bar{v}\bar{v}_1, \tag{410}$$

and Eq. (69).

A.5 Proof of Lemma 1

In this appendix we show that an equilibrium without a wedge $\ell \equiv 0$ always obtains under Assumption 1; this equilibrium is the one that obtains absent residual uncertainty. We start by noting that the solution in Eqs. (82)–(83) satisfies the terminal boundary conditions in Eqs. (76) and (77). Furthermore, the solution in Eq. (83) implies that the two ODEs for v and $\bar{v}_1$ (see Proposition 3) decouple from those for ℓ and ξ (see Proposition 4). This corresponds to an important simplification as $\bar{v} = \bar{v}_1 \equiv v$ (as given in Eq. (433)) and thus the coefficients in investors' value function:

$$\mathbf{U} \equiv \mathbf{a}'\mathbf{u}\boldsymbol{\xi}_0\mathbf{M} \tag{411}$$

$$\mathbf{V} \equiv \mathbf{a}'\mathbf{v}\mathbf{a}, \tag{412}$$

and equilibrium equity premia (given that $\Pi_3 \equiv 0$):

$$\mathbf{A}_{\mathbf{P}} = \sigma_{\mathbf{P}}\Pi\boldsymbol{\Phi}\boldsymbol{\Phi}'\mathbf{a} \tag{413}$$

with $\Pi \equiv -\tau_P^{1/2}$ (by Eq. (43)) can be described just in terms of $\mathbf{a}$, as opposed to $\mathbf{b}$ and $\mathbf{c}$ separately. Since v is known in this case, the system of ODEs in Eq. (68) simplifies to a system of just two ODEs for λ and ξ:

$$\lambda' = -\tau_P^{1/2}\tau_m^{-1/2}\xi + \lambda\tau_P^{1/2}\sigma_{\mathbf{P}} \tag{414}$$

$$\xi' = \sigma_{\mathbf{P}}\tau_P^{1/2}\xi, \tag{415}$$

where $\sigma_{\mathbf{P}} \equiv \tau_m^{-1/2}\xi - \tau_P^{1/2}/\tau$ given that, under Eq. (82), $(\tau^c)^{-1}(1-\lambda) \equiv \tau^{-1}$. To verify the conjecture in Eq. (82) we observe that it implies:

$$\lambda' = -\tau^{-1}(\tau_P\lambda - (1-\lambda)\tau_v), \tag{416}$$

which we can plug in the first ODE above to get an algebraic equation of the form:

$$\tau_P^{1/2} = -\tau_v\tau^{-1}\tau_m^{1/2}\xi^{-1}. \tag{417}$$

For the conjecture to be verified this expression must agree with that in Eq. (**??**), which simplifies in this case to:

$$\tau_P^{1/2} = \frac{\xi\tau(\gamma+\xi v)}{\sqrt{\tau_m}(\gamma+\xi\tau)}. \tag{418}$$

That the two must agree in turn implies an equation for ξ:

$$-\tau_v\tau^{-1}\tau_m^{1/2}\xi^{-1} = \frac{\xi\tau(\gamma+\xi v)}{\sqrt{\tau_m}(\gamma+\xi\tau)}, \tag{419}$$

which is a cubic equation, as in Andrei et al. (2021). Under this assumption, Eq. (417) implies that:

$$\tau_P \equiv 0. \tag{420}$$

For this solution to coincide with Eq. (418), ξ must satisfy Eq. (83). Since the ODE in Eq. (415) now says $\xi' \equiv 0$ (and $v' = 0$), we conclude that $\alpha_t \equiv \alpha_{T-}$, $v_t \equiv v_{T-}$ and $\xi_t \equiv -\gamma/v_{T-}$, and thus the solution of Lemma 1 holds post-announcement; to show that it holds at all times we must still show it satisfies the boundary conditions upon announcements as given in Propositions 3 and 4. Since the $\ell = 0$ equilibrium holds post-announcement, λ_{t-} immediately prior to the announcement statisfies Eq. (513). This equation shows that for $\ell_{t-} \equiv 0$ to remain an equilibrium we need $\tau_G = 0$. Note that, after premultiplying by $(\mathbf{I} + \mathbf{b_P S b'_\Psi a'_t v}_t)^{-1}$, Eq. (**??**) becomes:

$$\mathbf{b_P y} + (\boldsymbol{\xi}_t - \boldsymbol{\xi}_{t-})\boldsymbol{\xi}_{t-}^{-1}\mathbf{\Phi} = 0. \tag{421}$$

Going back to the definition of τ_G in Eq. (46), which we can rewrite as:

$$-\tau_G^{1/2}\mathbf{\Phi} = \tau_M^{1/2}((\lambda_t - \lambda_{t-})\boldsymbol{\xi}_t^{-1} - \lambda_{t-}\boldsymbol{\xi}_t^{-1}(\boldsymbol{\xi}_t - \boldsymbol{\xi}_{t-})\boldsymbol{\xi}_{t-}^{-1})\mathbf{\Phi}, \tag{422}$$

and substituting the previous equation we get:

$$-\tau_G^{1/2}\mathbf{\Phi} = \tau_M^{1/2}((\lambda_t - \lambda_{t-})\boldsymbol{\xi}_t^{-1}\mathbf{\Phi} + \lambda_{t-}\boldsymbol{\xi}_t^{-1}\mathbf{b_P}\mathbf{y}). \tag{423}$$

Using the definition of $\mathbf{y}$ we have (recall that $\ell \equiv 0$ implies $(\tau^c)^{-1}(1-\lambda) = \tau^{-1}$):

$$\boldsymbol{\xi}_t^{-1}\mathbf{b_P}\mathbf{y} = (-\tau_G^{1/2}\tau_M^{-1/2}\,\mathbf{I} + \tau_t^{-1}(\tau_A + \tau_G)\boldsymbol{\xi}_t^{-1})\mathbf{\Phi}, \tag{424}$$

which substituted back gives:

$$-\tau_G^{1/2}\mathbf{\Phi} = -\lambda_{t-}\tau_G^{1/2}\mathbf{\Phi} + \tau_M^{1/2}(\lambda_t - \lambda_{t-} + \lambda_{t-}\tau_t^{-1}(\tau_A + \tau_G))\boldsymbol{\xi}_t^{-1}\mathbf{\Phi}. \tag{425}$$

Under $\ell \equiv 0$ we further have that:

$$\lambda_t - \lambda_{t-} + \lambda_{t-}\tau_t^{-1}(\tau_A + \tau_G) = \lambda_t - \lambda_{t-} + \lambda_{t-}\tau_t^{-1}(\tau_t - \tau_{t-}) \tag{426}$$

$$= \frac{\tau_t - \tau_{t-} - (\tau_t^c - \tau_{t-}^c)}{\tau_t} = 0 \tag{427}$$

and thus the previous equation becomes:

$$\tau_G^{1/2}\mathbf{\Phi} = \lambda_{t-}\tau_G^{1/2}\mathbf{\Phi}. \tag{428}$$

There are only two ways this equation is true. One is if $\lambda_{t-} \equiv 1$ but this would imply together with Eq. (82) that $\tau_{t-}^c \equiv 0$ and this cannot be true. So it must be that $\tau_G \equiv 0$ is an equilibrium and thus $\ell = 0$ remains an equilibrium pre-announcement.

A.6 Proof of Corollary 3

To solve the ODE in Eq. (57) over the post-announcement period, denote by $\bar{v}^c$ the coefficient associated with the hypothetical maximization problem the econometrician would solve in this economy, i.e., someone who only observes $\mathscr{F}^c$. The econometrician would solve this ODE but with $\tau_v \equiv 0$:

$$(\bar{v}^c)' = \tau_P(2\bar{v}^c/\tau^c - 1), \quad \bar{v}_{T-}^c = \frac{\tau_\epsilon \tau_{T-}^c}{\tau_{T-}^c + \tau_\epsilon}. \tag{429}$$

Furthermore, since dependence on time is triggered solely through common precision τ^c (since $(\tau^c)' = \tau_P$) we can implement the following change of variable, $\bar{v}^c \equiv f(\tau^c)$, which gives in turn the ODE:

$$f' = 2f/\tau^c - 1 \tag{430}$$

with boundary condition $f(\tau^c_{T-}) = \tau_\epsilon \tau^c_{T-}/(\tau^c_{T-} + \tau_\epsilon)$. Its solution is:

$$v^c_t = \frac{\tau^c_t(\tau_\epsilon + \tau^c_{T-} - \tau^c_t)}{\tau^c_{T-} + \tau_\epsilon}. \tag{431}$$

Furthermore, using Eqs. (130) and (132), we can write $\tau_t = \tau^c_t + \tau_v(t+1)$, which motivates the following transform:

$$\bar{v}_t = \frac{\bar{v}^c_t}{1 + \left(\frac{1}{\tau^c_t} + \frac{1}{\tau^c_t + \tau_v(t+1)}\right)\bar{v}^c_t}, \tag{432}$$

from which we get

$$\bar{v}_t = \frac{\tau_t(\tau_\epsilon + \tau^c_{T-} - \tau^c_t)}{\tau_t + \tau_\epsilon + \tau^c_{T-} - \tau^c_t}, \quad t \in [\tau, T), \tag{433}$$

and which indeed solves the ODE in Eq. (57).

Take the pre-announcement boundary conditions for λ_{t-} and ξ_{t-}:

$$\lambda_{t-} = 1 - \underbrace{\frac{\tau^c_{t-}}{\tau_{t-}}}_{\equiv 1-\alpha_{t-}} \frac{v_t\xi_t^2 - \xi_t \tau_{G,t}^{1/2}\tau_M^{1/2} + \tau_M}{v_t\xi_t^2(1 + \tau_{t-}^{-1}\tau_{G,t}) + \tau_M} \tag{434}$$

$$\xi_{t-} = \frac{-\gamma\xi_t^2(v_t/\tau_t\tau_A + \tau_{t-} + \tau_{G,t}) + \xi_t(2\gamma + v_t\xi_t)\tau_{G,t}^{1/2}\tau_M^{1/2} + (\xi_t\tau_{t-} - \gamma(1 - \tau_{t-}/\tau_t))\tau_M}{v_t\xi_t^2(\tau_{t-} + \tau_{G,t}) + \tau_{t-}\tau_M}. \tag{435}$$

We can then use the first boundary condition for λ_{t-} to write:

$$\ell_{t-} = \frac{1 - \alpha_{t-}}{\alpha_{t-}} \left(\frac{v_t\xi_t^2 - \xi_t\tau_G^{1/2}\tau_M^{1/2} + \tau_M}{v_t\xi_t^2(1 + \tau_G/\tau_{t-}) + \tau_M} - 1 \right). \tag{436}$$

Using the fact that $\xi_t = -\gamma/v_t$ post-announcement we can simplify the second boundary condition for ξ_{t-} as:

$$\xi_t - \xi_{t-} = \gamma \left(\frac{\upsilon_t \xi_t^2 - \xi_t \tau_G^{1/2} \tau_M^{1/2} + \tau_M}{\upsilon_t \xi_t^2 (\tau_{t-} + \tau_G) + \tau_{t-} \tau_M} - \tau_t^{-1} \right). \tag{437}$$

Furthermore notice that:

$$\upsilon_{t-} = \underbrace{-\gamma \xi_{t-}^{-1}}_{\text{solution when } \ell \equiv 0} + \frac{\gamma \upsilon_t \xi_t^2 \tau_{G,t}^{1/2} \tau_M^{1/2}}{\xi_{t-}^2 (\upsilon_t \xi_t^2 (\tau_{t-} + \tau_{G,t}) + \tau_{t-} \tau_M)}. \tag{438}$$

Now using the previous equation we have...

A.7 Proof of Proposition 5

We start by expressing the dynamics of $(\widetilde{\mathbf{P}}, \mathbf{\Psi})$ under perfect information. Using the results of Proposition 1 we obtain (we ignore the lump at the liquidation date):

$$\begin{aligned} \mathrm{d} \begin{pmatrix} \widetilde{\mathbf{P}}_t \\ \mathbf{\Psi}_t \end{pmatrix} &= \left(\begin{pmatrix} \mathbf{A_P} \\ \mathbf{A_\Psi} \end{pmatrix} \mathbf{\Psi}_t + \begin{pmatrix} \dot{\boldsymbol{\xi}}_t \mathbf{M} \\ \mathbf{0} \end{pmatrix} \right) \mathrm{d}t + \begin{pmatrix} \mathbf{\Sigma_P} \\ \mathbf{\Sigma_\Psi} \end{pmatrix} \mathrm{d}\mathbf{B}_{m,t} \\ &+ \mathbf{1}_{t=\tau} \left(\begin{pmatrix} \mathbf{a_P} \\ \mathbf{a_\Psi} \end{pmatrix} \mathbf{\Psi}_{t-} + \begin{pmatrix} \mathbf{b_P} \\ \bar{\mathbf{b}}_\mathbf{\Psi} \end{pmatrix} \widetilde{\mathbf{y}} + \begin{pmatrix} (\boldsymbol{\xi}_t - \boldsymbol{\xi}_{t-}) \mathbf{M} \\ \mathbf{0} \end{pmatrix} \right), \end{aligned} \tag{439}$$

where

$$\mathbf{\Sigma_\Psi} \equiv \begin{pmatrix} \tau_P^{1/2} / \tau_t^c \mathbf{\Phi} & \tau_m^{-1/2} \mathbf{I} \end{pmatrix}' \tag{440}$$

$$\bar{\mathbf{b}}_\mathbf{\Psi} \equiv \begin{pmatrix} -\tau_A / \tau_t^c & \tau_G^{1/2} \tau_M^{1/2} / \tau_t^c \mathbf{\Phi}' \boldsymbol{\xi}_t^{-1} \\ \mathbf{0} & \boldsymbol{\xi}_t^{-1} \end{pmatrix} \tag{441}$$

$$\widetilde{\mathbf{y}} \equiv \begin{pmatrix} \widetilde{\upsilon} & \Delta \widetilde{\mathbf{m}}_t' \boldsymbol{\xi}_t \end{pmatrix}'. \tag{442}$$

Taking expectations on dollar returns conditional on the sign of the announcement yields:

$$\begin{aligned} \mathbb{E} \left[\mathrm{d}\widetilde{\mathbf{P}}_t \middle| \operatorname{sign}(\widetilde{A}) \right] &= \left(\boldsymbol{\mu}_t + \mathbf{A_P} \, \mathbb{E} \left[\mathbf{\Psi}_t | \operatorname{sign}(\widetilde{A}) \right] \right) \mathrm{d}t \\ &+ \mathbf{1}_{t=\tau} \left(\Delta \boldsymbol{\mu}_t + \mathbf{a_P} \, \mathbb{E} \left[\mathbf{\Psi}_{t-} | \operatorname{sign}(\widetilde{A}) \right] + \mathbf{b_P} \, \mathbb{E} \left[\widetilde{\mathbf{y}} | \operatorname{sign}(\widetilde{A}) \right] \right), \end{aligned} \tag{443}$$

where $\boldsymbol{\mu}_t \equiv \mathbb{E}[\mathrm{d}\widetilde{\mathbf{P}}_t]/\mathrm{d}t = \dot{\boldsymbol{\xi}}_t \mathbf{M}$ and $\Delta \boldsymbol{\mu}_t = \mathbb{E}[\Delta \widetilde{\mathbf{P}}_t] = (\boldsymbol{\xi}_t - \boldsymbol{\xi}_t)\mathbf{M}$ denote unconditional expected returns in between and at announcements, respectively. Further observing that $\mathbb{E}[\mathbf{\Psi}_t | \operatorname{sign}(\widetilde{A})] = \begin{pmatrix} \mathbb{E}[\Delta_t | \operatorname{sign}(\widetilde{A})] & \mathbf{0}' \end{pmatrix}'$ and $\mathbb{E}[\widetilde{\mathbf{y}} | \operatorname{sign}(\widetilde{A})] = \begin{pmatrix} \mathbb{E}[\widetilde{\upsilon} | \operatorname{sign}(\widetilde{A})] & \mathbf{0}' \end{pmatrix}'$ we can write (recall from Proposition 4 that $\Pi_{2,t} = 0$ and $\pi_2 = 0$ at all times):

$$\mathbf{A_P}\,\mathbb{E}\left[\mathbf{\Psi}_t|\,\mathrm{sign}(\widetilde{A})\right] = ((1-\ell_t)(1-\alpha_t)\Pi_t + \ell_t\Pi_{3,t})\,\mathbb{E}[\Delta_t|\mathrm{sign}(\widetilde{A})]\Sigma_{\mathbf{P}}\mathbf{\Phi} \tag{444}$$

$$\mathbf{a_P}\,\mathbb{E}\left[\mathbf{\Psi}_{t-}|\,\mathrm{sign}(\widetilde{A})\right] = \mathbf{b_P}\begin{pmatrix} \pi_1^A(1-\ell_{t-})(1-\alpha_{t-}) + \ell_{t-}\pi_2^A \\ (\pi_1(1-\ell_{t-})(1-\alpha_{t-}) + \ell_{t-}\pi_3)\mathbf{\Phi} \end{pmatrix}\mathbb{E}\left[\Delta_{t-}|\,\mathrm{sign}(\widetilde{A})\right] \tag{445}$$

$$\mathbb{E}\left[\widetilde{\mathbf{y}}|\,\mathrm{sign}(\widetilde{A})\right] = (1-\lambda_t)\tau_A/\tau_t^c\,\mathbb{E}[\widetilde{v}|\mathrm{sign}(\widetilde{A})]. \tag{446}$$

Using now the two relations in Eqs. (43) and (44) of Conjecture 1 and substituing in expected dollar returns above gives:

$$\begin{aligned}\mathbb{E}\left[\mathrm{d}\widetilde{\mathbf{P}}_t\middle|\,\mathrm{sign}(\widetilde{A})\right] &= \left(\boldsymbol{\mu}_t - \Sigma_{\mathbf{P}}(\lambda_t\Pi_t + \tau_P^{1/2})\,\mathbb{E}\left[\Delta_t|\,\mathrm{sign}(\widetilde{A})\right]\mathbf{\Phi}\right)\mathrm{d}t \qquad (447)\\ &+ \mathbf{1}_{t=\tau}\left(\Delta\boldsymbol{\mu}_t + (y-\lambda_{t-}\pi_b)\,\mathbb{E}\left[\Delta_{t-}|\,\mathrm{sign}(\widetilde{A})\right]\mathbf{\Phi} + (1-\lambda_t)\frac{\tau_A}{\tau_t^c}\,\mathbb{E}\left[\widetilde{v}|\,\mathrm{sign}(\widetilde{A})\right]\mathbf{\Phi}\right),\end{aligned}$$

where y and π_b are defined in Proposition 3. It remains to compute the expectations above. Extracing Δ from $\mathbf{\Psi}$ under perfect information in Eq. (439) we can write its dynamics as:

$$\mathrm{d}\Delta_t = -\frac{\tau_P}{\tau_t^c}\Delta_t\mathrm{d}t + \mathbf{\Sigma_\Psi}\mathrm{d}\mathbf{B}_{m,t} + \mathbf{1}_{t=\tau}\left(-\frac{\tau_A+\tau_G}{\tau_t^c}\Delta_{t-} + (\tau_t^c)^{-1}\begin{pmatrix} -\tau_A & \tau_G^{1/2}\tau_M^{1/2}\mathbf{\Phi}'\boldsymbol{\xi}_t^{-1}\end{pmatrix}\widetilde{\mathbf{y}}\right). \tag{448}$$

Differentiating $\tau_t^c\Delta_t$ and integrating back then gives:

$$\Delta_t = \frac{\tau_0^c}{\tau_t^c}\Delta_0 + \int_0^t \frac{\tau_u^c}{\tau_t^c}\mathbf{\Sigma_\Psi}\mathrm{d}\mathbf{B}_{m,u} + \mathbf{1}_{t=\tau}(\tau_t^c)^{-1}\begin{pmatrix} -\tau_A & \tau_G^{1/2}\tau_M^{1/2}\mathbf{\Phi}'\boldsymbol{\xi}_t^{-1}\end{pmatrix}\widetilde{\mathbf{y}}. \tag{449}$$

Now taking expectations on both sides we get:

$$\mathbb{E}[\Delta_t|\mathrm{sign}(\widetilde{A})] = \frac{\tau_0^c}{\tau_t^c}\Delta_0\,\mathbb{E}[\Delta_0|\mathrm{sign}(\widetilde{A})] - \mathbf{1}_{t=\tau}\frac{\tau_A}{\tau_t^c}\,\mathbb{E}[\widetilde{v}|\mathrm{sign}(\widetilde{A})]. \tag{450}$$

At time 0, the empiricist's applies Bayes' rule to the initial price signal, which gives:

$$\Delta_0 = \frac{\tau_F}{\tau_0^c}\widetilde{F} - \frac{\xi_0\lambda_0\tau_F^{-1}}{\tau_0^c}\mathbf{\Phi}'\widetilde{\mathbf{m}}, \tag{451}$$

so that its conditional expectation satisfies:

$$\mathbb{E}\left[\Delta_0|\mathrm{sign}(\widetilde{A})\right] = \frac{\tau_F}{\tau_t^c}\,\mathbb{E}\left[\widetilde{F}\middle|\,\mathrm{sign}(\widetilde{A})\right] - \mathbf{1}_{t=\tau}\frac{\tau_A}{\tau_t^c}\,\mathbb{E}\left[\widetilde{v}|\mathrm{sign}(\widetilde{A})\right]. \tag{452}$$

Finally, applying Bayes' rule we can write:

$$\mathbb{E}\left[\widetilde{F}\middle|\operatorname{sign}(\widetilde{A})\right] = \frac{\int_{\mathbb{R}+}\int_{\mathbb{R}} x\frac{\tau_A^{1/2}}{\sqrt{2\pi}}\exp(-\tau_A/2(a-x)^2)\frac{\tau_F^{1/2}}{\sqrt{2\pi}}\exp(-\tau_F/2x^2)\mathrm{d}x\mathrm{d}a}{\mathbb{P}(\widetilde{A}\geq 0)} \tag{453}$$

$$= \sqrt{\frac{2}{\pi}\frac{\tau_A/\tau_F}{\tau_A+\tau_F}} \tag{454}$$

and similarly

$$\mathbb{E}\left[\widetilde{v}|\operatorname{sign}(\widetilde{A})\right] = \sqrt{\frac{2}{\pi}\frac{\tau_F/\tau_A}{\tau_A+\tau_F}}. \tag{455}$$

Substituting back into the conditional expectation for Δ gives:

$$\mathbb{E}[\Delta_t|\operatorname{sign}(\widetilde{A})] = \frac{1}{\tau_t^c}\sqrt{\frac{2}{\pi}\frac{\tau_A\tau_F}{\tau_A+\tau_F}}(1-\mathbf{1}_{t=\tau}), \tag{456}$$

and substituting this expression in turn into expected return we get:

$$\mathbb{E}\left[\mathrm{d}\widetilde{\mathbf{P}}_t\middle|\operatorname{sign}(\widetilde{A})\right] = \left(\boldsymbol{\mu}_t - \Sigma_{\mathbf{P}}(\lambda_t\Pi_t+\tau_P^{1/2})\operatorname{sign}(\widetilde{A})\frac{1}{\tau_t^c}\sqrt{\frac{2}{\pi}\frac{\tau_A\tau_F}{\tau_A+\tau_F}}(1-\mathbf{1}_{t=\tau})\mathbf{\Phi}\right)\mathrm{d}t \tag{457}$$
$$+\mathbf{1}_{t=\tau}\left(\Delta\boldsymbol{\mu}_t+\operatorname{sign}(\widetilde{A})\frac{1}{\tau_t^c}\sqrt{\frac{2}{\pi}\frac{\tau_A\tau_F}{\tau_A+\tau_F}}(y-\lambda_{t-}\pi_b+1-\lambda_t)\right)\mathbf{\Phi}$$

Pre-multiplying by $\mathbf{M}'$ we obtain the desired expression.

A.8 Proof of Proposition 6

In this appendix we formulate the risk premia of Conjecture 1 in terms of betas for all times strictly preceding the liquidation date. Consider first all non-announcement dates $t \in (0,\tau)\cup(\tau,T)$. In this case, because information flows continuously investors' and empiricist's betas must agree, and equal:

$$\boldsymbol{\beta}_t \equiv \widehat{\boldsymbol{\beta}}_t = \frac{1}{\sigma^2_{\mathbf{M},t}\mathrm{d}t}\mathrm{d}\langle\widetilde{\mathbf{P}}\rangle\mathbf{M} = \frac{1}{\sigma^2_{\mathbf{M},t}}\mathbf{\Sigma_P\Sigma_P M} \tag{458}$$

$$= \frac{1}{\sigma^2_{\mathbf{M},t}}\left((\sigma^2_{\mathbf{P}}-\tau_m^{-1}\xi^2_{2,t})\bar{\Phi}\mathbf{\Phi}+\tau_m^{-1}\xi^2_{2,t}/N\,\mathbf{1}\right), \tag{459}$$

where the instantaneous variance on market returns on non-announcement dates satisfies:

$$\sigma^2_{\mathbf{M},t}\mathrm{d}t = \mathbf{M}'\mathrm{d}\langle\widetilde{\mathbf{P}}\rangle\mathbf{M} = \mathbf{M}'\boldsymbol{\Sigma}_{\mathbf{P}}\boldsymbol{\Sigma}_{\mathbf{P}}\mathbf{M}\mathrm{d}t \tag{460}$$

$$= ((\sigma^2_{\mathbf{P}} - \tau_m^{-1}\xi^2_{2,t})\bar{\Phi}^2 + \tau_m^{-1}\xi^2_{2,t}/N)\mathrm{d}t. \tag{461}$$

Due to hedging demands, the CAPM fails. Specifically, conditioning down the asset-pricing relation in Conjecture 1 gives:

$$\mathbb{E}[\mathrm{d}\widetilde{\mathbf{P}}_t] = \dot{\boldsymbol{\xi}}_0\mathbf{M}\mathrm{d}t = -\boldsymbol{\Sigma}_{\mathbf{P}}(\Pi_{1,t}\boldsymbol{\Phi}\boldsymbol{\Phi}' + \Pi_{2,t}\,\mathbf{I})\boldsymbol{\xi}_{0,t}\mathbf{M}\mathrm{d}t \tag{462}$$

$$= -\bar{\Phi}\sigma_{\mathbf{P}}\Pi_t\xi_t\boldsymbol{\Phi}\mathrm{d}t, \tag{463}$$

where the second equality uses Eq. (554). Importantly, unlike the CAPM that holds at the horizon and whereby the cross section of expected returns is spanned by the two vectors $\boldsymbol{\Phi}$ and $\mathbf{1}$, the asset-pricing relation that holds at all other dates implies that this cross section is spanned by the single vector $\boldsymbol{\Phi}$. As in the benchmark model of Section 2, on all other dates prior to T asset loadings $\boldsymbol{\Phi}$ entirely determine cross-sectional heterogeneity in returns. Betas, however, are spanned by both $\boldsymbol{\Phi}$ and $\mathbf{1}$, which implies that when substituting betas into expected returns, the relation exhibits an intercept, i.e., the CAPM fails:

$$\mathbb{E}[\mathrm{d}\widetilde{\mathbf{P}}_t] = -\frac{\sigma_{\mathbf{P}}\Pi_t\xi_t}{\sigma^2_{\mathbf{P}} - \tau_m^{-1}\xi^2_{2,t}}\left(\sigma^2_{\mathbf{M}}\boldsymbol{\beta}_t - \tau_m^{-1}\xi^2_{2,t}/N\,\mathbf{1}\right)\mathrm{d}t. \tag{464}$$

Applying this relation to the market portfolio shows that:

$$\mathbb{E}[\mathbf{M}'\mathrm{d}\widetilde{\mathbf{P}}_t] = -\sigma_{\mathbf{P}}\Pi_t\xi_t\bar{\Phi}^2\mathrm{d}t, \tag{465}$$

which substituted back gives:

$$\mathbb{E}[\mathrm{d}\widetilde{\mathbf{P}}_t] = \mathbb{E}[\mathbf{M}'\mathrm{d}\widetilde{\mathbf{P}}_t]\left(\frac{\sigma^2_{\mathbf{M}}}{\sigma^2_{\mathbf{M}} - \tau_m^{-1}\gamma^2\tau^2_\epsilon/N}\boldsymbol{\beta}_t - \frac{\tau_m^{-1}\xi^2_{2,t}/N}{\sigma^2_{\mathbf{M}} - \tau_m^{-1}\gamma^2\tau^2_\epsilon/N}\,\mathbf{1}\right) \tag{466}$$

$$\equiv (\mathrm{s}_t\boldsymbol{\beta}_t + \alpha_t\,\mathbf{1})\mathrm{d}t, \tag{467}$$

where the first equality uses the definition of market volatility and Eq. (**??**), and in the second equality s_t denotes the slope and α_t the intercept of second-pass regressions at date t. In contrast to the CAPM at the horizon date, the CAPM here fails for everyone.

On announcement dates a wedge between investors' and empiricist's betas reappears. Specifically, the jump in expected returns caused by the announcement reactivate the second term in the law of total variance of Eq. (115). For investors, immediately prior to the announcement, the covariance matrix of returns satisfies:

$$\mathbb{V}[\Delta\widetilde{\mathbf{P}}_t|\mathscr{F}^i_{t-}] = \mathbf{b_P}\boldsymbol{\Upsilon}\mathbf{b}'_{\mathbf{P}} \tag{468}$$

$$= \mathbf{1}^\star\,\boldsymbol{\Upsilon}\,\mathbf{1}^{\star\prime} + (1-\lambda_t)\frac{\tau_t}{\tau^c_t}(\mathbf{x}\boldsymbol{\Upsilon}\,\mathbf{1}^{\star\prime} + \mathbf{1}^\star\,\boldsymbol{\Upsilon}\mathbf{x}') + (1-\lambda_t)^2\left(\frac{\tau_t}{\tau^c_t}\right)^2\mathbf{x}\boldsymbol{\Upsilon}\mathbf{x}'. \tag{469}$$

Using that:

$$\mathbf{x}\boldsymbol{\Upsilon}\mathbf{x}' = (\tau^{-1}_{t-} - \tau^{-1}_t)\boldsymbol{\Phi}\boldsymbol{\Phi}' \tag{470}$$

$$\mathbf{1}^\star\,\boldsymbol{\Upsilon}\mathbf{x}' = -\tau^{-1}_{t-}\tau^{1/2}_G\tau^{-1/2}_M\xi_t\boldsymbol{\Phi}\boldsymbol{\Phi}' \tag{471}$$

$$\mathbf{1}^\star\,\boldsymbol{\Upsilon}\,\mathbf{1}^{\star\prime} = \tau^{-1}_M\boldsymbol{\xi}_t(\mathbf{I}+\tau^{-1}_{t-}\tau_G\boldsymbol{\Phi}\boldsymbol{\Phi}')\boldsymbol{\xi}_t, \tag{472}$$

we can rewrite this expression as:

$$\mathbb{V}[\Delta\widetilde{\mathbf{P}}_t|\mathscr{F}^i_{t-}] = \tau^{-1}_M\boldsymbol{\xi}_t\boldsymbol{\xi}_t + \tau^{-1}_{t-}\left(\left(\tau^{1/2}_G\tau^{-1/2}_M\xi_t - \frac{1-\lambda_t}{1-\alpha_t}\right)^2 - \left(\frac{1-\lambda_t}{1-\alpha_t}\right)^2\frac{\tau_{t-}}{\tau_t}\right)\boldsymbol{\Phi}\boldsymbol{\Phi}'. \tag{473}$$

Turning to the econometrician, in her eyes the noise:

$$\widetilde{\mathbf{y}}^c_t \equiv \mathbf{y}_t - \mathbf{h}_t\widehat{\mathbf{z}}^c_{t-} \tag{474}$$

in signals and in trading caused by the announcement has covariance matrix:

$$\boldsymbol{\Upsilon}^c \equiv \begin{pmatrix} (\tau^c_t)^{-1} + \tau^{-1}_A & -(\tau^c_{t-})^{-1}\tau^{1/2}_G\tau^{-1/2}_M\boldsymbol{\Phi}'\boldsymbol{\xi}_t \\ -(\tau^c_{t-})^{-1}\tau^{1/2}_G\tau^{-1/2}_M\boldsymbol{\xi}_t\boldsymbol{\Phi} & \tau^{-1}_M\boldsymbol{\xi}_t(\mathbf{I}+(\tau^c_{t-})^{-1}\tau_G\boldsymbol{\Phi}\boldsymbol{\Phi}')\boldsymbol{\xi}_t \end{pmatrix}. \tag{475}$$

Hence, the empiricist perceives the covariance matrix of returns as:

$$\mathbb{V}[\Delta\widetilde{\mathbf{P}}_t|\mathscr{F}^c_{t-}] = \tau^{-1}_M\boldsymbol{\xi}_t\boldsymbol{\xi}_t + (\tau^c_{t-})^{-1}\left(\left(\tau_G\tau^{-1/2}_M\xi_t - (1-\lambda_t)\right)^2 - (1-\lambda_t)^2\frac{\tau^c_{t-}}{\tau^c_t}\right)\boldsymbol{\Phi}\boldsymbol{\Phi}'. \tag{476}$$

These two covariance matrices are related through the law of total variance as:

$$\mathbb{V}[\Delta\widetilde{\mathbf{P}}_t|\mathscr{F}^c_{t-}] = \mathbb{V}[\Delta\widetilde{\mathbf{P}}_t|\mathscr{F}^i_{t-}] \tag{477}$$

$$+\left(\frac{\left(\tau^{-1/2}_M\tau^{1/2}_G\xi_t - (1-\lambda_t)\right)^2}{\tau^c_{t-}} - \frac{\left(\tau^{-1/2}_M\tau^{1/2}_G\xi_t - \frac{1-\lambda_t}{1-\alpha_t}\right)^2}{\tau_{t-}} + \frac{(1-\lambda_t)^2\alpha_t}{(1-\alpha_t)\tau^c_t}\right)\boldsymbol{\Phi}\boldsymbol{\Phi}',$$

or equivalently in terms of betas:

$$\widehat{\boldsymbol{\beta}}_{t-} = \frac{\sigma^2_{\mathbf{M},t-}}{\widehat{\sigma}^2_{\mathbf{M},t-}}\boldsymbol{\beta}_{t-} + \frac{\bar{\Phi}}{\widehat{\sigma}^2_{\mathbf{M},t-}}\left(\frac{\left(\tau_M^{-1/2}\tau_G^{1/2}\xi_t - (1-\lambda_t)\right)^2}{\tau^c_{t-}} - \frac{\left(\tau_M^{-1/2}\tau_G^{1/2}\xi_t - \frac{1-\lambda_t}{1-\alpha_t}\right)^2}{\tau_{t-}} + \frac{(1-\lambda_2)^2\alpha_t}{(1-\alpha_t)\tau^c_t}\right)\boldsymbol{\Phi}, \tag{478}$$

where the variance of market returns as perceived by investors and the empiricist satisfy:

$$\sigma^2_{\mathbf{M},-} = \left(\frac{1}{\tau_{t-}}\left(\tau_G^{1/2}\tau_M^{-1/2}\xi_t - \frac{1-\lambda_t}{1-\alpha_t}\right)^2 - \left(\frac{1-\lambda_t}{1-\alpha_t}\right)^2\frac{1}{\tau_t} + \tau_M^{-1}(\xi_t^2 - \xi_{2,t}^2)\right)\bar{\Phi}^2 + \frac{\xi^2_{2,t}}{N}\tau_M^{-1} \tag{479}$$

and

$$\widehat{\sigma}^2_{\mathbf{M},-} = \left(\frac{1}{\tau^c_{t-}}\left(\tau_G^{1/2}\tau_M^{-1/2}\xi_t - (1-\lambda_t)\right)^2 - (1-\lambda_t)^2\frac{1}{\tau^c_t} + \tau_M^{-1}(\xi_t^2 - \xi_{2,t}^2)\right)\bar{\Phi}^2 + \frac{\xi^2_{2,t}}{N}\tau_M^{-1}. \tag{480}$$

Now compute investors' betas based on their covariance matrix:

$$\boldsymbol{\beta}_{t-} = \frac{\xi^2_{2,t}}{\tau_M N \sigma^2_{\mathbf{M}}}\mathbf{1} + \left(\tau_M^{-1}(\xi_t^2 - \xi^2_{2,t}) + \left(\frac{1}{\tau_{t-}}\left(\tau_G^{1/2}\tau_M^{-1/2}\xi_t - \frac{1-\lambda_t}{1-\alpha_t}\right)^2 - \left(\frac{1-\lambda_t}{1-\alpha_t}\right)^2\frac{1}{\tau_t}\right)\right)\frac{\bar{\Phi}}{\sigma^2_{\mathbf{M}}}\boldsymbol{\Phi}, \tag{481}$$

which substituted back in the relation between the two betas allows one to express their relation in terms of the vector $\mathbf{1}$, as opposed to $\boldsymbol{\Phi}$:

$$\widehat{\boldsymbol{\beta}}_{t-} - \mathbf{1} = \frac{\sigma^2_{\mathbf{M}}}{\widehat{\sigma}^2_{\mathbf{M}}}\left(1 + \frac{\frac{\left(\tau_M^{-1/2}\tau_G^{1/2}\xi_t-(1-\lambda_t)\right)^2}{\tau^c_{t-}} - \frac{\left(\tau_M^{-1/2}\tau_G^{1/2}\xi_t-\frac{1-\lambda_t}{1-\alpha_t}\right)^2}{\tau_{t-}} + \frac{(1-\lambda_2)^2\alpha_t}{(1-\alpha_t)\tau^c_t}}{\frac{1}{\tau_{t-}}\left(\tau_G\tau_M^{-1/2}\xi_t - \frac{1-\lambda_t}{1-\alpha_t}\right)^2 - \left(\frac{1-\lambda_t}{1-\alpha_t}\right)^2\frac{1}{\tau_t} + \tau_M^{-1}(\xi_t^2 - \xi^2_{2,t})}\right)(\boldsymbol{\beta}_{t-} - \mathbf{1}). \tag{482}$$

Now referring to the form of unconditional premia in Lemma **??** and substituting in it the relevant matrix we can write:

$$\mathbb{E}\left[\widetilde{\mathbf{P}}_t - \widetilde{\mathbf{P}}_{t-}\right] = -\bar{\Phi}\xi_{t-}\left((1-\lambda_t)\frac{\tau_A}{\tau^c_t}\pi_1^A + \left(1-(1-\lambda_t)\tau_M^{1/2}\tau_G^{1/2}/\tau^c_t\xi_t^{-1}\right)\pi\right)\boldsymbol{\Phi}. \tag{483}$$

Plugging the expression for investors' betas in it gives the beta representation from investors' perspective:

$$\mathbb{E}\left[\widetilde{\mathbf{P}}_t - \widetilde{\mathbf{P}}_{t-}\right] = \frac{-\xi_{t-}\left((1-\lambda_t)\frac{\tau_A}{\tau_t^c}\pi_1^A + \pi(1-(1-\lambda_t)\tau_M^{1/2}\tau_G^{1/2}/\tau_t^c\xi_t^{-1})\right)}{\tau_M^{-1}(\xi_t^2 - \xi_{2,t}^2) + \tau_{t-}^{-1}\left(\tau_G^{1/2}\tau_M^{-1/2}\xi_t - \frac{1-\lambda_t}{1-\alpha_t}\right)^2 - \left(\frac{1-\lambda_t}{1-\alpha_t}\right)^2\tau_t^{-1}}\left(\sigma_{\mathbf{M}}^2\boldsymbol{\beta}_{t-} - \frac{\xi_{2,t}^2}{\tau_M N}\mathbf{1}\right). \tag{484}$$

Applying this relation to the market portfolio then shows that:

$$\mathbb{E}\left[\mathbf{M}'(\widetilde{\mathbf{P}}_t - \widetilde{\mathbf{P}}_{t-})\right] = -\xi_{t-}\left((1-\lambda_t)\frac{\tau_A}{\tau_t^c}\pi_1^A + \pi(1-(1-\lambda_t)\tau_M^{1/2}\tau_G^{1/2}/\tau_t^c\xi_t^{-1})\right)\bar{\Phi}, \tag{485}$$

which once plugged back gives:

$$\mathbb{E}\left[\widetilde{\mathbf{P}}_t - \widetilde{\mathbf{P}}_{t-}\right] = \mathbb{E}\left[\mathbf{M}'(\widetilde{\mathbf{P}}_t - \widetilde{\mathbf{P}}_{t-})\right]\left(\frac{\sigma_{\mathbf{M}}^2}{\sigma_{\mathbf{M}}^2 - \gamma^2\tau_\epsilon^2\tau_M^{-1}/N}\boldsymbol{\beta}_{t-} - \frac{\gamma^2\tau_\epsilon^2\tau_M^{-1}/N}{\sigma_{\mathbf{M}}^2 - \gamma^2\tau_\epsilon^2\tau_M^{-1}/N}\mathbf{1}\right), \tag{486}$$

which is identical to Eq. (466). We conclude that for N taken to be large (a large cross section of stocks), the CAPM will be close to hold exactly. Investors and the econometrician will agree on this approximate CAPM on all non-announcement days. Yet, they will disagree about this relation on all announcement days, we now show. Substituting the vector of empiricist's betas the asset-pricing relation she perceives satisfies:

$$\mathbb{E}\left[\widetilde{\mathbf{P}}_t - \widetilde{\mathbf{P}}_{t-}\right] = \mathbb{E}\left[\mathbf{M}'(\widetilde{\mathbf{P}}_t - \widetilde{\mathbf{P}}_{t-})\right]\left(\frac{\widehat{\sigma}_{\mathbf{M}}^2}{\widehat{\sigma}_{\mathbf{M}}^2 - \gamma^2\tau_\epsilon^2\tau_M^{-1}/N}\widehat{\boldsymbol{\beta}}_{t-} - \frac{\gamma^2\tau_\epsilon^2\tau_M^{-1}/N}{\widehat{\sigma}_{\mathbf{M}}^2 - \gamma^2\tau_\epsilon^2\tau_M^{-1}/N}\mathbf{1}\right). \tag{487}$$

A.9 Proof of Lemma 2

In equilibrium we can reformulate hedging demands in Eq. (64) as:

$$\mathbf{1}^\star\mathbf{B}'_{\boldsymbol{\Psi}}((\mathbf{v}\mathbf{b} + v_3\mathbf{c})'(\mathbf{b}\boldsymbol{\Psi}^i - \boldsymbol{\xi}_0\mathbf{M}) + (v_3\mathbf{b} + v_4\mathbf{c})'\mathbf{c}\boldsymbol{\Psi}^i \tag{488}$$

$$= \left((\Pi + \gamma(\sigma_{\mathbf{P}}/\xi - \tau_m^{-1/2}))\boldsymbol{\Phi}\boldsymbol{\Phi}' + \gamma\tau_m^{-1/2}\,\mathbf{I}\right)(\mathbf{b}\boldsymbol{\Psi}^i - \boldsymbol{\xi}_0\mathbf{M}) + \Pi_3\mathbf{c}\boldsymbol{\Psi}^i$$

$$= \boldsymbol{\Sigma}_{\mathbf{P}}^{-1}(\mathbf{A}_{\boldsymbol{\Psi}}\boldsymbol{\Psi}^i + \dot{\boldsymbol{\xi}}_0\mathbf{M}) + \left(\gamma(\sigma_{\mathbf{P}}/\xi - \tau_m^{-1/2}))\boldsymbol{\Phi}\boldsymbol{\Phi}' + \gamma\tau_m^{-1/2}\,\mathbf{I}\right)(\mathbf{b}\boldsymbol{\Psi}^i - \boldsymbol{\xi}_0\mathbf{M}), \tag{489}$$

which, substituted back in Eq. (64), gives the optimal portfolio policy in equilibrium:

$$\mathbf{w}^i = -\boldsymbol{\Sigma}_{\mathbf{P}}^{-1}\left((\sigma_{\mathbf{P}}/\xi - \tau_m^{-1/2}))\boldsymbol{\Phi}\boldsymbol{\Phi}' + \tau_m^{-1/2}\,\mathbf{I}\right)(\mathbf{b}\boldsymbol{\Psi}^i - \boldsymbol{\xi}_0\mathbf{M}). \tag{490}$$

This expression shows that Π_3 is set so that investors do not bet on the wedge ℓ. Second, pre-multiplying this expression by $\mathbf{\Phi}'$ gives:

$$\mathbf{\Phi}'\mathbf{w}^i = -\frac{1}{\xi}\mathbf{\Phi}'\mathbf{b}\mathbf{\Psi}^i + \mathbf{\Phi}'\mathbf{M} \tag{491}$$

$$= -((1-\ell)(1-\alpha)/\xi - 1)\mathbf{\Phi}'\mathbf{\Psi}^i + \mathbf{\Phi}'\mathbf{M}. \tag{492}$$

B Data appendix

Although not necessarily the case theoretically, perhaps intuitively we may also expect higher trading volume and market volatility in the run-up to the announcement. Figure 9 plots intraday market volatility over 30-minute rolling windows, and reveals two patterns. First, market volatility is higher prior to announcements on PN days in sample A. In particular, the difference between market volatility on PN days and NN days before the announement in sample A is statistically significant, and only becomes insignificant closely around the announcement (see appendix). In sample B, however, pre-announcement volatility does not differ among the different types of announcements, in line with the symmetric and weak pre-announcement drifts over this period. Second, there are spikes in volatility at the announcement, suggesting that the market reacts (strongly) to published information. These spikes have on average been smaller in sample B, and thus suggests that the reaction to the announcement has decreased since the introduction of PCs. This findings is consistent with the intuition that improved forward guidance through PCs reduce uncertainty.

[to be completed]

B.1 Purgatory

In what follows, to alleviate notations we adopt the convention that the time index is omitted for all variables evaluated at instant t and that variables evaluated at time $t-$ are indexed by $-$, e.g., $\tau_{t-} \equiv \tau_-$. Using the conjectured form for $\boldsymbol{\xi}$ in Eq. (67) and substituting $\mathbf{1}^\star$ and $\mathbf{x}$, this matrix is given by:

$$\mathbf{b}'_{\mathbf{\Psi}}\mathbf{V}\mathbf{b}_{\mathbf{\Psi}} = \begin{pmatrix} (\alpha\ell/\tau^c)^2\tau_A^2 v_4 & \alpha\ell\frac{\tau_A}{\tau^c}(v_3 - v_4\alpha\ell\frac{\tau_M^{1/2}\tau_G^{1/2}}{\tau^c\xi})\mathbf{\Phi}' \\ \alpha\ell\frac{\tau_A}{\tau^c}(v_3 - v_4\alpha\ell\frac{\tau_M^{1/2}\tau_G^{1/2}}{\tau^c\xi})\mathbf{\Phi} & \mathbf{v} + \alpha\ell\frac{\tau_G^{1/2}\tau_M^{1/2}}{\tau^c\xi}(v_4\alpha\ell\frac{\tau_M^{1/2}\tau_G^{1/2}}{\tau^c\xi} - 2v_3)\mathbf{\Phi}\mathbf{\Phi}' \end{pmatrix}. \tag{493}$$

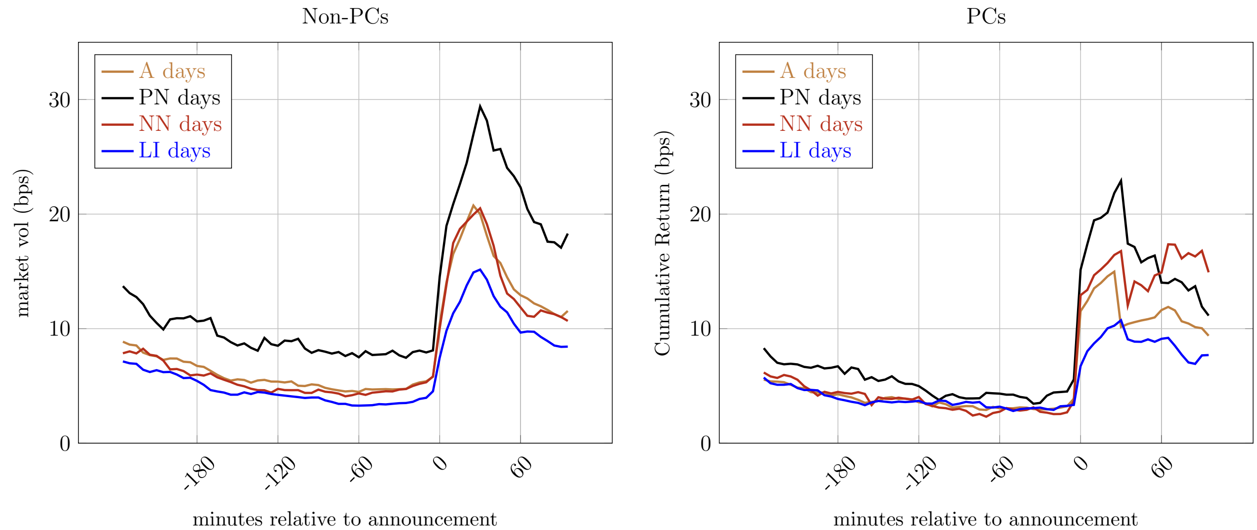

Figure 9: Market volatility on announcement days. This figure shows the average time-series volatility of a market proxy consisting of S&P500 stocks which are traded on the NYSE. The time period of sample A runs from January 2001 through March 2011. The time period of sample B runs from April 2011 (when press conferences after FOMC announcements were introduced) through December 2020. Positive news (PN) days are announcement days with a daily return that falls in the upper 75% quantile of the daily return distribution of the respective sample, and negative news (NN) days returns in the lower 25% quantile. Low information days neither belong to PN nor NN days.

Then using Eq. (251) and the definition of $\mathbf{S}$ we obtain:

$$\mathbf{S}^{-1} = \begin{pmatrix} a_{11} & a_{12}\mathbf{\Phi}' \\ a_{12}\mathbf{\Phi} & a_{22}^{\mathbf{I}}\,\mathbf{I} + a_{22}^{\mathbf{\Phi}}\mathbf{\Phi}\mathbf{\Phi}' \end{pmatrix}, \tag{494}$$

where

$$a_{11} = \tau_A\left((\alpha\ell/\tau^c)^2\tau_A v_4 + \frac{\tau-\tau_A}{\tau}\right) \tag{495}$$

$$a_{12} = \tau_A\left(\alpha\ell/\tau^c\left(v_3 - v_4\alpha\ell\frac{\tau_M^{1/2}\tau_G^{1/2}}{\tau^c\xi}\right) + \frac{\tau_G^{1/2}\tau_M^{1/2}}{\tau\xi}\right) \tag{496}$$

$$a_{22}^{\mathbf{\Phi}} = v - v_2 + \alpha\ell\frac{\tau_G^{1/2}\tau_M^{1/2}}{\tau^c\xi}\left(v_4\alpha\ell\frac{\tau_M^{1/2}\tau_G^{1/2}}{\tau^c\xi} - 2v_3\right) + \tau_M\left(\frac{\tau-\tau_G}{\tau\xi^2} - \xi_2^{-2}\right) \tag{497}$$

$$a_{22}^{\mathbf{I}} = v_2 + \tau_M/\xi_2^2. \tag{498}$$

Then using block matrix inversion we get:

$$\mathbf{S} = \begin{pmatrix} \frac{1}{a_{11}}\left(1 + \frac{a_{12}^2}{a_{11}}x\right) & -\frac{a_{11}}{a_{12}}x\mathbf{\Phi}' \\ -\frac{a_{11}}{a_{12}}x\mathbf{\Phi} & \left(x - \frac{1}{a_{22}^{\mathbf{I}}}\right)\mathbf{\Phi}\mathbf{\Phi}' + \frac{1}{a_{22}^{\mathbf{I}}}\mathbf{I} \end{pmatrix}, \tag{499}$$

where:

$$x \equiv \left(a_{22}^{\mathbf{I}} + a_{22}^{\mathbf{\Phi}} - a_{12}^2/a_{11}\right)^{-1}. \tag{500}$$

We can compute the two terms above and obtain:

$$\mathbf{b_P S 1}^{\star\prime} = \left(x\left(1 - \frac{1-\lambda}{\tau^c}\left(\frac{\tau_M^{1/2}\tau_G^{1/2}}{\xi} + \frac{a_{12}}{a_{11}}\tau_A\right)\right) - (v_2 + \tau_M/\xi_2^2)^{-1}\right)\mathbf{\Phi\Phi}' \tag{501}$$
$$+ (v_2 + \tau_M/\xi_2^2)^{-1}\,\mathbf{I}$$
$$\mathbf{b_P S x}' = \tau^{-1}\left(x\left(\tau_A\frac{a_{12}}{a_{11}} + \frac{\tau_G^{1/2}\tau_M^{1/2}}{\xi}\right)\left(\frac{1-\lambda}{\tau^c}\left(\tau_A\frac{a_{12}}{a_{11}} + \frac{\tau_G^{1/2}\tau_M^{1/2}}{\xi}\right) - 1\right) + \frac{\tau_A^2(1-\lambda)}{\tau^c a_{11}}\right)\mathbf{\Phi\Phi}'. \tag{502}$$

Substituting the coefficients defined above, tedious computations then show that:

$$\mathbf{\Phi}'\mathbf{b_P S 1}^{\star\prime}\mathbf{\Phi} = \tag{503}$$
$$\frac{\xi\left(\alpha\ell\tau\left((1-\alpha)\xi v_3\tau_A + \tau^c\tau_M^{1/2}\tau_G^{1/2}\right) + \alpha^2\ell^2\xi\tau\left(v_3 - v_4\right)\tau_A + \tau^c\left((1-\alpha)\tau\tau_M^{1/2}\tau_G^{1/2} + \xi\tau_-\tau^c\right)\right)}{\alpha^2\ell^2\tau\left(\xi^2\left(v_3^2 - vv_4\right)\tau_A - v_4\tau_M\left(\tau_A + \tau_G\right)\right) + 2\alpha\ell\xi\tau\tau^c v_3\tau_M^{1/2}\tau_G^{1/2} - (\tau^c)^2\left(\tau_M\left(\tau_- - \tau_G\right) + \xi^2\tau_- v\right)}$$

and

$$\mathbf{\Phi}'\mathbf{b_P S x}'\mathbf{\Phi} = \tag{504}$$
$$\frac{\tau^c\left(\alpha\ell\left(\xi^2\left(v_3 - v\right)\tau_A - \tau_M\left(\tau_A + \tau_G\right)\right) - (1-\alpha)\left(\tau_M\left(\tau_A + \tau_G\right) + \xi^2 v\tau_A\right) + \xi\tau^c\tau_M^{1/2}\tau_G^{1/2}\right)}{\alpha^2\ell^2\tau\left(\xi^2\left(v_3^2 - vv_4\right)\tau_A - v_4\tau_M\left(\tau_A + \tau_G\right)\right) + 2\alpha\ell\xi\tau\tau^c v_3\tau_M^{1/2}\tau_G^{1/2} - (\tau^c)^2\left(\tau_M\left(\tau_- - \tau_G\right) + \xi^2\tau_- v\right)}.$$

The idea now is to use the two alternative expressions for the price noise-signal ratio in Eqs. (**??**) and (**??**) to simplify Eqs. (**??**) and (**??**) for λ_- and ξ_-, respectively. We start with λ_-. To obtain an intuitive expression for λ_- we exploit the definition of $\mathbf{a_P}$. We go back to the market-clearing condition in Eq. (324) and rewrite it as:

$$\mathbf{a_P} = \mathbf{b_P S b}'_{\mathbf{\Psi}}(\mathbf{b}'(v\mathbf{b} + v_3\mathbf{c}) + \mathbf{c}'(v_3\mathbf{b} + v_4\mathbf{c}))(\mathbf{I} + \mathbf{a_\Psi}) + \gamma\mathbf{b_P S b}'_{\mathbf{P}}\mathbf{1}^{\star\prime}\mathbf{\Gamma}_{t-}^{-1} \tag{505}$$
$$= \mathbf{b_P S}(-\mathbf{1}^{\star\prime}(v\mathbf{b} + v_3\mathbf{c}) - \alpha\ell\tau/\tau^c\mathbf{x}'(v_3\mathbf{b} + v_4\mathbf{c}))(\mathbf{I} + \mathbf{a_\Psi}) - \gamma\mathbf{b_P S b}'_{\mathbf{P}}\boldsymbol{\xi}_-^{-1}\mathbf{b}_-, \tag{506}$$

where the second line uses the identities in Eqs. (208) and (209) and also Eq. (349). Now take the left-hand column of $\mathbf{a_P}$, which we temporarily denote by $\mathbf{a_P}^L$:

$$\begin{aligned}\mathbf{a_P}^L = &-\frac{\tau_-^c}{\tau^c}\mathbf{b_P}\mathbf{S}((\bar{v}_1 - \alpha(1-\ell)v)\mathbf{1}^\star + \alpha\ell\tau/\tau^c(\bar{v}_2 - \alpha(1-\ell)v_3)\mathbf{x})'\mathbf{\Phi} \\ &- \gamma\mathbf{b_P}\mathbf{S}\mathbf{b_P}'\boldsymbol{\xi}_-^{-1}(1-\ell_-)(1-\alpha_-)\mathbf{\Phi}.\end{aligned} \tag{507}$$

Using the second expression we obtained for the price noise-signal ratio in Eq. (**??**) we can write:

$$\gamma\mathbf{b_P}\mathbf{S}\mathbf{b_P}'\boldsymbol{\xi}_-^{-1}(1-\ell_-)(1-\alpha_-)\mathbf{\Phi} = -\frac{\tau_-^c}{\tau}\mathbf{b_P}\mathbf{S}(\bar{v}_1\mathbf{1}^\star + (\alpha\ell\tau/\tau^c\bar{v}_2 + \tau)\mathbf{x})'\mathbf{\Phi}. \tag{508}$$

Substituting back gives:

$$\mathbf{a_P}^L = -\frac{\tau_-^c}{\tau^c}\mathbf{b_P}\mathbf{S}(\alpha\ell v_3\mathbf{1}^\star + (\alpha^2\ell^2\tau/\tau^c v_4 - \tau^c)\mathbf{x})'\mathbf{\Phi} \tag{509}$$

Further substituting the expressions we obtained in Eqs. (501) and (502) and simplifying this gives:

$$\mathbf{a_P}^L = (\lambda-1)\frac{\tau_-^c}{\tau^c} - \frac{\tau_-^c\left(\frac{\alpha\ell\xi\sqrt{\tau_G\tau_M}(v_3-\alpha\bar{v}_2)}{\alpha-1} - \xi\tau^c\tau_G^{\frac{1}{2}}\tau_M^{\frac{1}{2}} + \tau(\alpha(\ell-1)+1)\tau_M + \xi^2\tau(v-\alpha\bar{v}_1)\right)}{\frac{\alpha^2\ell^2\left(\xi^2\left(vv_4-v_3^2\right)\tau_A + v_4\tau_M(\tau-\tau_-)\right)}{\alpha-1} + 2\alpha\ell\xi\tau v_3\tau_G^{\frac{1}{2}}\tau_M^{\frac{1}{2}} - \tau^c\left(\xi^2 v\left(\tau_G+\tau_-\right) + \tau_-\tau_M\right)}. \tag{510}$$

But the definition of $\mathbf{a_P}$ tells us that the coefficient in the first column is:

$$\mathbf{a_P}^L = 1 - \lambda_- - (1-\lambda)\tau_-^c/\tau. \tag{511}$$

This identification between the first column of $\mathbf{a_P}$ as implied by market clearing and its definition gives an equation for λ_-, which we can solve to obtain an expression for it:

$$\lambda_- = 1 + \frac{\tau_-^c}{\tau_-}\frac{\frac{\alpha\ell\xi\sqrt{\tau_G\tau_M}(v_3-\alpha\bar{v}_2)}{\alpha-1} - \xi\tau^c\sqrt{\tau_G\tau_M} + \tau(\alpha(\ell-1)+1)\tau_M + \xi^2\tau(v-\alpha\bar{v}_1)}{\frac{\alpha^2\ell^2\left(\xi^2\left(v_3^2-vv_4\right)\tau_A - v_4\tau_M(\tau-\tau_-)\right)}{(1-\alpha)\tau_-} + \frac{2\alpha\ell\xi\tau v_3\sqrt{\tau_G\tau_M}}{\tau_-} - \tau^c\left(\xi^2 v\left(\frac{\tau_G}{\tau_-}+1\right) + \tau_M\right)} \tag{512}$$

This expression indeed looks like a weight but one that does not assign the optimal Bayesian weight to fundamentals in prices. To get some intuition into it, suppose that the equilibrium absent residual uncertainty prevails post-announcement, i.e., $\ell \equiv 0$. In this case, this expression simplifies to:

$$\lambda_{t-} = 1 - \underbrace{\frac{\tau^c_{t-}}{\tau_{t-}}}_{\equiv 1-\alpha_{t-}} \frac{v_t\xi_t^2 - \xi_t\tau_{G,t}^{1/2}\tau_M^{1/2} + \tau_M}{v_t\xi_t^2(1+\tau_{t-}^{-1}\tau_{G,t}) + \tau_M}. \tag{513}$$

This expression shows that $\lambda_{t-} \neq \alpha_{t-}$ pre-announcement, if and only if there is a discontinuity in price informativeness upon the announcement, $\tau_G \neq 0$; in other words, after the announcement τ_P falls to 0 and for a distortion to occur on the announcement the equilibrium in which $\ell \neq 0$ must prevail pre-announcement.

We then obtain $\boldsymbol{\xi}_{t-}$ from Eq. (**??**), which we can reorganize as:

$$\boldsymbol{\xi}_{t-} = \boldsymbol{\xi}_t - \mathbf{b_P}\mathbf{S}\left(\mathbf{1}^{\star\prime}(\gamma + \mathbf{v}\boldsymbol{\xi}_t) + \frac{\tau_t}{\tau^c_t}(\gamma(1-\alpha_t(1-\ell_t))\mathbf{x}' + v_{3,t}\alpha_t\ell_t\mathbf{x}'\boldsymbol{\xi}_t)\right). \tag{514}$$

We then get an equation for $\xi_{t-} \equiv \xi_{1,t-} + \xi_{2,t-}$ by pre- and post-multiplying Eq. (514) by $\boldsymbol{\Phi}$:

$$\xi_{t-} = \xi_t - \left((\gamma + v_t\xi_t)\boldsymbol{\Phi}'\mathbf{b_P}\mathbf{S}\mathbf{1}^{\star\prime}\boldsymbol{\Phi} + \frac{\tau_t}{\tau^c_t}(\gamma(1-\alpha_t(1-\ell_t) + v_{3,t}\alpha_t\ell_t\xi_t)\boldsymbol{\Phi}'\mathbf{b_P}\mathbf{S}\mathbf{x}'\boldsymbol{\Phi}\right), \tag{515}$$

into which we can substitute Eqs. (503) and (504) and which gives an explicit, although messy expression for ξ_{t-}. In the case in which $\ell \equiv 0$ post-announcement, this expression simplifies to:

$$\xi_{t-} = \frac{-\gamma\xi_t^2(v_t/\tau_t\tau_A + \tau_{t-} + \tau_{G,t}) + \xi_t(2\gamma + v_t\xi_t)\tau_{G,t}^{1/2}\tau_M^{1/2} + (\xi_t\tau_{t-} - \gamma(1-\tau_{t-}/\tau_t))\tau_M}{v_t\xi_t^2(\tau_{t-} + \tau_{G,t}) + \tau_{t-}\tau_M}. \tag{516}$$

Using the definition of τ_G and Eq. (513) for the price signal-noise ratio, which in this case simplifies to

$$\lambda_{t-}\boldsymbol{\Phi}'\boldsymbol{\xi}_{t-}^{-1}\boldsymbol{\Phi} = (\tau_{t-} - \tau^c_{t-})\frac{\xi_t(v_t+\tau_t)\tau_{G,t}^{1/2}\tau_M^{1/2} - (\tau_t - \tau_{t-})\tau_M - v_t\xi_t^2\tau_t}{\gamma(\xi_t^2(v_t\tau_A + \tau_t(\tau_{t-} + \tau_{G,t})) - 2\tau_t\xi_t\tau_{G,t}^{1/2}\tau_M^{1/2} + (\tau_t - \tau_{t-})\tau_M)}, \tag{517}$$

we can obtain the following, even simpler expression:

$$\xi_{t-} = \frac{\sqrt{\tau_M}\xi_t\tau_t\left(\sqrt{\tau_M}\xi_t\tau^c_{t-}\sqrt{\tau_{G,t}} + \xi_t^2 v_t\left(\tau_{G,t} - \tau^c_{t-} + \tau_{t-}\right) + \tau_M\left(\tau_{t-} - \tau^c_{t-}\right)\right)}{\left(\xi_t\tau_t\sqrt{\tau_{G,t}} + \sqrt{\tau_M}\left(\tau_{t-} - \tau^c_{t-}\right)\right)\left(\xi_t^2 v_t\left(\tau_{G,t} + \tau_{t-}\right) + \tau_M\tau_{t-}\right)}. \tag{518}$$

Next we get an equation for τ_G by using its definition, which we reorganize as:

$$(\tau_M^{-1/2}\tau_{G,t}^{1/2} + \alpha_t(1-\ell_t)\xi_t^{-1})/\alpha_{t-} = (1-\ell_{t-})\xi_{t-}^{-1}, \tag{519}$$

and in which we substitute Eq. (??) on the right-hand side. Eq. (??) itself relies on the computations of the two terms $(\mathbf{b_P S b'_P})^{-1}\mathbf{b_P S 1^{\star\prime}}$ and $(\mathbf{b_P S b'_P})^{-1}\mathbf{b_P S x'}$. Tedious computations show that these two terms are given by:

$$\mathbf{\Phi}'(\mathbf{b_P S b'_P})^{-1}\mathbf{b_P S 1^{\star\prime}}\mathbf{\Phi} = \tag{520}$$
$$\frac{\xi\left(\tau^c\left(\xi\tau^c(\tau-\tau_A)-\tau(1-\alpha(1-\ell))\sqrt{\tau_G\tau_M}\right)+\alpha\ell\xi\tau\tau_A(\alpha\bar{v}_2-v_3)\right)}{\tau\tau_A(1-\alpha(1-\ell))^2\tau_M-\xi^2(\tau^c)^2\tau_A+\xi^2\tau\tau_A(v+\alpha(\alpha\bar{v}-2\bar{v}_1))+\tau\left(\xi\tau^c-(1-\alpha(1-\ell))\sqrt{\tau_G\tau_M}\right)^2}$$

and

$$\mathbf{\Phi}'(\mathbf{b_P S b'_P})^{-1}\mathbf{b_P S x'}\mathbf{\Phi} = \tag{521}$$
$$\frac{\tau^c\left((1-\alpha(1-\ell))\tau_M(\tau_A+\tau_G)+\xi^2\tau_A(v-\alpha\bar{v}_1)-\xi\tau^c\sqrt{\tau_G\tau_M}\right)}{\tau\tau_A(1-\alpha(1-\ell))^2\tau_M-\xi^2(\tau^c)^2\tau_A+\xi^2\tau\tau_A(v+\alpha(\alpha\bar{v}-2\bar{v}_1))+\tau\left(\xi\tau^c-(1-\alpha(1-\ell))\sqrt{\tau_G\tau_M}\right)^2}.$$

Substituting in turn Eqs. (389) and (399) into Eq. (32) and simplifying shows that $\mathbf{V}_{t-}$ can indeed be expressed in terms of the two matrices $\mathbf{b}_{t-}$ and $\mathbf{c}_{t-}$; in particular, defining the following four matrices:

$$\mathbf{w}_{1,t} \equiv \mathbf{v}_t - (\mathbf{v}_t\mathbf{b}_t + v_{3,t}\mathbf{c}_t)\mathbf{b_\Psi S b'_\Psi}(\mathbf{v}_t\mathbf{b}_t + v_{3,t}\mathbf{c}_t)' \tag{522}$$
$$\mathbf{w}_{2,t} \equiv \mathbf{\Phi}'(v_{3,t} - (\mathbf{v}_t\mathbf{b}_t + v_{3,t}\mathbf{c}_t)\mathbf{b_\Psi S b'_\Psi}(v_{3,t}\mathbf{b}_t + v_{4,t}\mathbf{c}_t)')\mathbf{\Phi\Phi\Phi}' \tag{523}$$
$$\mathbf{w}_{3,t} \equiv \mathbf{\Phi}'(v_{4,t}\,\mathbf{I} - (v_{3,t}\mathbf{b}_t + v_{4,t}\mathbf{c}_t)\mathbf{b_\Psi S b'_\Psi}(v_{3,t}\mathbf{b}_t + v_{4,t}\mathbf{c}_t)')\mathbf{\Phi\Phi\Phi}' \tag{524}$$
$$\mathbf{z}_t \equiv -\frac{1-\alpha_{t-}}{\alpha_{t-}}\xi_t\tau_{G,t}^{1/2}\tau_M^{-1/2}\mathbf{\Phi\Phi}', \tag{525}$$

we can write:

$$\begin{aligned}\mathbf{V}_{t-} &= \mathbf{b}'_{t-}\boldsymbol{\xi}_{t-}^{-1}(\boldsymbol{\xi}_t\mathbf{w}_{1,t}\boldsymbol{\xi}_t + \gamma^2\mathbf{b_P S b'_P})\boldsymbol{\xi}_{t-}^{-1}\mathbf{b}_{t-} \\ &+ \frac{1}{\ell_{t-}}\mathbf{c}'_{t-}\left(\mathbf{z}'_t\mathbf{w}_{1,t} + \ell_t\frac{\tau^c_{t-}}{\tau^c_t}\mathbf{w}'_{2,t}\right)\boldsymbol{\xi}_t\boldsymbol{\xi}_{t-}^{-1}\mathbf{b}_{t-} + \frac{1}{\ell_{t-}}\mathbf{b}'_{t-}\boldsymbol{\xi}_{t-}^{-1}\boldsymbol{\xi}_t\left(\mathbf{w}'_{1,t}\mathbf{z}_t + \ell_t\frac{\tau^c_{t-}}{\tau^c_t}\mathbf{w}_{2,t}\right)\mathbf{c}_{t-} \\ &+ \frac{1}{\ell_{t-}^2}\mathbf{c}'_{t-}\left(\mathbf{z}'_t\mathbf{w}_{1,t}\mathbf{z}_t + \ell_t\frac{\tau^c_{t-}}{\tau^c_t}(\mathbf{z}'_t\mathbf{w}_{2,t} + \mathbf{w}'_{2,t}\mathbf{z}_t) + \left(\ell_t\frac{\tau^c_{t-}}{\tau^c_t}\right)^2\mathbf{w}_{3,t}\right)\mathbf{c}_{t-}.\end{aligned} \tag{526}$$

It remains to compute the matrices $\mathbf{w}_\cdot$ involved in the middle term in each line by substituting the relevant matrices. Using the relations in Eqs. (208) and (209) we first rewrite $\mathbf{w}.$ as:

$$\mathbf{w}_{1,t} = \mathbf{v}_t - (\mathbf{v}_t \mathbf{1}^\star \mathbf{S} \mathbf{1}^{\star'} \mathbf{v}_t + 2 v_t v_{3,t} \alpha_t \ell_t \tau_t / \tau_t^c \mathbf{x} \mathbf{S} \mathbf{1}^{\star'} + v_{3,t}^2 (\alpha_t \ell_t \tau_t / \tau_t^c)^2 \mathbf{x} \mathbf{S} \mathbf{x}') \tag{527}$$

$$\mathbf{w}_{2,t} = \mathbf{\Phi}' \begin{pmatrix} v_{3,t} - v_{3,t} \mathbf{v}_t \mathbf{1}^\star \mathbf{S} \mathbf{1}^{\star'} \\ -(v_{3,t}^2 + v_t v_{4,t}) \alpha_t \ell_t \tau_t / \tau_t^c \mathbf{x} \mathbf{S} \mathbf{1}^{\star'} - v_{3,t} v_{4,t} (\alpha_t \ell_t \tau_t / \tau_t^c)^2 \mathbf{x} \mathbf{S} \mathbf{x}' \end{pmatrix} \mathbf{\Phi} \mathbf{\Phi} \mathbf{\Phi}' \tag{528}$$

$$\mathbf{w}_{3,t} = \mathbf{\Phi}' \begin{pmatrix} v_{4,t} - v_{3,t}^2 \mathbf{1}^\star \mathbf{S} \mathbf{1}^{\star'} \\ -2 v_{3,t} v_{4,t} \alpha_t \ell_t \tau_t / \tau_t^c \mathbf{x} \mathbf{S} \mathbf{1}^{\star'} - v_{4,t}^2 (\alpha_t \ell_t \tau_t / \tau_t^c)^2 \mathbf{x} \mathbf{S} \mathbf{x}' \end{pmatrix} \mathbf{\Phi} \mathbf{\Phi} \mathbf{\Phi}'. \tag{529}$$

All these expressions involve $\mathbf{x}\mathbf{S}\mathbf{x}'$, $\mathbf{x}\mathbf{S}\mathbf{1}^{\star'}$ and $\mathbf{1}^\star\mathbf{S}\mathbf{1}^{\star'}$, each of which we can compute using Eq. (499):

$$\mathbf{x} \mathbf{S} \mathbf{1}^{\star'} = -\tau_t^{-1} x (\tau_A a_{12}/a_{11} + \tau_{G,t}^{1/2} \tau_M^{1/2} \xi_t^{-1}) \mathbf{\Phi} \mathbf{\Phi}' \tag{530}$$

$$\mathbf{x} \mathbf{S} \mathbf{x}' = \tau_t^{-2} \left(\tau_A^2 / a_{11} + a_{12}/a_{11} x (\tau_A a_{12}/a_{11} + 2 \tau_{G,t}^{1/2} \tau_M^{1/2} \xi_t^{-1}) + x \tau_{G,t} \tau_M \xi_t^{-2} \right) \mathbf{\Phi} \mathbf{\Phi}' \tag{531}$$

$$\mathbf{1}^\star \mathbf{S} \mathbf{1}^{\star'} = 1/a_{22}^{\mathbf{I}} \, \mathbf{I} + (x - 1/a_2^{\mathbf{I}}) \mathbf{\Phi} \mathbf{\Phi}'. \tag{532}$$

We then obtain boundary conditions for the $v.$ coefficients by separating terms in Eq. (526):

$$v_{t-} = \xi_{t-}^{-2} (\xi_t^2 \mathbf{\Phi}' \mathbf{w}_{1,t} \mathbf{\Phi} + \gamma^2 \mathbf{\Phi}' \mathbf{b}_\mathbf{P} \mathbf{S} \mathbf{b}_\mathbf{P}' \mathbf{\Phi}) \tag{533}$$

$$v_{2,t-} = \frac{\xi_{2,t}^2 (v_{2,t} \tau_M + \gamma^2)}{\xi_{2,t-}^2 (\xi_{2,t}^2 v_{2,t} + \tau_M)} \tag{534}$$

$$v_{3,t-} = \frac{1}{\ell_{t-}} \left(\mathbf{\Phi}' \mathbf{z}_t' \mathbf{w}_{1,t} \mathbf{\Phi} + \ell_t \frac{\tau_{t-}^c}{\tau_t^c} \mathbf{\Phi}' \mathbf{w}_{2,t}' \mathbf{\Phi} \right) \xi_t \xi_{t-}^{-1} \tag{535}$$

$$v_{4,t-} = \frac{1}{\ell_{t-}^2} \mathbf{\Phi}' \left(\mathbf{z}_t' \mathbf{w}_{1,t} \mathbf{z}_t + \ell_t \frac{\tau_{t-}^c}{\tau_t^c} (\mathbf{z}_t' \mathbf{w}_{2,t} + \mathbf{w}_{2,t}' \mathbf{z}_t) + \left(\ell_t \frac{\tau_{t-}^c}{\tau_t^c} \right)^2 \mathbf{w}_{3,t} \right) \mathbf{\Phi}, \tag{536}$$

where $v_{1,t-} = v_{t-} - v_{2,t-}$, where we used once more that $\mathbf{c} \equiv \mathbf{\Phi}\mathbf{\Phi}'\mathbf{c}$, and where tedious computations based on those following Eq. (499) show that:

$$\mathbf{\Phi}' \mathbf{b}_\mathbf{P} \mathbf{S} \mathbf{b}_\mathbf{P}' \mathbf{\Phi} = \frac{\tau_t \tau_A (1 - \alpha_t (1 - \ell_t))^2}{\alpha_t^2 \ell_t^2 \tau_t v_{4,t} \tau_A + \tau_{t-} (\tau_t^c)^2} \\ + \frac{x \left(\alpha_t \ell_t \xi_t \tau_t \tau_A \left(v_{3,t} - \alpha \bar{v}_2 \right) + \tau_t \tau_t^c \sqrt{\tau_{G,t}} (1 - \alpha_t (1 - \ell_t)) \sqrt{\tau_M} - \xi_t \tau_{t-} (\tau_t^c)^2 \right)^2}{\left(\alpha_t^2 \ell_t^2 \xi_t \tau_t v_{4,t} \tau_A + \xi_t \tau_{t-} (\tau_t^c)^2 \right)^2}. \tag{537}$$

This verifies that the conjecture in Eq. (49) also holds pre-announcement. Furthermore, in the case in which we select the $\ell \equiv 0$ equilibrium post-annnouncement, these boundary conditions further simplify to:

$$v_{1,t-} = -\gamma\xi_{t-}^{-1} + \frac{\xi_t(\gamma v_t \xi_t \tau_{G,t}^{1/2}\tau_M^{1/2} + \tau_{t-}\tau_M(\xi_t v_t + \gamma))}{\xi_{t-}^2(v_t\xi_t^2(\tau_{t-} + \tau_{G,t}) + \tau_{t-}\tau_M)} - \frac{\xi_{2,t}^2(v_{2,t}\tau_M + \gamma^2)}{\xi_{2,t-}^2(\xi_{2,t}^2 v_{2,t} + \tau_M)} \tag{538}$$

$$v_{2,t-} = \frac{\xi_{2,t}^2(v_{2,t}\tau_M + \gamma^2)}{\xi_{2,t-}^2(\xi_{2,t}^2 v_{2,t} + \tau_M)} \tag{539}$$

$$v_{3,t-} = \frac{\xi_t v_t \tau_M^{1/2}\tau_{t-}}{\xi_{t-}(\tau_M^{1/2}\tau_{t-} + v_t\xi_t\tau_{G,t}^{1/2})} \tag{540}$$

$$v_{4,t-} = \frac{v_t\tau_{t-}(v_t\xi_t^2(\tau_{t-} + \tau_{G,t}) + \tau_{t-}\tau_M)}{(v_t\xi_t\tau_{G,t}^{1/2} + \tau_{t-}\tau_M^{1/2})^2}, \tag{541}$$

with

$$\mathbf{\Phi}'\mathbf{b_P}\mathbf{S}\mathbf{b_P}'\mathbf{\Phi} = -\xi_{t-}/\gamma + \frac{\xi_t(v_t\xi_t\tau_{G,t}^{1/2}\tau_M^{1/2} + \tau_{t-}\tau_M)}{\gamma(v_t\xi_t^2(\tau_{t-} + \tau_{G,t}) + \tau_{t-}\tau_M)}. \tag{542}$$

We then repeat these operations on Eq. (31), which determines $\mathbf{U}$ immediately prior to the announcement. Substituting the market-clearing condition in Eqs. (323) and (324) into this equation we get:

$$\mathbf{U}_{t-} = (\mathbf{I} + \mathbf{a_\Psi})(\mathbf{I} - \mathbf{V}_t\mathbf{b_\Psi}\mathbf{S}\mathbf{b_\Psi}')\mathbf{U}_t - \gamma^2\mathbf{b}_{t-}'\boldsymbol{\xi}_{t-}^{-1}\mathbf{b_P}\mathbf{S}\mathbf{b_P}'\mathbf{M}. \tag{543}$$

Further substituting Eq. (49) and using the coefficients $\mathbf{w}$. this becomes:

$$\mathbf{U}_{t-} = -(\mathbf{I} + \mathbf{a_\Psi})'\mathbf{b}_t'\mathbf{w}_{1,t}\boldsymbol{\xi}_{0,t}\mathbf{M} - \gamma^2\mathbf{b}_{t-}'\boldsymbol{\xi}_{t-}^{-1}\mathbf{b_P}\mathbf{S}\mathbf{b_P}'\mathbf{M} - (\mathbf{I} + \mathbf{a_\Psi})'\mathbf{c}_t'\mathbf{w}_{2,t}'\boldsymbol{\xi}_{0,t}\mathbf{M}. \tag{544}$$

Now using the relation in Eq. (399) we get:

$$\begin{aligned}\mathbf{U}_{t-} &= -\mathbf{b}_{t-}'\boldsymbol{\xi}_{t-}^{-1}\left(\boldsymbol{\xi}_t\mathbf{w}_{1,t}\boldsymbol{\xi}_t + \gamma^2\mathbf{b_P}\mathbf{S}\mathbf{b_P}'\right)\boldsymbol{\xi}_{t-}^{-1}\boldsymbol{\xi}_{t-}\mathbf{M} \\ &\quad - \frac{1}{\ell_{t-}}\mathbf{c}_{t-}(\mathbf{z}'\mathbf{w}_{1,t} + \tau_{t-}^c/\tau_t^c\ell_t\mathbf{w}_{2,t})\boldsymbol{\xi}_{0,t}\boldsymbol{\xi}_{t-}^{-1}\boldsymbol{\xi}_{t-}\mathbf{M}\end{aligned} \tag{545}$$

and given that we proved $\mathbf{u}_t \equiv -\mathbf{v}_t$ and $\boldsymbol{\xi}_{0,t} \equiv \boldsymbol{\xi}_t$, Eq. (526) says that:

$$\mathbf{U}_{t-} = -(\mathbf{b}_{t-}'\mathbf{v}_{t-} + v_{3,t-}\mathbf{c}_{t-})\boldsymbol{\xi}_{t-}\mathbf{M}, \tag{546}$$

which validates Eq. (49) on the announcement date and shows that Eq. (63) holds there, too.

Using Eq. (499) we can write:

$$\mathbf{S}\,\mathbf{1}^{\star'} = \begin{pmatrix} -a_{11}/a_{12}x\mathbf{\Phi}' \\ (x - 1/a^{\mathbf{I}}_{22})\mathbf{\Phi}\mathbf{\Phi}' + 1/a^{\mathbf{I}}_{22}\,\mathbf{I} \end{pmatrix} \tag{547}$$

and

$$\mathbf{S}\mathbf{x}' = \begin{pmatrix} \left(\frac{\tau_A}{a_{11}}(1 + a^2_{12}/a_{11}x) + a_{11}/a_{12}x\tau_M^{1/2}\tau_G^{1/2}\xi_t^{-1}\right)\mathbf{\Phi}' \\ -x(\tau_A a_{11}/a_{12} + \tau_M^{1/2}\tau_G^{1/2}\xi_t^{-1})\mathbf{\Phi}\mathbf{\Phi}' \end{pmatrix}, \tag{548}$$

which substituted back gives the form in Eq. (42) with the identification:

$$\pi_1^A = \left((\gamma + \xi_t \upsilon_t)x\frac{a_{11}}{a_{12}} - \frac{\tau_t}{\tau_t^c}(\alpha_t \ell_t \upsilon_{3,t}\xi_t + \gamma(1-\lambda_t))\left(\frac{\tau_A}{a_{11}}\left(1 + \frac{a^2_{12}}{a_{11}}x\right) + \frac{a_{11}}{a_{12}}x\tau_M^{1/2}\tau_G^{1/2}\xi_t^{-1}\right)\right)\xi_{t-}^{-1} \tag{549}$$

$$\pi_1 = \left(\frac{\tau_t}{\tau_t^c}(\alpha_t \ell_t \upsilon_{3,t}\xi_t + \gamma(1-\ell_t))x\left(\tau_A\frac{a_{11}}{a_{12}} + \tau_M^{1/2}\tau_G^{1/2}\xi_t^{-1}\right) - (\gamma + \upsilon_t\xi_t)x\right)\xi_{t-}^{-1} - \pi_2 \tag{550}$$

$$\pi_2 = -(\gamma + \upsilon_{2,t}\xi_{2,t})\xi^{-1}_{2,t-}/a^{\mathbf{I}}_{22} \tag{551}$$

$$\pi_2^A = \frac{1}{\ell_{t-}}\begin{pmatrix} \left(\frac{1-\alpha_{t-}}{\alpha_{t-}}\tau_G^{1/2}\tau_M^{-1/2}\upsilon_t + \ell_t\frac{\tau^c_{t-}}{\tau^c_t}\upsilon_{3,t}\right)\frac{a_{11}}{a_{12}}x \\ -\frac{\alpha_t}{1-\alpha_t}\ell_t\left(\frac{1-\alpha_{t-}}{\alpha_{t-}}\tau_G^{1/2}\tau_M^{-1/2}\upsilon_{3,t} + \ell_t\frac{\tau^c_{t-}}{\tau^c_t}\upsilon_{4,t}\right)\left(\frac{\tau_A}{a_{11}}\left(1 + \frac{a^2_{12}}{a_{11}}x\right) + \frac{a_{11}}{a_{12}}x\tau_M^{1/2}\tau_G^{1/2}\xi_t^{-1}\right) \end{pmatrix} \tag{552}$$

$$\pi_3 = \frac{1}{\ell_{t-}}\begin{pmatrix} \frac{\alpha_t}{1-\alpha_t}\ell_t\left(\frac{1-\alpha_{t-}}{\alpha_{t-}}\tau_G^{1/2}\tau_M^{-1/2}\upsilon_{3,t} + \ell_t\frac{\tau^c_{t-}}{\tau^c_t}\upsilon_{4,t}\right)x\left(\tau_A\frac{a_{11}}{a_{12}} + \tau_M^{1/2}\tau_G^{1/2}\xi_t^{-1}\right) \\ -x\left(\frac{1-\alpha_{t-}}{\alpha_{t-}}\tau_G^{1/2}\tau_M^{-1/2}\upsilon_t + \ell_t\frac{\tau^c_{t-}}{\tau^c_t}\upsilon_{3,t}\right) \end{pmatrix}. \tag{553}$$

Substituting Eqs. (**??**) and (406) into the second equation then shows $\pi_2 \equiv 0$ and thus:

$$\Pi_{2,t} \equiv 0 \tag{554}$$

and the solution in Eq. (360) hold at all dates. The other identities are not particularly intuitive; yet they take simpler expressions if we assume that the equilibrium with $\ell_t \equiv 0$

holds post-announcement:

$$\pi_1^A = \frac{\xi_t\sqrt{\tau_G}\sqrt{\tau_M}(\gamma + \xi_t v_t) - \gamma\tau_t(\tau_M + \xi_t^2 v_t)}{\xi_t^2 v_t \tau_G + \tau_{t-}(\tau_M + \xi_t^2 v_t)} \tag{555}$$

$$\pi_1 = -\frac{\xi_t\left(\xi_t\left(\tau_{t-} + \tau_G\right)\left(\gamma + \xi_t v_t\right) - \gamma\sqrt{\tau_G}\sqrt{\tau_M}\right)}{\xi_t^2 v_t \tau_G + \tau_{t-}(\tau_M + \xi_t^2 v_t)} \tag{556}$$

$$\pi_2^A = \frac{(1 - \alpha_{t-})\xi_t v_t \tau_G}{\alpha_{t-}\ell_{t-}\left(\xi_t^2 v_t \tau_G + \tau_{t-}(\tau_M + \xi_t^2 v_t)\right)} \tag{557}$$

$$\pi_3 = -\frac{(1 - \alpha_{t-})\xi_t^2 v_t\left(\tau_t - \tau_A\right)\sqrt{\tau_G}}{\alpha_{t-}\ell_{t-}\sqrt{\tau_M}\left(\xi_t^2 v_t \tau_G + \tau_{t-}(\tau_M + \xi_t^2 v_t)\right)}. \tag{558}$$