Investor bias, risk and price volatility

Ali Yavuz Polat
Department of Economics, Abdullah Gul University, Kayseri, Turkey

Received 11 April 2022
Revised 29 October 2022
2 November 2022
Accepted 2 November 2022

Abstract

Purpose – This study proposes a framework based on salience theory and shows that focusing on one type of risk (idiosyncratic or systemic) can explain overpricing of securities *ex ante*, and resales at low prices during crisis periods.

Design/methodology/approach – The author consider an overlapping generations (OLG) model where each generation lives for two periods and there is no population growth. Agents (investors) start their lives with an endowment $W > 0$ and have mean-variance utility. They invest their endowment when young and consume when old. Each period, the young investors optimally choose their portfolio from different risky assets acquired from the old generation, all assumed to be in fixed supply.

Findings – The author show that investor salience bias can explain excess volatility of asset prices and the resulting fire-sales in periods of financial turmoil. A change in salience – from one component (idiosyncratic) to the other (systemic) – will generate excess volatility. Interestingly, higher risk aversion generally exacerbates the excess volatility of prices. Moreover, the model predicts that if a big systemic shock hits the financial system, due to salience bias the price of systemic assets falls sharply. This relates to the observed fire-sales of assets during the global financial crisis.

Practical implications – The proposed model and results suggest that there may be a scope for intervention in financial markets during turbulences. In terms of *ex ante* policies the study suggests that investors and regulator should use better risk assessment technologies.

Originality/value – This is the first study constructing a tractable model based on the argument that investor salience may exacerbate the excess volatility of prices during financial downturns. The author relate salience to two types of risk; idiosyncratic and systemic and assume that investors' risk perception is biased towards the type of risk that is currently salient based on prior beliefs or past data. The author show that the diversification fallacy of the precrisis period, where seemingly safe assets were overpriced, can be explained by agents overweighing idiosyncratic risk and ignoring systemic risk.

Keywords Systemic risk, Salience bias, Price volatility, Financial crisis, Fragility

Paper type Research paper

1. Introduction

One of the proposed explanations for the global financial crisis is that investors, issuers and regulators [1] failed to fully grasp the scale of systemic risk in the financial system. This is often related to new, nontraditional securities, which were issued and bought in large volumes [2], and which were believed to be safe. While insurance, tranching and sophisticated financial engineering provide wider idiosyncratic risk diversification, this does not necessarily result in less systemic risk. As a consequence, the financial system in principle can become even more vulnerable to systemic shocks. As occurred during the global financial crisis, with the arrival of negative news, both issuers and investors of these securities realized their true exposure to systemic risk (which had previously been ignored) and started fire-selling their assets, this time possibly worrying excessively about systemic risk.

In this paper, we propose a framework based on salience theory and show that focusing on one type of risk (idiosyncratic or systemic) can explain overpricing of securities *ex ante*, and

JEL Classification — D90, G01, G11, G12, G40

The author conveys his special thanks to Fabrizio Adriani. The author also benefited from comments be S. Bougheas, A. Boukouras, T. Movahedi, J. Arshad and M. İsmaili.

0144-3585
DOI 10.1108/JES-04-2022-0211

fire-sales at low prices during crisis periods. The central idea is that investors perceive the two types of risk disproportionately and focus primarily on the currently salient one. Either type of risk (systemic or idiosyncratic) is salient when its realization deviates sufficiently from a reference point. We show that assets are mispriced due to the salience bias of investors, which can create excess price volatility. Considering the detrimental effect of this volatility on the real economy, understanding the driving mechanism is crucial for policy makers. It also provides a rationale for the natural question of why investors were prepared to pay excessively high prices for securities in the first place, only to fire-sell them during the crisis [3].

The phenomenon of first ignoring one type of risk and later focusing too much on it can be explained by salience theory, which is based on agents' paying more attention to the salient attributes/states (Bordalo *et al.*, 2012, 2013a, b). We relate salience to two types of risk; idiosyncratic and systemic. Investors' risk perception is biased towards the type of risk that is currently salient based on prior beliefs or past data [4]. We show that the diversification fallacy of the precrisis period, where seemingly safe assets were overpriced, can be explained by agents overweighing idiosyncratic risk and ignoring systemic risk. In that sense, systemic assets are overpriced, while nonsystemic ones are underpriced. Moreover, our model predicts that if a big systemic shock hits the financial system, the perception changes and systemic risk becomes salient for investors. Due to overweighting of systemic risk, the price for systemic assets falls sharply, similar to a fire-sales phenomenon. This relates to the observed fire-sales of assets during the global financial crisis. The combination of overpricing *ex ante* (during the precrisis period) and underpricing ex-post (during the crisis) leads to excess volatility in the market.

We also conduct comparative statics with respect to the model parameters. The most interesting result is that price volatility and mispricing increases with risk aversion. When risk aversion increases, due to mean-variance utility, investors expected utility becomes more sensitive to a change in perceived variance. Initially, when idiosyncratic risk is salient, agents are willing to pay a premium for assets that carry less idiosyncratic risk. The more risk-averse agents are, the more prevalent the mispricing of these assets. However, when a shock hits the market making systemic risk more salient, these investors will try to rebalance their portfolios towards assets that carry less systematic risk. The more risk-averse agents are, the more aggressively they will rebalance their portfolios, thus creating excess volatility. In contrast, in the extreme case of risk neutrality, investors do not care about which type of risk they are facing – systemic or idiosyncratic – and focus solely on the expected returns. Thus, their demand is unaffected by which type of risk is salient. The policy implications of this paper involve both *ex ante* and ex-post policies. In terms of ex-post interventions, the proposed model and results suggest that there may be a scope for intervention in financial markets during turbulances. However, it should be noted that we do not conduct a welfare analysis, which means that the effectiveness of these interventions should be discussed and analyzed in relation to a specific context. In terms of *ex ante* policies the study suggests that investors and regulator should use better risk assessment technologies.

1.1 Literature review

There is a vast literature based on the different types of explanations as to the market turmoil observed during the global financial crisis. The contributions can broadly be classified as belonging to one of three strands of the literature. The first, incentive-based explanations mainly focus on the incentives of the banks during the build-up to the crisis – such as risk shifting and moral hazard generated by the originate-to-distribute banking model, (de) regulation and implicit government guarantees (Shleifer and Vishny, 2010; Rajan, 2006; Allen *et al.*, 2015). Shleifer and Vishny (2010) explain the driving source of the instability in the banking system as the short-term extraordinary profit opportunities available to banks due to the huge demand for AAA-rated securities. However, this prompts the question of why investors could not anticipate the fragility of the financial system. It has also been argued that securitization, as one of the possible main drivers of the crisis, created moral hazard (Gorton and Metrick, 2012; Acharya *et al.*, 2013). This was mainly due to the fact that the holders of the liabilities and the issuers of the credits were different entities so that the issuers could sell off the risks and did not need to worry about the payment ability of the borrowers [5]. Beccalli *et al.* (2015) mention that prior to the financial crisis, securitization was generally assumed to have a positive role, mainly in dispersing credit risk and increasing efficiency in risk-sharing. However, with the outbreak of the financial crisis, it has been argued that securitization actually drove down the lending standards (Greenlaw *et al.*, 2008; Altunbas *et al.*, 2010; Uhde and Michalak, 2010). He claims: "Rather than dispersing the risk, securitization led to a concentration of the risk in the banking sector itself".

The second type of argument is based on a "global savings glut", global imbalances in capital flows and the deregulatory environment (Bernanke, 2005; Obstfeld and Rogoff, 2009; Justiniano *et al.*, 2014; Ferrero, 2015; Favilukis *et al.*, 2012; Aizenman and Jinjarak, 2009). The basic idea behind these arguments is that there was a search for higher yield worldwide, especially accumulated in the United States (US) financial markets. Moreover, the lax regulatory environment exacerbated the problems in the financial system. While the global savings glut explanation may help to understand global imbalances, it may not explain why the prices of these assets collapsed. Thus, the current paper complements this strand of the literature by also explaining a possible mechanism for fire-sales.

Our paper is more closely related to the last class of explanations, namely those models that consider behavioral biases as the main driver of the financial crisis. Chernenko *et al.* (2016) state that due to the unique feature of credit markets, as skewed payoffs, normal conditions do not convey much information. They further emphasize that "absence of negative experiences" may lead to overoptimism due to investors' tendency to neglect downside risks (Greenwood and Shleifer, 2014; Gennaioli *et al.*, 2012, 2015). Gennaioli *et al.* (2012) show that due to the investor demand for securities that provide safe cash flows, financial intermediaries offer innovative securities that are perceived to be safe but in reality are exposed to neglected risk. This generates financial fragility when investors eventually recognize the neglected state. However, such information neglect may not explain why this mispricing still prevails, even among sophisticated investors [6]. Klibanoff *et al.* (1998) argues that the explanations based on the "over/under-reaction" of investors (or markets) can usually only justify ex-post anomalies, not the driving mechanisms behind them. This paper offers a complementary idea to this behavioral literature, presenting a possible *ex ante* theoretical mechanism based on the well-documented psychological phenomenon of salience (or information availability, as it is sometimes termed). Considering the existence of the diversification fallacy/illusion [7], especially during the boom period prior to the financial crisis, this paper builds upon the salience theory to explain the investors' neglect of systemic risk.

Our paper is also related to the investor sentiment literature. According to classical asset pricing theory, stock prices (especially in the long-run) should reflect the fundamentals since rational investors (or arbitrageurs) will revert prices back to fundamentals, even though in the short-run there may exist deviations. Thus, classical theory suggests that mispricing cannot exist in the long run. However, the vast literature on investor sentiment shows that sentiment has a long-lasting and non-negligible effect on prices. When the share of sentiment investors is significant, trading against sentiment may be costly and risky. As a result, arbitrageurs may not be able to afford to bet against the sentiment and prices may not reflect fundamentals (i.e., there are limits to arbitrage (Shleifer and Vishny, 1997)). The history of financial crises – such as the Great Depression and the Dot.com bubble in the 1990s – validates the premise that prices can deviate from fundamentals for a long duration, especially considering the nontraditional asset markets (such as derivative markets). Mendel and Shleifer (2012) argue that the problems that occurred in the last financial crisis regarding derivative markets are particularly interesting, considering that the investors in these markets are mostly sophisticated investors. They present a model where uninformed rational traders, who only learn from prices, end up chasing the sentiment. Thus, they claim that large numbers of noise traders or large sentiment shocks are not always needed for the sentiment to matter as long as sophisticated investors constitute a large proportion of the traders. Akhtar *et al.* (2012) find evidence that when sentiment information is released, both futures markets and US stock markets react asymmetrically and that the reaction is more significant among the "stocks that are more salient to investors". They posit that this can be explained through investors using the availability heuristic. Baker and Wurgler (2007) mention that speculative (riskier) stocks may have lower (higher) return during high (low) sentiment periods, implying that investors over (under) value the stocks when sentiment is high (low). This is perhaps especially true for nontraditional, difficult-to-value assets. As with the investors' mispricing of stocks during different sentiment periods, in our model, when systemic risk is salient (not salient) investors under-(over-) value systemic stocks. The model offers a theoretical mechanism for how investors over- (under-) value the assets. In this sense, our model of investor salience bias as to perceived risk may fit the sentiment-related empirical evidence (Palomino *et al.*, 2009; Yu and Yuan, 2011; Stambaugh *et al.*, 2012; Yu and Yuan, 2011, 2011; Baker *et al.*, 2012; Möhlmann, 2013; Da *et al.*, 2014; Huang *et al.*, 2014; Lepori, 2015).

Shiller (2017) discusses that narratives significantly contribute to the psychology of decision makers. He claims that narratives are quite important in economics since people usually depend on stories which are usually a mixture of facts and emotions. Some narrations can go viral as it happens in the transmission of epidemics and may significantly affect decisions. Shiller (2020a) stresses the importance of the contagion of narratives which is a significant mechanism for economic change and an important dimension that can be used in economic forecasting. Shiller (2020b) shows examples of popular economic narratives. Among them, the "housing bubble" displays a typical example of an epidemic curve, starting to rise before the global financial crisis and going viral in 2008. Bhargava *et al.* (2022) construct indicators based on textual analysis to quantify narratives. They find that empirically narratives contain information for market returns beyond traditional indicators used in the literature. As an example, their market crash narrative plays a significant role in explaining US equity markets. Borup *et al.* (2022) quantify investor narratives during the Covid-19 pandemic by extracting narratives from an open-ended survey. They claim that the pandemic created an important opportunity as a natural experiment to analyze the impact of narratives which is overlooked in the economic theory. They find a significant relationship between the narratives and future returns in both stock and bond markets. Their results imply that narratives have a significant impact on economic conditions confirming the important role and relevance of narratives. Goetzmann *et al.* (2016) find that investors usually have excessive risk assessments regarding the stock market crash. Especially salient news such as front page articles and the dominant narratives influence these assessments.

Considering the aforementioned studies, the change in the salience and perception of risk in this study goes in line with the narrative economics argument. Prior to the global financial crisis the narration that riskier assets can be bundled in tranches and become less risky but at the same time offer good returns was the popular view among investors; whereas after the crisis investors and regulators become much more skeptical about this narrative. Even one can claim that during the crisis the narration went to the exact opposite side, focusing too much attention on systematic risk. Our study offers a theoretical background for such narration changes that impact significantly investor psychology and then in turn the financial markets.

The remainder of the paper proceeds as follows. The next section, 1.2 will briefly introduce the notion of salience in decision-making with the help of a simple example. Section 2 then presents the model of salience on different types of risk. Section 3 analyses and discusses the results for both the benchmark (rational investor) case and the salient investor case. Section 4 presents comparative statics. Proofs are contained in Online Appendix. Section 5 discusses the results and mentions policy implications. Finally, Section 6 concludes and offers a number of possible future extensions.

1.2 Salience theory

According to Taylor and Thompson (1982), salience refers to a phenomenon in which a decision-maker's attention is attracted disproportionally by one portion of the environment, which will create disproportionate weighting in the decision-maker's judgment; similarly, Kahneman (2011) states that humans have a useful capacity to focus on the odd, different or unusual. This may be due to humans using a heuristic by concentrating their time and attention on salient information, considering their limited cognitive capacity (i.e., focusing on the salient state, attribute or condition provides a useful heuristic) (Akhtar *et al.*, 2012). Based on the salience idea, Bordalo *et al.* (2012) present a model of choice under risk in which the decision-maker focuses on salient payoffs for a given state and thus evaluates a lottery by inflating the decision weight of the salient states. They emphasize that salience enables the development of a theory based on context-dependent choice aligned with a wide range of evidence. Bordalo *et al.* (2013b) further apply a similar idea to a consumer choice context in which a consumer can pay more or less attention to some attributes of goods such as quality or price. A good's attribute is salient when it stands out or is unusual as being the most different from that of a reference good. To summarize this idea, let two attributes for N goods be price and quality.

Salience ranks the attributes of a good based on the reference good's attribute. An attribute is salient if it is significantly different from the average attribute. As an illustration, see the simple example below where there are only two goods, $N = 2$, and two attributes: quality and price:

Example 1. *Let the utility of a rational agent be* $u_k = q_k - p_k$, *where* q *represents quality and* p *represents the price of good* k. *Also, let the average* $(\overline{q}, \overline{p})$ *be the reference. To create a ranking between attributes, define a salience function as* $S(a_k, \overline{a}) = \frac{|a_k - \overline{a}|}{\overline{a}}$ *for* $k \in \{1, 2\}$, $a \in \{q, p\}$.
If $|q_1 - q_2| \gg |p_1 - p_2|$, *then quality is salient for both goods, since* $S(q_k, \overline{q}) > S(p_k, \overline{p})$ *for both* k [8].

If quality is salient, then the consumer will evaluate the utility as follows: $u_k = q_k - \delta p_k$, where $\delta < 1$. In other words, the consumer effectively inflates (deflates) the salient (nonsalient) attribute (Bordalo *et al.*, 2013b).

2. The model

We consider an overlapping generations (OLG) model where each generation lives for two periods and there is no population growth. Agents (investors) start their lives with an endowment $W > 0$ and have mean-variance utility [9]. The endowment W cannot be stored. They invest their endowment when young and consume when old. Each period, the young investors optimally choose their portfolio from N different risky assets acquired from the old generation, all assumed to be in fixed supply. We will consider $N = 3$ [10]. Each asset has a deterministic dividend K, and a stochastic dividend. We assume that K is sufficiently large in order to ensure that in the optimization problem of the investors (given below in (1)) the expected utility is non-negative in equilibrium, and prices of all assets are non-negative.

The stochastic dividend is formed of two parts, representing idiosyncratic risk and systemic risk, respectively.

$$R_j = K + \varepsilon_j + \alpha_j\mu, \quad \varepsilon_j \sim \left(0, \sigma_j^2\right), \quad \mu \sim \left(0, \sigma_\mu^2\right) \quad j \in N$$

where ε is an idiosyncratic shock (ε_j are independently distributed and independent from μ) and μ is the systemic shock. Each asset thus has a stochastic part which is undiversifiable. If the coefficient α_j is large, then asset j entails more systemic risk. We do not assume any specific probability distribution for the stochastic parts but only assume a zero mean and finite variance. The time subscripts are omitted for R_j since the payout structure is identical for each period t.

For $N = 3$;

$$\begin{aligned} R_A &= K + \varepsilon_A + \alpha\mu, & E[\varepsilon_A] &= 0, & Var(\varepsilon_A) &= \sigma_A^2 \\ R_B &= K + \varepsilon_B + \beta\mu, & E[\varepsilon_B] &= 0, & Var(\varepsilon_B) &= \sigma_B^2 \\ R_C &= K + \varepsilon_C + \theta\mu, & E[\varepsilon_C] &= 0, & Var(\varepsilon_C) &= \sigma_C^2 \end{aligned}$$

We assume $\sigma_C^2 > \sigma_B^2 > \sigma_A^2$, $\alpha > \beta > \theta$ and $\sigma_A^2 + \alpha^2\sigma_\mu^2 = \sigma_B^2 + \beta^2\sigma_\mu^2 = \sigma_C^2 + \theta^2\sigma_\mu^2$, so that $\text{Var}(R_A) = \text{Var}(R_B) = \text{Var}(R_C)$, i.e. all assets have identical variance. The assumption that all assets have identical variance is mostly for expositional convenience as it implies that if an asset has higher idiosyncratic risk, it must carry lower systemic risk. As a result, it is immaterial whether assets are ordered in terms of either type of risk [11]. For the rest of the paper, asset A, which carries the larger amount of systemic risk, will be called as the "systemic asset".

The assets are in fixed supply. In each period t, the old generation (who were born at $t-1$) will sell the assets at any non-negative price since they will consume anything they have invested. Thus, high or low demand will determine the prices at the end of each period. The young generation born at t choose the optimal portfolio by demanding x_A, x_B, x_C quantities of each asset (based on a prior regarding salience, which will be explained later) [12]. Prices are determined in any period, by market clearing.

At the beginning of each period, young investors (with mean-variance preferences) solve the following problem:

$$\max_{x_{t,A}, x_{t,B}, x_{t,C} \in [0, W_t]} E[W_{t+1}] - \gamma \text{Var}(W_{t+1}) \tag{1}$$

s.t.

$$x_{t,A}p_{t,A} + x_{t,B}p_{t,B} + x_{t,C}p_{t,C} = W \tag{2}$$

where γ is the risk-aversion parameter and $E[W_{t+1}] = (x_{t,A} + x_{t,B} + x_{t,C})K + W$. This is because investors *ex ante* expect the prices to stay same, i.e. $E[p_{t+1,i}] = p_{t,i}$ since they do not predict salience to change. To see this point, note that $E[W_{t+1}] = E[\sum_i p_{t+1,i}x_{t,i} + \sum_i R_i x_{t,i}] = W_t + E[\sum_i R_i x_{t,i}] = W + (x_{t,A} + x_{t,B} + x_{t,C})K$.

2.1 Salience

Salience works as follows; depending on which risk is salient, the perceived variance may differ. Hence, $\text{Var}(W_{t+1})$ will depend on investors' perceptions of risk. The investor can perceive either idiosyncratic risk ε_j as salient or systemic risk μ as salient. Investors will overweigh the salient risk and underweigh the nonsalient risk [13]. As with Bordalo *et al.* (2012, 2013b), we introduce a salience function in Section 3.2 which basically produces a ranking between two types of risk. Since we have only two elements to be ordered, the more salient element will be overweighed and the other will be underweighed.

According to salient decision-making, the stochastic dividends of the assets will be weighed as follows:

(1) When μ is salient, $R_j = K + \frac{1}{\delta}\varepsilon_j + \delta(\alpha_j\mu)$

(2) When ε is salient, $R_j = K + \delta\varepsilon_j + \frac{1}{\delta}\alpha_j\mu$

where $\delta > 1$ [14] and $j \in \{A, B, C\}$. This implies that the salient risk will be overweighed [15]. From a dynamic viewpoint, there can be four different cases: (1) ε is salient at time t but μ becomes salient at time $t+1$, (2) μ is salient at time t but ε becomes salient at time $t+1$, (3) and (4) ε or μ is salient throughout.

Depending on what is currently salient, investors will have different perceived variances. Formally, the variances as perceived by a rational agent, an agent who perceives ε as salient, and an agent who perceives μ as salient are as follows.

(1) Rational agents: $\mathrm{Var}(W_2)^R = {x_A}^2\sigma_A^2 + {x_B}^2\sigma_B^2 + {x_C}^2\sigma_C^2 + (\alpha x_A + \beta x_B + \theta x_C)^2\sigma_\mu^2$

(2) ε-salient: $\mathrm{Var}(W_2)^\varepsilon = \omega({x_A}^2\sigma_A^2 + {x_B}^2\sigma_B^2 + {x_C}^2\sigma_C^2) + \frac{(\alpha x_A+\beta x_B+\theta x_C)^2\sigma_\mu^2}{\omega}$

(3) μ-salient: $\mathrm{Var}(W_2)^\mu = \frac{({x_A}^2\sigma_A^2+{x_B}^2\sigma_B^2+{x_C}^2\sigma_C^2)}{\omega} + (\alpha x_A + \beta x_B + \theta x_C^2\sigma_\mu^2)\omega$

where $\omega = \delta^2 > 1$.

We assume;

$$\frac{\sigma_A^2\omega}{\alpha(\alpha+\beta+\theta)} < \sigma_\mu^2 < \frac{\sigma_C^2}{\omega\theta(\alpha+\beta+\theta)} \tag{3}$$

Note that, by construction, $\sigma_A^2/\alpha < \sigma_C^2/\theta$. Hence, essentially we assume that ω is not too large (i.e. salience is not extreme) and that the systemic variance is neither too large nor too small relative to the idiosyncratic variances. This restriction is required due to the specific way the salience is modeled. If salience bias is too extreme; for example, consider arbitrarily large ω, then the investors perceive the variance of their portfolio arbitrarily large as well, independent of the assets they hold and independent of what is salient. This implies that, a systemic asset (A) with nonzero idiosyncratic variance could be in principle perceived as excessively risky even when idiosyncratic risk is salient [16].

3. Results

3.1 Rational investors

We start with the benchmark case, where rational young investors at t solve (1) using the actual variance $\mathrm{Var}(W_2)^R$. Given the optimal portfolio allocation $({x_A}^R(p_A^R, p_B^R, p_C^R), {x_B}^R(p_A^R, p_B^R, p_C^R), {x_C}^R(p_A^R, p_B^R, p_C^R))$ and solving for the equilibrium prices by assuming a fixed supply of 1 unit for each asset; at t [17]

Proposition 1. In the rational benchmark case prices for each asset are such that;

$$p_i^R = \frac{W\left(K - 2\gamma\left(\alpha_i\sigma_\mu^2(\alpha+\beta+\theta) + \sigma_i^2\right)\right)}{3K - 2\gamma\left(\sigma_\mu^2(\alpha+\beta+\theta)^2 + (\sigma_A^2 + \sigma_B^2 + \sigma_C^2)\right)}$$

for $i \in \{A, B, C\}$, $\alpha_i \in \{\alpha, \beta, \theta\}$ and for any time period [18].

Assuming that the total variance is the same for all assets, the systemic asset (A) *has the lowest price, that is;*

$$p_A^R < p_B^R < p_C^R.$$

Proof. For the benchmark case, rational investors solve (1) considering the actual variance of the portfolio $\mathrm{Var}(W_2)^R$. Then, having the demands for each asset and assuming a fixed 1 unit supply for each, we get the prices;

$$p_A^R = \frac{W\left(K - 2\gamma\left(\sigma_\mu^2\alpha(\alpha+\beta+\theta) + \sigma_A^2\right)\right)}{3K - 2\gamma\left(\sigma_\mu^2(\alpha+\beta+\theta)^2 + \left(\sigma_A^2 + \sigma_B^2 + \sigma_C^2\right)\right)}$$

$$p_B^R = \frac{W\left(K - 2\gamma\left(\sigma_\mu^2\beta(\alpha+\beta+\theta) + \sigma_B^2\right)\right)}{3K - 2\gamma\left(\sigma_\mu^2(\alpha+\beta+\theta)^2 + \left(\sigma_A^2 + \sigma_B^2 + \sigma_C^2\right)\right)}$$

$$p_C^R = \frac{W\left(K - 2\gamma\left(\sigma_\mu^2\theta(\alpha+\beta+\theta) + \sigma_C^2\right)\right)}{3K - 2\gamma\left(\sigma_\mu^2(\alpha+\beta+\theta)^2 + \left(\sigma_A^2 + \sigma_B^2 + \sigma_C^2\right)\right)}.$$

For K large enough, the expected utility is positive in equilibrium, which also implies both the numerator and denominator are positive for each price. Assuming assets have the same total variance, $\sigma_A^2 + \alpha^2\sigma_\mu^2 = \sigma_B^2 + \beta^2\sigma_\mu^2 = \sigma_C^2 + \theta^2\sigma_\mu^2$, and using the prices found above, we obtain the following; $p_A^R < p_B^R < p_C^R$. This holds since $\sigma_C^2 > \sigma_B^2 > \sigma_A^2$ and $\alpha > \beta > \theta$.■

The intuition of this proposition is simple. The first part basically says that if investors are rational, then the prices will be stable over time (i.e., they will be the same in any time period). Rational investors will perceive the same variance of assets in any period so that their demand will be the same in each period. Considering that the supply is fixed, this will imply stable prices over time. For the second part, the core of the intuition is that the idiosyncratic risk is partially diversifiable whereas the systemic is not. Thus, if the total variance is the same for all assets, in having higher systemic risk, asset A will have lower demand and consequently a lower price compared to other assets.

3.2 Salient investors

This section provides the results for the case when investors have salience bias on the perceived risk. At any period, when the realized systemic risk is low enough, investors are defined as $\varepsilon - salient$ since they will overweigh the idiosyncratic risk. When the realized systemic risk is sufficiently large ($\mu > \hat{\mu}$), then systemic risk will become salient and the investors are defined as $\mu - salient$. $\varepsilon - salient$ investors consider $\mathrm{Var}(W_2)^\varepsilon$ and $\mu - salient$ investors consider $\mathrm{Var}(W_2)^\mu$ as the perceived risk for their optimal portfolio demands.

Lemma 1. *When idiosyncratic risk (ε) is salient, the systemic asset A is overpriced $p_A^\varepsilon > p_A^R$ and the nonsystemic asset C is underpriced $p_C^\varepsilon < p_C^R$. Moreover, $p_A^\varepsilon > p_B^\varepsilon > p_C^\varepsilon$ for $\omega > \sqrt{\frac{\alpha+\beta+\theta}{\alpha+\beta}}$.*

Lemma 1 basically states that when idiosyncratic risk is salient, investors overweigh idiosyncratic risk and underweigh the systemic one. Thus the systemic asset, A, is overpriced whereas the nonsystemic asset, C, is underpriced.

Lemma 2. *When systemic risk is salient, the systemic asset A is underpriced $p_A^\mu < p_A^R$, and the nonsystemic asset C is overpriced $p_C^\mu > p_C^R$. Moreover $p_A^\mu < p_B^\mu < p_C^\mu$.*

Lemma 2 basically states that when systemic risk is salient, investors overweigh systemic risk and underweigh the idiosyncratic one. Thus, the systemic asset, A, is underpriced whereas the nonsystemic asset, C, is overpriced. The intuition is simple. In the benchmark case, asset A has the lowest price due to its highest systemic correlation coefficient. When systemic risk is salient, the demand for asset A is even smaller when compared to that of the benchmark case.

Proposition 2. Assuming $\text{Var}(R_A) = \text{Var}(R_B) = \text{Var}(R_C)$, *we obtain* $p_A^{\varepsilon} > p_A^{\mu}$ *and* $p_C^{\varepsilon} < p_C^{\mu}$:

(1) *If at time t, ε is salient and μ becomes salient at* $t+1$, *then the price* p_A *of the systemic asset (A) decreases and the price* p_C *of the less systemic asset (C) increases.*

(2) *If at time t, μ is salient and ε becomes salient at* $t+1$, *then the price* p_A *of the systemic asset (A) increases and the price* p_C *of the less systemic asset (C) decreases.*

(3) *In both cases, price volatility is higher than in the benchmark case of full rationality.*

Proof The proof directly follows from Lemmas 1 and 2 above. For the benchmark case, since prices stay the same over time, any price deviation after a change in salience implies excess volatility in prices.■

If investors start as ε-salient at t, there are two cases that can occur in the subsequent period. If investors remain ε-salient, the price will not change since the young investors will have the same perceived variance. In contrast, if they switch to μ-salience, the young investors will use $\text{Var}(W_{t+1})^{\mu}$ instead of $\text{Var}(W_{t+1})^{\varepsilon}$, which will generate price volatility.

The main implication of this result is as follows. In taking no stance on how investors form their prior, we conclude that when the salient feature of the risk (idiosyncratic or systemic) changes, investors change their perceived risk for the assets, which results in price volatility in equilibrium. The main insight is that due to the bias in perceived risk, there is excess volatility in the asset markets.

The literature mentions that a salient stimulus may attract the attention of the decision maker so that it may interfere with and alter the decision weights. In our setting, the salient stimulus affects the perceived variance of the assets. There may be possible mechanisms that can trigger the shift in decision weights. As Shiller (2017) discusses a significant change in the dominant narration may alter investors' behavior. The role of narratives is significant in economic decision making as Shiller (2020a) claims that some narratives go viral among the public. Recent empirical evidence shows that narrations are quite important and significant in impacting economic outcomes and financial markets (Goetzmann *et al.*, 2016; Bhargava *et al.*, 2022; Borup *et al.*, 2022). Salient news and the dominant narratives may influence the risk assessment of investors (Goetzmann *et al.*, 2016) which may derive the prices away from the benchmark rational prices in our model. For example, the "housing bubble" displays a typical example of an epidemic curve, starting to rise before the global financial crisis and going viral in 2008 (Shiller, 2020b). Prior to the global financial crisis, the popular narration among investors was that tranching and securitization reduce risks for the engineered assets. This narration ignored the inherent risk built up before the crisis. Then investors consider μ as small ($\mu < \hat{\mu}$) and consequently underweight the systemic risk. However, during (and after) the crisis the narration focused too much on the systemic risk resulting in salient systematic risk perception. This time investors consider μ as large enough ($\mu > \hat{\mu}$) so that they overweight the systemic risk.

Another possible mechanism is due to herding behavior or informational cascade [19]. Since the tractable model in this study is based on a representative agent OLG model, we do not provide a micro foundation regarding a possible cascade mechanism. However, still one can consider an argument that with the crisis investors tend to cascade information so that the perception before the crisis was to underweight the systemic risk. In practice, both cascade and the popular narratives may strengthen each other creating a greater bias in the risk perception of investors and resulting in a bigger deviation from the rational benchmark prices.

In order to be more specific on the change in salience and how salience may arise, define a salience function $S(a_k, a_j, \overline{a})$ where $a \in \{\varepsilon, \mu\}$, $k, j \in \{A, C\}$ and $\overline{a}$ represents the reference point [20]. The role of this function is to produce a ranking between the two types of risk, idiosyncratic and systemic. In that sense, whenever $S(\varepsilon_A, \varepsilon_C, \overline{\varepsilon}) < (>) S(\alpha\mu, \theta\mu, \overline{\mu})$, then systemic (idiosyncratic) risk will be salient for assets $j \in \{A, C\}$.

In the model, upon the realization of the stochastic components of dividends, similar to an information arrival, investors will update their perceived variance. For example, if the realized systemic part μ is bigger than some value $\hat{\mu}$, investors will focus on the systemic risk and the systemic part will be salient.

Considering the result in Proposition 2 above, the implication of the above salience function is that salience changes based on the realized values of ε and μ. If at time t,

(1) ε is salient, after a systemic shock $(\mu > \hat{\mu})$ μ becomes salient at $t+1$. Then, the price of the systemic asset p_A decreases and the price of the nonsystemic asset p_C, increases.

(2) μ is salient, after an idiosyncratic shock ε becomes salient at $t+1$. Then, the price of the systemic asset p_A increases and the price of the nonsystemic asset p_C decreases.

4. Comparative statics

The results from the previous section show that there is excess volatility in prices due to investor salience. We now conduct comparative statics analysis on price volatility. Let $P(\varepsilon - salient)$ and $P(\mu - salient)$ be the probabilities that in a given time period, ε is salient or μ is salient, respectively. W.l.g assume that investors are ε-salient at t. Then we can proxy the price volatility of each asset $j \in \{A, B, C\}$ by $|p^{\varepsilon}_{t,j} - E[p_{t+1,j}]|$ [21], where $E[p_{t+1,j}] = P(\varepsilon - salient)p^{\varepsilon}_{t+1,j} + P(\mu - salient)p^{\mu}_{t+1,j}$. However, since $P(\varepsilon - salient) = 1 - P(\mu - salient)$ and since the price will not change unless salience changes at $t+1$ (i.e. $p^{\varepsilon}_{t,j} = p^{\varepsilon}_{t+1,j}$), we have;

$$|p^{\varepsilon}_{t,j} - E[p_{t+1,j}]| = P(\mu - salient)|p^{\mu}_{t+1,j} - p^{\varepsilon}_{t,j}|.$$

We will focus on the difference $|p^{\mu}_{t+1,j} - p^{\varepsilon}_{t,j}|$ without imposing a structure on the probabilities and look at the comparative statics w.r.t to the model parameters γ(risk aversion), σ^2_{μ} (systemic risk), σ^2_j (idiosyncratic risks), ω (salience weight) and K. We are thus implicitly assuming that these exogenous parameters do not affect the salience function (and thus the probabilities). Time subscripts are omitted for simplification since $p^{\varepsilon}_{t,j} = p^{\varepsilon}_{t+1,j}$ and $p^{\mu}_{t,j} = p^{\mu}_{t+1,j}$ for all assets and all periods t.

For ease of comparison, we restrict $\mathrm{Var}(W_2)^{\varepsilon}$ and $\mathrm{Var}(W_2)^{\mu}$ to have the same value. This implies $\sigma^2_A + \sigma^2_B + \sigma^2_C = (\alpha + \beta + \theta)^2\sigma^2_{\mu}$. In other words, we are considering the case where salience does not affect the investors' perception of the total risk that they face. This restriction merely normalizes perceived variances $\mathrm{Var}(W_2)^{\varepsilon}$ and $\mathrm{Var}(W_2)^{\mu}$ so that they are comparable [22].

Proposition 3. Price volatility $|p_j^\varepsilon - p_j^\mu|$ increases with γ for all assets $j \in \{A, B, C\}$.

Price volatility increases with risk aversion γ, which at first glance may seem counter-intuitive [23]. The intuition for this result lies within how we model mispricing. We can understand this by focusing on asset A as an illustration. Investors overprice the systemic asset (A) when idiosyncratic risk is salient and underprice it when systemic risk is salient (i.e. $p_A^\varepsilon > p_A^\mu$). When risk aversion is high, overpricing and underpricing are more significant due to the investors' expected utility being more sensitive to risks. This implies that $|p_A^\varepsilon - p_A^\mu|$ increases with risk aversion. To better grasp this intuition, consider the scenario of $\gamma = 0$. When investors are risk neutral, they do not care about the difference between the assets as long as their expected returns are the same. Thus, no risk aversion implies no price deviation, i.e. $p_A^\varepsilon = p_A^\mu$.

This result holds for any asset. When risk aversion increases, due to mean-variance utility, investors' expected utility becomes more sensitive to a change in perceived variance. Initially, when idiosyncratic risk is salient, agents are willing to pay a premium for assets that carry less idiosyncratic risk. The more risk averse agents are, the more prevalent the mispricing of these assets. However, when a shock hits the market making systemic risk more salient, these investors will try to rebalance their portfolios towards assets that carry less systematic risk. The more risk averse agents are, the more aggressively they will rebalance their portfolios, thus creating excess volatility.

Also, see Figure 1 for a graphical illustration of this result, whereby the price volatilities of the assets are normalized by dividing into the benchmark prices p_j^R. This normalization helps us to understand that for asset A (left figure) and asset C the price volatility is significant as a percentage of rational prices. For asset B (middle figure) the change is not large (%10 at maximum) since asset B is like an average asset.

Lemma 3. Price volatility $|p_j^\varepsilon - p_j^\mu|$ increases with σ_μ^2 for all assets $j \in \{A, B, C\}$

As systemic risk σ_μ^2 increases, the price of assets will have more volatility between two different salient cases. Due to investors ignoring systemic risk, when it is not salient, mispricing is more detrimental when σ_μ^2 is bigger. The intuition is that when systemic risk is larger, the gap between ε-salient and μ-salient cases is more significant since the perceived systemic parts will be more different. This can be observed from Figure 2 as well, where again to gain an idea as to the size of the volatility we divide them by the rational prices. Again, note that the volatility is significant for assets A and C compared to the benchmark prices.

Note that in both Figures 1 and 2, the price volatility of asset A is larger (in terms of % of rational price). This implies that, A, being the systemic asset experiences larger volatility when either the systemic risk or the risk aversion parameter increases. This result may produce interesting policy implications. For example regulators may want to monitor the systemic assets/products more intensely.

Lemma 4. For asset C, price volatility $|p_C^\varepsilon - p_C^\mu|$ increases in σ_C^2. For asset A, price volatility $|p_A^\varepsilon - p_A^\mu|$ can increase or decrease in σ_A^2 depending on parameter values.

Figure 3 shows that as σ_C^2 increases, price volatility increases as well for asset C. The intuition of this lies within the weighing parameter. Since salient risk is overweighed and the other risk is underweighed, a larger idiosyncratic variance implies a higher gap between the perceived variances of the assets for the different salient cases. For asset A the result is ambiguous since a higher σ_A^2 reduces overpricing when ε is salient.

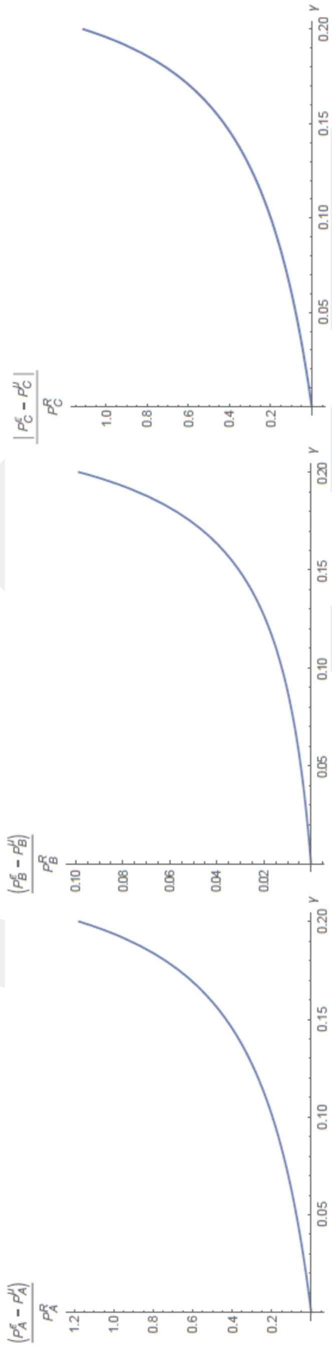

Figure 1.
Price volatility w.r.t risk aversion γ, normalized by diving into the rational (benchmark) prices p_j^R. The parameters used for these graphs ensure that the expected utility is non-negative for the maximization problem (1)

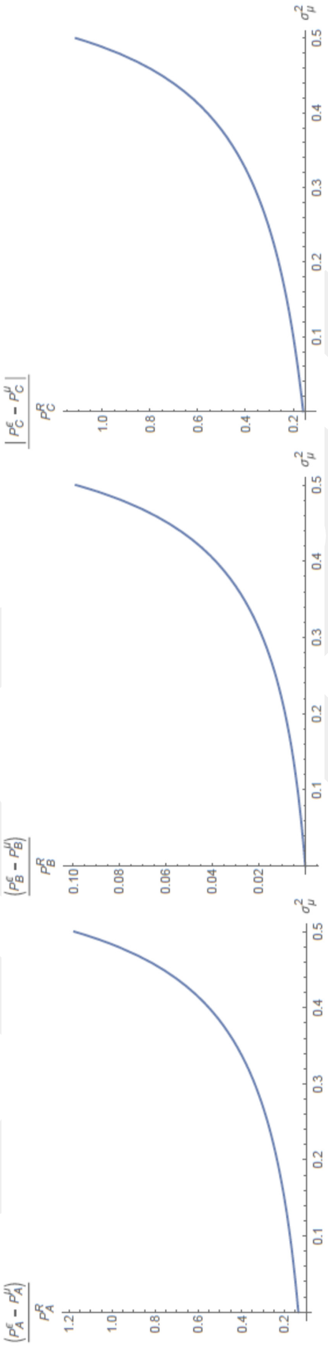

Figure 2.
Price volatility with respect to systemic risk σ_μ^2, normalized by dividing into the rational (benchmark) prices p_j^R

Lemma 5. Price volatility $|p_j^{\epsilon} - p_j^{\mu}|$ decreases with K for all assets $j \in \{A, B, C\}$.

Price volatility $|p_j^{\epsilon} - p_j^{\mu}|$ increases with ω, for all $\omega > 1$ and for all assets $j \in \{A, B, C\}$.

The intuition of this lemma is quite obvious. As K, the expected dividend, becomes larger, the difference between systemic and nonsystemic assets becomes less significant. Thus, the deviation of price between two different salient cases becomes smaller. The second part of the lemma is obvious considering that ω represents the over/under weighing parameter. As it becomes bigger, the mispricing becomes more significant.

5. Policy implications

Price volatility can be a crucial element that undermines financial stability. Considering the soundness of the financial markets, price stability should have a high priority in policy making. As the global financial crisis has manifested, the costs of such financial crises can be severe and detrimental to the real economy. Thus, policy makers should try to understand the possible drivers of excess asset price volatility so that policies can be tailored to address the structural problems in the financial system.

The policy implications of this paper can be considered in terms of both *ex ante* and ex-post policies. The results suggest that for *ex ante* policies, investors should use better risk assessment technologies and regulators should try to develop early warning signals for the buildup of an extreme systemic risk within the system. In terms of ex-post interventions, the model and results suggest that there may be a scope for interventions in financial markets. However, note that we do not conduct a welfare analysis so the effectiveness of these interventions should be discussed in regards to specific contexts.

Specifically, the result that higher risk aversion creating more volatility in prices can help policy makers to tailor their policy to reverse the cyclical behavior of investors, especially during a financial downturn. For instance, if the risk appetite of investors changes during times of financial stress, intervention policies may not only help to stabilize prices but may also decrease agents mispricing if these policies are able to revert the risk appetites.

6. Conclusion and discussion

Although there is a vast literature on explanations for the global financial crisis in terms of the supply side (i.e. the bank side), the investor side has been overlooked. The main puzzle as to what happened prior to the crisis is the extent to which investors neglected systemic risk. In addressing the question of why complex securities are significantly overpriced, this paper looks at the demand side (i.e., investors) by building a tractable model based on salience

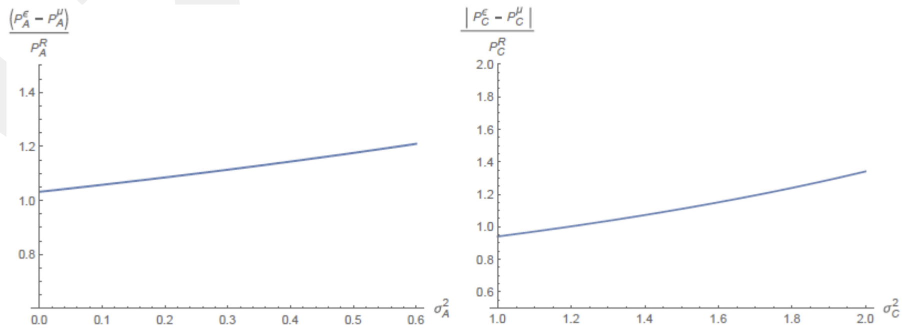

Figure 3.
Price volatility with respect to idiosyncratic risks

theory (Bordalo *et al.*, 2012, 2013b). Classifying the risk into two components, idiosyncratic and systemic, and assuming investors over-(under-)weigh the risk that is salient (nonsalient), we show that investors will misprice the assets and that this will generate excess volatility when there is an extreme systemic shock. This study thus complements the existing supply side explanations. From the fact that systemic risk was ignored prior to the financial crisis, the model shows how systemic assets were overpriced. Under an extreme systemic shock, systemic risk becomes salient and investors dump systemic assets, this results in fire-sales and excess volatility. The excess volatility in prices could potentially create externalities for the real sector.

An important dimension worth exploring is the interaction between the "supply side" and the demand. Consider an issuer (bank), who can exploit the bias in variance to extract more rent. The issuer may intentionally design/package the securities in a more complex structure which may affect the misperception parameter ω. In other words, ω increases with the opaqueness/complexity of the security, which may imply a higher profit opportunity for the issuer. However, in considering that a higher misperception will increase price volatility, a larger degree of mispricing may be detrimental to the financial sector and consequently to the economy. This extension is quite interesting in regards to what we observed in the last global financial crisis. Issuers strategically built more complexity into the securities and investors who ignored systemic risk consequently, bought these opaque securities in huge volumes without really understanding the actual risk they faced.

Our theory can be tested in a lab through the conduction of an experimental study. The participants may be asked to participate in an investment decision where they are instructed with the definition of two types of risk. In order to make systemic risk more intuitive to understand, we can instruct the students that there is a system-wide (macro) risk which cannot be diversified by choosing any of the assets. Without entering into a discussion as to whether the participants, as decision makers, will choose the optimal portfolio suggested by the classical asset pricing theory, we can test whether they change their investment decision when faced with either a very small systemic risk or a big systemic risk.

Another possible way of testing our theory is by measuring participants' risk aversion in an experimental setting. Then one can ask the subjects to form portfolios of risky assets and then look at whether the more risk averse participants rebalance their portfolio more aggressively (i.e., change the composition of assets more significantly) after a systemic shock.

Notes

1. Acharya *et al.* (2017) mentions that the regulatory framework before the crisis did not sufficiently focus on dealing with systemic risk.
2. Especially prior to the global financial crisis nontraditional securities were issued in huge volumes. Figures 4 and 5 in Online Appendix show the significant volume changes after the 2000s. Asset-backed securities (ABS) in the US doubled from 2003 to 2007 (Figure 4) and nontraditional securitization quadrupled from 2002 to 2006 (Figure 5).
3. For example, Henderson and Pearson (2011) claim that it is difficult to rationalize the investors buying of overpriced complex securities.
4. As it has been discussed, considering the global financial crisis, the lack of availability of past historical default rates for nontraditional securities may have resulted in the neglect of systemic risk. Also see Gennaioli *et al.* (2015) as an application of the representativeness idea of Kahneman and Tversky (1972) where people overestimate the outcomes that occurred relatively more frequently in recent history.
5. Several studies have examined the impact of securitization on monitoring incentives of the banks (Fender and Mitchell, 2009; Parlour and Plantin, 2008; Plantin, 2011).

6. See Mendel and Shleifer (2012) for a detailed discussion as to why the facts of the financial crisis of 2007–09 make the case more interesting in regards to the participants in derivative markets mostly being sophisticated investors.
7. See Thakor (2015).
8. Note that when we have only two goods with two attributes, if one attribute is significantly different between the two goods compared to the other attribute, then it will stand out as the salient attribute for both goods due to symmetry.
9. W.l.g let $W = \tilde{W} + \bar{c}$, and let us assume that the young generation consumes a fixed $\bar{c}$ and invests the leftover. Thus, in a sense, we merely focus on the asset choice of the investors and isolate our discussion from the optimal consumption choice for the newborns. When a generation arrives in the next period (i.e. the old generation), they consume everything they have after selling their assets to the newborns.
10. The reason we did not pick $N = 2$ is because when there are only 2 assets, their payouts are directly correlated due to the modeling of systemic risk. Thus, we need more than 2 assets to have a sensible systemic risk concept. Also our results carry through for the more generic case of $N > 3$.
11. This simplification is to have a reasonable comparison between the prices of the assets in equilibrium. When assets have different variances, due to variance size effect, the prices will be different. By assuming that all assets have the same total variance (total risk including systemic and idiosyncratic), one can say that the difference in prices directly results from a different combination of systemic and idiosyncratic risks.
12. Having the demands as functions of prices and parameters, equilibrium prices will be determined in consideration that the supply is fixed.
13. This over/under weighing is aligned with the context dependency, as in Prospect Theory, since salience is also based on a reference point.
14. Note that this modeling of δ generates salience bias in perceived risk. One can also generate qualitatively similar results of this paper by modeling the bias as follows. $R_j = K + (1-\delta)\varepsilon_j + \delta(\alpha_j \mu)$ where $1/2 < \delta < 1$.
15. The model can be modified so that historical information forms the prior and the salience weight. One can build a dynamic model in which the historical realization of risk may be modeled to increase the probability of being salient.
16. Note that arbitrarily large ω may also imply negative prices.
17. Time subscripts are ignored in the notation, in order to keep it simple.
18. For the generic N asset case: $p_i^R = \frac{W(K-2\gamma(\alpha_i\sigma_\mu^2(\sum_{j=1}^N \alpha_j)+\sigma_i^2))}{NK-2\gamma(\sigma_\mu^2(\sum_{j=1}^N \alpha_j)^2+\sum_{j=1}^N \sigma_j^2)}$ for $i \in N$ and for any time period, where α_i stands for the correlation with systemic risk for asset i
19. Çelen and Kariv (2004) discuss the difference between an informational cascade and herd behavior. They claim that an informational cascade implies a herd behavior but not necessarily vice a versa. Regarding the focus of this study we do not go into this discussion and imply similar meaning for both terminology.
20. The reference point can be defined as the average of all assets or can be a specific asset.
21. We use absolute difference rather than $(p_{t,j}^\varepsilon - E[p_{t+1,j}])^2$ since the results do not change qualitatively.
22. Investors have mean-variance utility, which implies that as variance increases the demand decreases. Thus, to have a meaningful comparison between ε- and μ-salient cases, the variances should be comparable. Given that there is a fixed supply of assets, this restriction allows us to compare p_j^ε and p_j^μ by allowing $\mathrm{Var}(W_2)^\varepsilon = \mathrm{Var}(W_2)^\mu$.
23. Note that this is not a size effect. Actually size effect works in the opposite direction. When risk aversion increases, investors have a smaller demand and this results in smaller prices.

References

Acharya, V.V., Schnabl, P. and Suarez, G. (2013), "Securitization without risk transfer", *Journal of Financial Economics*, Vol. 107 No. 3, pp. 515-536.

Acharya, V.V., Pedersen, L.H., Philippon, T. and Richardson, M. (2017), "Measuring systemic risk", *Review of Financial Studies*, Vol. 30 No. 1, pp. 2-47.

Aizenman, J. and Jinjarak, Y. (2009), "Current account patterns and national real estate markets", *Journal of Urban Economics*, Vol. 66 No. 2, pp. 75-89.

Akhtar, S., Faff, R., Oliver, B. and Subrahmanyam, A. (2012), "Stock salience and the asymmetric market effect of consumer sentiment news", *Journal of Banking and Finance*, Vol. 36 No. 12, pp. 3289-3301.

Allen, F., Carletti, E., Goldstein, I. and Leonello, A. (2015), "Moral hazard and government guarantees in the banking industry", *Journal of Financial Regulation*, Vol. 1 No. 1, pp. 30-50.

Altunbas, Y., Gambacorta, L. and Marques-Ibanez, D. (2010), "Bank risk and monetary policy", *Journal of Financial Stability*, Vol. 6 No. 3, pp. 121-129.

Baker, M. and Wurgler, J. (2007), "Investor sentiment in the stock market", *The Journal of Economic Perspectives*, Vol. 21 No. 2, pp. 129-151.

Baker, M., Wurgler, J. and Yuan, Y. (2012), "Global, local, and contagious investor sentiment", *Journal of Financial Economics*, Vol. 104 No. 2, pp. 272-287.

Beccalli, E., Boitani, A. and Di Giuliantonio, S. (2015), "Leverage pro-cyclicality and securitization in us banking", *Journal of Financial Intermediation*, Vol. 24 No. 2, pp. 200-230.

Bernanke, B.S. (2005), "The global saving glut and the us current account deficit", Technical report.

Bhargava, R., Lou, X., Ozik, G., Sadka, R. and Whitmore, T. (2022), "Quantifying narratives and their impact on financial markets", Available at: SSRN 4166640.

Bordalo, P., Gennaioli, N. and Shleifer, A. (2012), "Salience theory of choice under risk", *The Quarterly Journal of Economics*, Vol. 127 No. 3, pp. 1243-1285.

Bordalo, P., Gennaioli, N. and Shleifer, A. (2013a), "Salience and asset prices", *American Economic Review*, Vol. 103 No. 3, pp. 623-628.

Bordalo, P., Gennaioli, N. and Shleifer, A. (2013b), "Salience and consumer choice", *Journal of Political Economy*, Vol. 121 No. 5, pp. 803-843.

Borup, D., Hansen, J., Liengaard, B. and Schütte, E.C.M. (2022), "Quantifying investor narratives and their role during covid-19", Available at: SSRN 3752116.

Çelen, B. and Kariv, S. (2004), "Distinguishing informational cascades from herd behavior in the laboratory", *American Economic Review*, Vol. 94 No. 3, pp. 484-498.

Chernenko, S., Hanson, S.G. and Sunderam, A. (2016), "Who neglects risk? Investor experience and the credit boom", *Journal of Financial Economics*, Vol. 122 No. 2, pp. 248-269.

Da, Z., Engelberg, J. and Gao, P. (2014), "The sum of all fears investor sentiment and asset prices", *The Review of Financial Studies*, Vol. 28 No. 1, pp. 1-32.

Favilukis, J., Kohn, D., Ludvigson, S.C. and Van Nieuwerburgh, S. (2012), "International capital flows and house prices: theory and evidence", in *Housing and the Financial Crisis*, University of Chicago Press, pp. 235-299.

Fender, I. and Mitchell, J. (2009), "Incentives and tranche retention in securitisation: a screening model", BIS Working Paper, p. 289.

Ferrero, A. (2015), "House price booms, current account deficits, and low interest rates", *Journal of Money, Credit and Banking*, Vol. 47 No. S1, pp. 261-293.

Gennaioli, N., Shleifer, A. and Vishny, R. (2012), "Neglected risks, financial innovation, and financial fragility", *Journal of Financial Economics*, Vol. 104 No. 3, pp. 452-468.

Gennaioli, N., Shleifer, A. and Vishny, R. (2015), "Neglected risks: the psychology of financial crises", *The American Economic Review*, Vol. 105 No. 5, pp. 310-314.

Goetzmann, W.N., Kim, D. and Shiller, R.J. (2016), "Crash beliefs from investor surveys", *National Bureau of Economic Research*.

Gorton, G. and Metrick, A. (2012), "Securitized banking and the run on repo", *Journal of Financial Economics*, Vol. 104 No. 3, pp. 425-451.

Greenlaw, D., Hatzius, J., Kashyap, A.K. and Shin, H.S. (2008), "Leveraged losses: lessons from the mortgage market meltdown", *Proceedings of the US Monetary Policy Forum*, Vol. 2008, pp. 7-59.

Greenwood, R. and Shleifer, A. (2014), "Expectations of returns and expected returns", *Review of Financial Studies*, Vol. 27 No. 3, pp. 714-746.

Henderson, B.J. and Pearson, N.D. (2011), "The dark side of financial innovation: a case study of the pricing of a retail financial product", *Journal of Financial Economics*, Vol. 100 No. 2, pp. 227-247.

Huang, D., Jiang, F., Tu, J. and Zhou, G. (2014), "Investor sentiment aligned: a powerful predictor of stock returns", *The Review of Financial Studies*, Vol. 28 No. 3, pp. 791-837.

Justiniano, A., Primiceri, G.E. and Tambalotti, A. (2014), "The effects of the saving and banking glut on the us economy", *Journal of International Economics*, Vol. 92, pp. S52-S67.

Kahneman, D. (2011), *Thinking, Fast and Slow*, Macmillan, New York.

Kahneman, D. and Tversky, A. (1972), "Subjective probability: a judgment of representativeness", *Cognitive Psychology*, Vol. 3 No. 3, pp. 430-454.

Klibanoff, P., Lamont, O. and Wizman, T.A. (1998), "Investor reaction to salient news in closed-end country funds", *The Journal of Finance*, Vol. 53 No. 2, pp. 673-699.

Lepori, G.M. (2015), "Investor mood and demand for stocks: evidence from popular tv series finales", *Journal of Economic Psychology*, Vol. 48, pp. 33-47.

Mendel, B. and Shleifer, A. (2012), "Chasing noise", *Journal of Financial Economics*, Vol. 104 No. 2, pp. 303-320.

Möhlmann, A. (2013), "Investor home bias and sentiment about the country benefiting from the tax revenue", *Journal of Economic Psychology*, Vol. 35, pp. 31-46.

Obstfeld, M. and Rogoff, K. (2009), "Global imbalances and the financial crisis: products of common causes", CEPR Discussion Paper No. DP7606.

Palomino, F., Renneboog, L. and Zhang, C. (2009), "Information salience, investor sentiment, and stock returns: the case of british soccer betting", *Journal of Corporate Finance*, Vol. 15 No. 3, pp. 368-387.

Parlour, C.A. and Plantin, G. (2008), "Loan sales and relationship banking", *The Journal of Finance*, Vol. 63 No. 3, pp. 1291-1314.

Plantin, G. (2011), "Good securitization, bad securitization", Technical report, Institute for Monetary and Economic Studies, Bank of Japan.

Rajan, R.G. (2006), "Has finance made the world riskier?", *European Financial Management*, Vol. 12 No. 4, pp. 499-533.

Shiller, R.J. (2017), "Narrative economics", *American Economic Review*, Vol. 107 No. 4, pp. 967-1004.

Shiller, R.J. (2020a), *Narrative Economics: How Stories Go Viral and Drive Major Economic Events*, Princeton University Press, New Jersey.

Shiller, R.J. (2020b), "Popular economic narratives advancing the longest us expansion 2009-2019", *Journal of Policy Modeling*, Vol. 42 No. 4, pp. 791-798.

Shleifer, A. and Vishny, R.W. (1997), "The limits of arbitrage", *The Journal of Finance*, Vol. 52 No. 1, pp. 35-55.

Shleifer, A. and Vishny, R.W. (2010), "Unstable banking", *Journal of Financial Economics*, Vol. 97 No. 3, pp. 306-318.

Stambaugh, R.F., Yu, J. and Yuan, Y. (2012), "The short of it: investor sentiment and anomalies", *Journal of Financial Economics*, Vol. 104 No. 2, pp. 288-302.

Taylor, S.E. and Thompson, S.C. (1982), "Stalking the elusive 'vividness' effect", *Psychological Review*, Vol. 89 No. 2, p. 155.

Thakor, A.V. (2015), "The financial crisis of 2007-2009: why did it happen and what did we learn?", *Review of Corporate Finance Studies*, Vol. 4 No. 2, pp. 155-205.

Uhde, A. and Michalak, T.C. (2010), "Securitization and systematic risk in european banking: empirical evidence", *Journal of Banking and Finance*, Vol. 34 No. 12, pp. 3061-3077.

Yu, J. and Yuan, Y. (2011), "Investor sentiment and the mean–variance relation", *Journal of Financial Economics*, Vol. 100 No. 2, pp. 367-381.

Appendix

The appendix file for this article can be found online.

Corresponding author

Ali Yavuz Polat can be contacted at: aliyavuz.polat@agu.edu.tr