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An experimental analysis of contagion in financial markets ☆

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ABSTRACT

In an experimental market, we study how information about the dividend of an asset, which is available to some traders, is absorbed in the asset's price when all traders also have access to the prices of another different asset. We consider two treatments: in one, the dividends of the two assets are independent; in the other, the dividend of the own asset correlates positively with the dividend of the other asset. Since there is no aggregate uncertainty in the own market, the other dividend should not affect own prices according to the rational expectations equilibrium. Consistent with a prior information perspective, we find that (a) own prices are increasing in the other dividend if and only if dividends are correlated, and (b) correlated dividends can worsen information dissemination when the own dividend is low, and the other dividend is high. These findings imply that linkages between markets, both via fundamentals and via observability of market prices, can cause financial contagion even if there are corrective market forces at play (superior private information in the own market).

1. Introduction

1.1. Motivation and contribution

It is widely documented in the empirical finance literature that asset prices, both across countries and across asset classes, co-move more than what can be explained by asset fundamentals (Eichengreen et al., 1996; Edwards and Rigobon, 2002; Ehrmann et al., 2011). Such financial contagion can cause financial instability to quickly spread from one country or asset class to another, and is one of the explanations for the excess correlation of asset prices that has been observed during the Asian Financial Crisis of 1997, the Russian Financial Crisis of 1998, and the Global Financial Crisis of 2007-08. The theoretical asset pricing literature identifies informational spillovers as one of the most prominent channels of financial contagion (King and Wadhwani, 1990; Pericoli and Sbracia, 2003; Allen

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and Gale, 2008; Knyazeva et al., 2012), though supportive empirical evidence is only circumstantial, mostly because identifying excess in correlation of asset prices requires an accurate knowledge of the fundamentals (Cipriani et al., 2018).

This paper explores the underlying channels of financial contagion by experimentally examining how linkages between asset fundamentals impact the dissemination of private information and, consequently, market efficiency. To achieve this, we design a laboratory experiment with two countries: one domestic and one foreign. Each country has an asset that commonly pays either a high or a low dividend. These assets are traded in completely separated continuous-time double-auction markets. Prior to trading, three out of the ten foreign traders receive perfect information about the actual foreign dividend, while the remaining traders receive no private information. The distribution of private information is common knowledge. Importantly, there is no information flow from the domestic to the foreign market, and one should thus think of the foreign market as being completely isolated. The domestic market mirrors the foreign market in all aspects, including the distribution of information, except for the possibility of a linkage to the foreign market. We explore two treatment variations regarding this linkage: in one treatment, the domestic dividend is independent of the foreign dividend; in the other treatment, the domestic dividend depends positively on the foreign dividend. A key ingredient of our experiment is that domestic traders can update their beliefs about the domestic dividend by observing both domestic and foreign prices.

We derive our experimental hypotheses from both the rational expectations equilibrium and the prior information equilibrium. In the rational expectations equilibrium, prices fully incorporate all private information, leading to an efficient domestic market outcome with no financial contagion, meaning that potential informational spillovers from the foreign to the domestic market have no equilibrium effect. However, the situation differs under the prior information equilibrium. Here, uninformed domestic traders base their decisions only on foreign prices, thus disregarding the information provided by domestic prices. As a result, the domestic equilibrium price is shaped by the foreign dividend whenever dividends are correlated.

Our experimental results strongly support the prior information perspective. When dividends are independent, as predicted by both equilibrium models, domestic prices turn out to be independent of the foreign dividend. However, if dividends are correlated, evidence of financial contagion emerges. Specifically, domestic prices tend to rise in response to an increase in the foreign dividend, and prices are significantly higher in the correlated dividend treatment when the domestic dividend is low and the foreign dividend is high. These findings can be connected to the recent study of Trevino (2020), which introduces the concepts of a *fundamental channel* and a *social learning channel* in the context of financial contagion. The former refers to interconnectedness or financial linkages between different institutions or markets; the latter arises when agents base their decisions upon noisy information from the other economy. While Trevino (2020) studies these channels and identifies experimental biases in one-shot investment decisions under solvency risk, we explore them in continuous-time double-auction asset markets. Our setting, however, features three channels of financial contagion: the fundamental channel, which captures the correlation between dividends, and two social learning channels—the *domestic social learning channel*, which involves learning from domestic prices, and the *foreign social learning channel*, which entails learning from foreign prices. Since superior private information exists in the domestic market, beyond what the potential correlation with the foreign market provides, the key takeaway from our study is that the fundamental channel and learning from other prices can cause financial contagion even if there are corrective market forces at play (learning from own prices).

We ensure the above findings are robust by running both treatments under three secondary variations called conditions. In one condition, the domestic market opens after the foreign market closes. In another condition, the domestic and the foreign market open and close simultaneously. In the third condition, we allow for short-selling in order to rule out that our results are caused by a lack of convergence if the domestic dividend is low (i.e., Biais et al., 2005, Hanson et al., 2006, Veiga and Vorsatz, 2009 and 2010, and Corgnet et al., 2023). The most important difference between these conditions arises when both dividends are low. In this case, correlated dividends have a negative impact on information dissemination only if traders cannot sell the asset short. As soon as these short-selling constraints are relaxed, there are no treatment differences, as predicted by our main hypotheses.

The remainder is organized as follows. In Section 2, we describe our experimental design and procedures and derive theoretical hypotheses. Section 3 presents and discusses our experimental results. Finally, in Section 4, we conclude. Additional figures and data analysis, experimental instructions and z-tree screenshots, control questions, and the ex-post questionnaire are included in the Online Appendix.

1.2. Literature review

The question whether financial markets are able to correctly incorporate information held by traders into market prices has received considerable attention in economics and finance. According to the efficient-market hypothesis (Hayek, 1945; Muth, 1961; Fama, 1970), asset prices perfectly reflect all available information, which implies that it is impossible to "beat the market". While the early empirical literature supports this hypothesis (Fama, 1965, 1970; Scholes, 1972), later research produced contradicting evidence (De Bondt and Thaler, 1985; Ito et al., 1998; Jegadeesh and Titman, 1993). Given that it is not possible to control in the field for the private information of the market participants, laboratory experiments are considered a useful tool to complement the theoretical and empirical research on market efficiency. The main insight from the early experimental literature on asset pricing is that markets have some capacity to incorporate private information (Forsythe et al., 1982; Plott and Sunder, 1982, 1988; Forsythe and Lundholm, 1990). However, there are also several studies that report a substantial divergence between market prices and underlying fundamentals (Camerer and Weigelt, 1991; O'Brien and Srivastava, 1991; Hanson et al., 2006; Huber et al., 2011; Page and Siemroth, 2017, 2021; Corgnet et al., 2018, 2020, 2023). Our study focuses on contagion in the sense that information about prices from one market may obstruct the process of information dissemination in another market, that is, prices end up further away from the rational expectations equilibrium if fundamentals are correlated.

Despite informational contagion being a prominent contagion mechanism, there is not a large experimental literature studying informational contagion and how it affects market efficiency. First, there have been studies focusing on settings where there is a strong linkage, and hence arbitraging opportunities, between the two markets, such as Fisher and Kelly (2000), Qi and Ochs (2009) and Ackert et al. (2011). Second, Vardanyan (2017) studies the contagion of crisis information from one market to the other. This study finds that a sudden price drop (mimicking a crisis effect) in one market causes a price drop in the other market. Third, Cipriani et al. (2018) analyzes, like us, how informational spillovers between two markets interact with information aggregation. They consider a model close to King and Wadhwani (1990) that can generate contagion (an excess correlation of asset prices in the rational expectations equilibrium with respect to the correlation in the asset fundamentals) and find that the experimental data is consistent with the model predictions, both in a treatment with and in a treatment without correlated asset fundamentals. One key difference with Cipriani et al. (2018) is that we allow for asymmetric information and that financial contagion can only occur in the prior information but not in the rational expectations equilibrium.

Finally, while Shurchkov (2013), Trevino (2020) and Bayona and Peia (2022) follow a global games approach to financial contagion, Chakravarty et al. (2014), Brown et al. (2017), Kiss et al. (2018) and Duffy et al. (2019) investigate in the laboratory coordination games with multiple equilibria to model bank-runs. In Chakravarty et al. (2014), when making their decision to withdraw or not, depositors of the domestic bank all share the same prior regarding the liquidity of their bank being high or low, and all receive information about withdrawal decisions by depositors at the foreign bank. If the fundamental channel is activated, public information is superior to the prior information held about the liquidity level of the domestic bank if foreign depositors coordinate on different equilibria (bank run or no-run) at different liquidity levels of their bank, which they are perfectly informed about prior to making their withdrawal decision; their results support this if-condition. They also find information contagion to be stronger when liquidity levels are correlated, which is consistent with our finding that the price of the domestic asset increases in the dividend of the foreign asset if and only if dividends are correlated. A major difference with this strand of the literature is that we are concerned with the capacity of markets to correctly reflect private information, which introduces domestic prices as a further source for belief updating.

2. Laboratory experiment

2.1. Design

Subjects assume the role of traders who can interchange an asset in a continuous-time double-auction market. The presence of insiders and the fact that these receive perfect private information is commonly known. Our main objective is to study how private information is incorporated into prices, and how information dissemination is affected by prices in other markets with correlated fundamentals. For expositional reasons, some subjects are assumed to be in a domestic country, while others are in a foreign country. We refer to the asset traded in the domestic country as asset D. The foreign asset is called asset F. Traders only participate in the market of the country they belong to. So, subjects in the domestic country trade asset D in market D, and foreign subjects trade asset F in market F. Foreign traders do not receive any information about the domestic market; in fact, they do not even know its existence, but domestic traders observe foreign prices.

Foreign market. Ten subjects trade asset F that either yields a high (150 ECU) or a low (50 ECU) dividend, each with a 50% chance. Three of the ten traders are randomly selected upfront, i.e., before the market opens, and learn whether the actual dividend is high or low. Each trader is endowed with four shares of the asset and 6,000 ECU of cash. This cash amount is provided as an interest-free loan and allows traders to buy all outstanding shares. The loan is automatically returned at market closure.

Once the market opens, subjects can trade shares of asset F for 240 seconds by posting buy (bid prices) and sell orders (ask prices). At any moment, traders can have at most one standing buy and one standing sell order (for a single share each), but these can be updated in continuous time. The order book is public, and trades are automatically liquidated at the best possible price for the last order entering the market. Prices at which trades take place are graphically shown in continuous time. After the market closes, all traders (i.e., also the seven initially uninformed traders) get to know the actual dividend of the asset and their personal payoff. All this is commonly known.

Domestic market. The domestic market conditions are identical to the foreign ones apart from a possible linkage to the foreign asset. All domestic traders know (and this is common knowledge) that if the foreign dividend is high (low), then the domestic dividend is high (low) with probability $p \geq 0.5$. That is, first, the foreign dividend is randomly determined. Then, given the realized foreign dividend, the conditional probability that two dividends are identical is $p \geq 0.5$. We consider two values of p. In treatment *Independent* (*Ind*), $p = 0.5$; and in treatment *Correlated* (*Cor*), $p = 0.7$. The latter probability has been chosen to be conveniently above 0.5, while still allowing for a sufficiently high chance of different dividend values to be realized in the two markets. No domestic trader has private information about the foreign dividend, but foreign prices are graphically shown. After market D closes, domestic traders also learn the foreign dividend.[1]

Our main objective is to uncover how the probability p affects the dissemination of information in the domestic market. In this respect, our design also includes two secondary variations that may have an impact on the results and that we control for: (a) the way

[1] An interesting design alternative would have been to inform domestic traders about the true foreign dividend (and not about foreign prices, which are noisy). We decided however to follow Cipriani et al. (2018) who also present foreign prices instead of the true foreign dividend to the domestic traders, as it induces a richer setting. In particular, subjects have to form subjective beliefs about the foreign dividend.

Table 1
The six domestic settings.

Conditions	Treatments	
	Independent	Correlated
Sequential	*Ind-Seq*	*Cor-Seq*
Parallel	*Ind-Par*	*Cor-Par*
Short-selling	*Ind-ShS*	*Cor-ShS*

in which foreign prices are displayed to domestic traders, and (b) the capacity to sell the asset short.[2] To facilitate the exposition, we refer to combinations of secondary variations as *conditions*. In our baseline condition, called condition *Sequential* (*Seq*), the foreign market closes before the domestic market opens, which implies that domestic traders have access to the complete time series of foreign prices when they start trading. Also, traders are unable to sell the asset short. In condition *Parallel* (*Par*), traders are still unable to sell the asset short, yet the two markets open and close simultaneously. Foreign prices thus update from a domestic trader's point of view in continuous time. Finally, in condition *Short-selling* (*ShS*), foreign prices are displayed as in condition *Seq* and every trader can sell up to 10 shares short. Thus, after trading stops, a trader with a negative number of shares in the inventory has to pay the actual dividend for each of these. Our design consequently consists of six domestic *settings* (combinations of treatments and conditions): *Ind-Seq*, *Ind-Par*, *Ind-ShS*, *Cor-Seq*, *Cor-Par*, and *Cor-ShS*, summarized in Table 1.[3]

2.2. Procedures

We ran the foreign market with six different groups—three groups without short-selling opportunities that are common for conditions *Seq* and *Par* and three different groups with relaxed short-selling constraints for condition *ShS*—and each of the six domestic settings with six different groups.[4] Therefore, 420 different subjects participated in the experiment. Market F was run upfront in an isolated fashion and the results were then used in the sessions for the domestic market. For each condition, group 1 of Market F was matched with Groups 1 and 4 of Market D, group 2 of Market F was matched with Groups 2 and 5 of Market D, and Group 3 of Market F was matched with Groups 3 and 6 of Market D.

Each group traded the asset for 13 rounds or periods. Period 0 was a practice round and periods 1 to 12 were subject to monetary incentives with payoffs being accumulated over these 12 rounds. At the beginning of each round, the asset's dividend was drawn anew, as were the three subjects that got to know the dividend. In the practice round, no one received private information. It was not possible to carry over shares or cash from one period to the next one in order to keep observations as independent as possible.

Sessions took place in the Laboratory for Research in Behavioural Experimental Economics (LINEEX) at the University of Valencia. Students of the University of Valencia from various disciplines were recruited to participate in one of the nine sessions.[5] During the sessions, participants were situated in isolated work-spaces accommodated with a computer. Instructions (see Online Appendix A) were read aloud, displayed on computer screens, and provided on paper for later referencing. Texts were phrased as neutrally as possible (e.g., dividend states were not called high and low, but W and Z for asset F and X and Y for asset D). All interactions took place via the computers that were connected to a central server, using z-Tree (Fischbacher, 2007). Before the trading phase started, all participants had to correctly answer a list of control questions that tested their understanding of the instructions. After the final trading period, a post-experimental questionnaire followed in which we elicited information about participants' gender and, using monetary incentives, their risk attitudes (Holt and Laury, 2002), attention levels by means of the CRT (Frederick, 2005; Sirota and Juanchich, 2018), and risk literacies using the Berlin Numeracy Test (Cokely et al., 2012). Sessions concluded with participants receiving their earnings, with the accumulated payoffs in the 12 incentivized trading rounds being exchanged for euro at an exchange rate of 400 ECUs per euro. A typical session lasted a bit less than two hours and average earnings were about 21 euro (including 6 euro show-up fee). It occasionally happened that a trader made a loss in a period, but no subject went bankrupt over the course of the whole experiment. The experiment received ethical approval from the University of Otago Human Ethics Committee (reference number D20/017).

[2] We are very grateful to two anonymous reviewers who motivated us to relax short-selling constraints.

[3] Our design does not include the combination of secondary variations with parallel markets and short-selling possibilities. The resulting unbalance (that is, an over-representation of conditions with the sequential information structure and an over-representation of conditions without short-selling possibilities) is carefully controlled for in our statistical analysis. Furthermore, Section 3.4 explores whether there are crucial differences between the conditions, where the conditions *Parallel* and *Short-selling* are compared to the baseline condition *Sequential*.

[4] In order to address the potential issue that the results in the domestic market are driven by market inefficiencies in the foreign market (i.e., the price ends up too high if the actual dividend is low), in condition *ShS*, the traders in the foreign market are also allowed to sell up to 10 shares of the asset short. We decided to use multiple observations for the foreign market rather than one in order to prevent reporting results that may potentially be unduly affected by this one observation. Our choice to go for three rather than six observations was to economize on expenditures. Figs. 2 and 3 in Online Appendix G.1 present the average price paths for the different groups, which are structurally very much alike.

[5] We ran two sessions with 30 subjects (three groups each) for market F and one session with 60 subjects for all settings but *Ind-Par*, for which we run two sessions with 30 subjects each due to COVID-19 restrictions.

Table 2
Rational expectations (RE) and prior information (PI) equilibrium prices for the domestic asset in each of the two treatments (*Cor* and *Ind*) and in each of the four states $s \in \{HH, HL, LH, LL\}$. For each state s, the first letter refers to the dividend of the domestic asset (high or low), and the second letter for the dividend of the foreign asset (high or low).

State	Treatment *Cor*		Treatment *Ind*	
	RE	PI	RE	PI
HH	150	150	150	150
HL	150	150	150	150
LH	50	[100,120]	50	100
LL	50	[80,100]	50	100

2.3. Hypotheses

We discuss the domestic market. In this process, we are explicit about the potential channels of financial contagion. As in Trevino (2020), the *fundamental channel* refers to the connectedness of the countries. The fundamental channel is only active in treatment *Cor*. The *domestic and foreign social learning channels* regard how subjects update their beliefs about the domestic dividend given domestic and foreign prices, respectively.

In the literature on experimental financial markets the rational expectations (RE) and the prior information (PI) equilibrium with payoff-maximizing traders have been applied extensively. According to the RE equilibrium prices incorporate all information available to traders. Since there is no aggregate uncertainty, the RE equilibrium price is always equal to the true domestic dividend. Thus, from a rational expectations perspective, the domestic social learning channel corrects the possibly misleading information from foreign prices.

The PI equilibrium is based upon the assumption that the uninformed traders update their belief about the domestic dividend by only considering foreign prices, that is, the domestic social learning channel is inactive. Traders then sell the asset at prices above the expected dividend of the posterior distribution and buy it at prices below, thereby ignoring all information that may be conveyed through domestic prices. The informed domestic traders proceed in the same way, but since they have access to perfect private information, they ignore foreign prices. Since buyers have deep pockets given the potential supply of shares from the sellers—independent of whether there is the opportunity to sell the asset short or not—, the PI equilibrium price, which is found by intersecting the aggregate supply and demand curves, is equal to the highest expected dividend of the two types of traders.

Table 2 shows the two equilibria for each possible state $s \in \{HH, HL, LH, LL\}$. In the notation $s = xy$, x stands for the dividend of the domestic asset (high or low) and y for the dividend of the foreign asset (high or low). Then, p_s^T is the price of the domestic asset in state s of treatment $T \in \{Ind, Cor\}$.

Next, we derive the PI equilibrium of Table 2. If the domestic dividend is high, the informed traders value the asset at 150, which is the highest possible value. Therefore, the PI equilibrium price is equal to 150 in HH and HL. If the domestic dividend is low, the informed traders value the asset at 50, which is the lowest possible value. The PI equilibrium price thus coincides with the expected dividend of the uninformed traders. In treatment *Cor*, the expected domestic dividend from the uninformed traders' point of view is

$$(0.7 \cdot 150 + 0.3 \cdot 50) \cdot \mu^{Cor} + (0.3 \cdot 150 + 0.7 \cdot 50) \cdot (1 - \mu^{Cor}) = 80 + 40 \cdot \mu^{Cor},$$

where μ^{Cor} is the subjective belief of an uninformed trader that the domestic dividend is high upon observing foreign prices. If the belief updating process is directionally correct, then $\mu^{Cor} \in [0.5, 1]$ whenever the foreign dividend is high and $\mu^{Cor} \in [0, 0.5]$ whenever the foreign dividend is low. The PI equilibrium price then falls into the interval [100,120] in state LH and into the interval [80,100] in state LL. In treatment Ind, on the other hand, uninformed traders think that the domestic asset is worth

$$(0.5 \cdot 150 + 0.5 \cdot 50) \cdot \mu^{Ind} + (0.5 \cdot 150 + 0.5 \cdot 50) \cdot (1 - \mu^{Ind}) = 100,$$

which is independent of μ^{Ind}.

The PI equilibrium highlights that if uninformed traders update their beliefs about the domestic dividend by only relying on foreign prices, then correlated dividends can affect domestic prices whenever the domestic dividend is low. With respect to the potential channels of financial contagion in treatment *Cor*, even though the fundamental channel is active by definition, we should consider it suppressed in HH and HL. This is because even though the uninformed traders might update their beliefs using foreign prices (the foreign social learning channel is active), the equilibrium is independent of the beliefs the uninformed traders hold. On the other hand, the fundamental channel is not suppressed in the low domestic dividend case because the equilibrium price depends on the foreign dividend.

Our main purpose—to study how the correlated asset structure affects domestic prices because subjects condition their behavior on foreign prices—is partly incorporated in the definition of the PI equilibrium, but from a behavioral point of view one can think of further violations of the RE equilibrium. For example, if the domestic dividend is high, the PI equilibrium price is 150. Intuitively, one can think that since there is competition between the informed traders, these have to bid prices up in order to make riskless gains until the equilibrium price is reached. However, in treatment *Cor*, the information the uninformed traders obtain in state HL

about the foreign market is more likely to indicate a low domestic dividend, so these may be inclined to sell their shares at lower prices when compared with state HH. So, if the competition among the informed traders is not too strong, one cannot exclude that in treatment *Cor*, prices are lower in HL than in HH. Similarly, it might be the case that in state HL, prices are higher in treatment *Ind* than in treatment *Cor*. Since we have already seen that the fundamental channel is suppressed in this case, such an effect should be attributed entirely to the foreign social learning channel. In Hypothesis H1, possible inequalities are expressed in a weak sense in order to accommodate the RE equilibrium, the PI equilibrium, and the discussed hypothesis in a single set of equations. There is evidence of contagion, spillover effects from the foreign to the domestic market, whenever a weak inequality holds strictly.[6]

Hypothesis 1 *(H1).* $p^{Cor}_{HH} = p^{Ind}_{HH} = p^{Ind}_{HL} \geq p^{Cor}_{HL}$ and $p^{Cor}_{LH} \geq p^{Ind}_{LH} = p^{Ind}_{LL} \geq p^{Cor}_{LL}$. In other words: (a) Domestic prices are unaffected by the foreign dividend in treatment *Ind*, whereas in treatment *Cor*, domestic prices are weakly increasing with the foreign dividend. (b) Domestic prices are weakly higher in treatment *Ind* than in treatment *Cor* when the foreign dividend is low. Conversely, domestic prices are weakly higher in treatment *Cor* than in treatment *Ind* when the foreign dividend is high, with equality when both dividends are high.

Hypothesis H1 has payoff consequences. Let $\pi^T_I(s)$ be the payoff of an informed trader in the domestic state s of treatment T. The corresponding payoff of an uninformed trader is $\pi^T_U(s)$. Due to private information, it is reasonable to expect that $d^T_s \equiv \pi^T_I(s) - \pi^T_U(s) \geq 0$. Indeed, the payoffs of the two groups should be equal only if prices converge quickly to the RE equilibrium or if there is no trade (see Grossman and Stiglitz, 1980). When the domestic dividend is high, informed traders are likely to buy shares from uninformed traders. And the gains from buying these shares can be hypothesized to be higher when the price of the domestic asset is lower so that d^T_s decreases with the price of the domestic asset. On the other hand, if the domestic dividend is low, then the informed traders sell shares to the uninformed traders. Thus, d^T_s is increasing in the price of the domestic asset. When combined with Hypothesis H1, we thus obtain the following hypothesis.

Hypothesis 2 *(H2).* $d^{Cor}_{HH} = d^{Ind}_{HH} = d^{Ind}_{HL} \leq d^{Cor}_{HL}$ and $d^{Cor}_{LH} \geq d^{Ind}_{LH} = d^{Ind}_{LL} \geq d^{Cor}_{LL}$. In other words: (a) The payoff difference between informed and uninformed traders does not depend on the foreign dividend in treatment *Ind*. However, it is weakly increasing (or decreasing) with the foreign dividend in treatment *Cor* whenever the domestic dividend is low (or high). (b) The payoff difference is weakly higher in treatment *Cor* than in treatment *Ind* whenever the two dividends differ. Conversely, it is weakly higher in treatment *Ind* than in treatment *Cor* when the two dividends are the same, with equality when both dividends are high.

3. Results

3.1. Foreign market

Subjects participating in the domestic market observe foreign prices while trading. Since, by Hypothesis H1, the trading activity in the domestic market is expected to be affected by foreign prices whenever there is a correlated dividend structure and since treatment *Ind* controls for framing effects—it cannot be ruled out that the simple display of the foreign prices, even though dividends are known to be uncorrelated, affects behavior and causes an overreaction—, it is crucial that the outcome of the foreign market is reasonable, as it is not desired that the domestic market is affected by some kind of abnormal foreign behavior. For example, it would be difficult to explain subject behavior in the domestic market if foreign prices were higher for the low than for the high dividend. Also, if the foreign dividend is low, one expects that prices are closer to the RE equilibrium whenever subjects can sell the asset short.

Fig. 1 shows the average price paths in the foreign market. The left panel labeled *noShS* refers to the sessions when foreign traders cannot sell the asset short and that is used for conditions *Seq* and *Par* of the domestic market. Similarly, the right panel labeled *ShS* summarizes the prices when there are short-selling opportunities in the foreign market. These sessions are employed in condition *ShS* of the domestic market. The average price paths are constructed by creating first for each trading period a time series that indicates for each time stamp t (in seconds) the last price at which a trade took place. For example, if there is a trade at a price of 110 ECU when the market opened 35 seconds ago, and the next trade occurs 10 seconds later at a price of 120 ECU, then the time series indicates a price of 110 ECU for all $t \in \{35, 36, 37, \ldots, 44\}$ and changes at $t = 45$ to 120 ECU. The average price paths in Fig. 1 for a given dividend (high or low) are obtained by first taking for each group averages over rounds (which results in an average price path for each group) and by then taking averages over groups.

Fig. 1 acknowledges that information is very well disseminated if the dividend is high. Both of the two high dividend average price paths start at a value of about 110 ECU and increase constantly over time. The slope of the price paths is steep in the beginning and then flattens, which suggests convergence. In the panels, $\bar{P}_H$ is defined as the mean of the high dividend average price path in the second half of the experiment; that is, from $t = 120$ onwards. We find that $\bar{P}_H = 135$ ECU without short-selling and $\bar{P}_H = 137$ ECU with short-selling. Second, and regarding the case of a low dividend, it has been observed in other studies (i.e., Veiga and Vorsatz,

[6] The market structure is such that the PI equilibrium is the same for conditions *Seq* and *ShS*, but we have not discussed possible differences between conditions *Seq* and *Par*. In condition *Seq*, subjects have access to all foreign prices when they start trading. In condition *Par*, the domestic and the foreign markets run in parallel. One could believe that subjects are more inclined to condition their behavior on foreign prices in *Seq*, which would imply that the adverse effect on information dissemination from the correlated asset structure would be larger in condition *Seq*. We provide some explorative evidence for this in Section 3.4, where we analyze the robustness of our main findings.

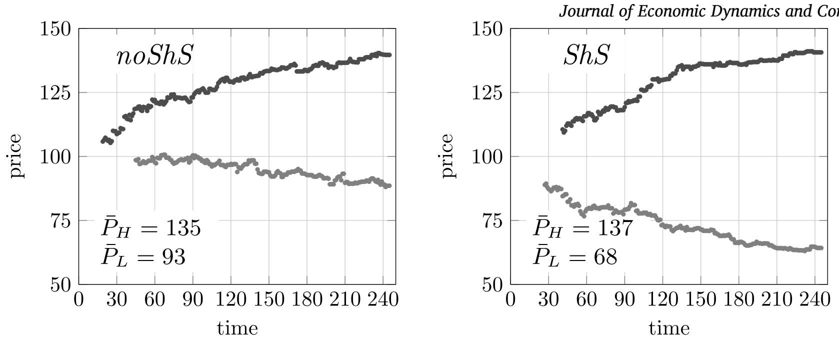


Fig. 1. Average price paths for the low (light-grey) and high (dark-grey) foreign dividend. Left: without short-selling (used for conditions *Seq* and *Par* in the domestic markets); right: with short-selling (used for condition *ShS* in the domestic market). $\bar{P}_H$ and $\bar{P}_L$ denote the average prices in the second half of the experiment ($t \geq 120$) when the foreign dividend is high and low, respectively.

2009 and 2010) that related markets with short-selling constraints have problems converging to the RE equilibrium. We observe here something very similar in the left panel because the mean of the low dividend average price path from $t = 120$ onwards, $\bar{P}_L$, is equal to 93 ECU, which is closer to the PI equilibrium of 100 ECU than to the RE equilibrium of 50 ECU. Convergence to the RE equilibrium improves when short-selling constraints are relaxed: the low dividend average price path for *ShS* always lies below the one of *noShS*, and $\bar{P}_L$ reduces to 68 ECU in *ShS*.[7]

Regarding payoffs, there are only minor differences between *ShS* and *noShS* if the foreign dividend is high. The average per-round payoff of an informed trader is 695 ECU for *ShS* and 702 ECU for *noShS*, while an uninformed trader gets on average 559 ECU in *ShS* and 556 ECU in *noShS*. Since a subject who does not trade gets 600 ECU for sure, the informed traders earn an extra 16% from trading in *ShS* and an extra 17% in *noShS*, while the uninformed traders lose due to trading about 7% in either case. With respect to the low asset F dividend, we have already indicated that the relaxation of short-selling constraints leads to a better price convergence, and this turns out to protect the uninformed traders. That is, even though the informed traders can sell more shares in *ShS*, the informed traders actually earn, on average, slightly less in this case due to the lower prices. The concrete numbers are as follows. The average per-round payoff of the informed traders is 314 ECU in *ShS* and 302 ECU in *noShS*, while the uninformed traders get 156 ECU in *ShS* and 151 ECU in *noShS*. The informed traders have thus a trading gain of 51% in *ShS* and 58% in *noShS* when compared with the no trade situation that gives a sure payoff of 200 ECU. The uninformed traders lose on average 22% in *ShS* and 25% in *noShS* due to trading.

3.2. Domestic market: prices

We concentrate on identifying domestic price patterns that are prevalent in *all* conditions; that is, we pool the data over all three conditions. Differences between *Seq* and *Par* and between *Seq* and *ShS* are explored in Section 3.4. Issues related to learning across periods are discussed in Online Appendix F.

Fig. 2 summarizes our main findings. The four large panels display the pooled average price paths for the domestic market in each state.[8] These price paths are generated in the very same way as before for the foreign market. Surrounding these four central panels, there are eight small panels that non-parametrically test Hypothesis H1; larger versions of these eight small panels are available in Online Appendix E. We detail the statistical analysis after describing the average price paths.

We can make the following observations from the average price paths. First, if the domestic dividend is high (i.e., the two large panels labeled "State HH" and "State HL"), then the ranking of the average price paths is completely in line with Hypothesis H1. In particular, in treatment *Ind*, all visible differences between HH and HL are minor. In this treatment, the average price over the second half of the experiment (the time series from $t = 120$ onwards), $\bar{P}_{Ind}$, is 129 ECU in HH and 122 ECU in HL. Also, as predicted, in state HH, there is hardly any difference between *Cor* and *Ind* and, in state HL, the average price path in *Cor* is always below the one from *Ind*. We find that $\bar{P}_{Cor} = 129$ ECU in HH and $\bar{P}_{Cor} = 115$ ECU in HL. Second, if the domestic dividend is low (i.e., the two large panels labeled "State LH" and "State LL"), the average price path in *Cor* is substantially above the one from *Ind*, for both LH and LL. According to Hypothesis H1, this should be so for LH but not for LL. In treatment *Cor*, the average price from $t = 120$ onwards is 108 ECU in state LH and 97 ECU in state LL. The corresponding numbers for treatment *Ind* are 85 ECU in LH and 86 ECU in LL. We thus highlight that if the domestic dividend is low, independently of the foreign dividend, prices are further away from the RE equilibrium in treatment *Cor* than in treatment *Ind*.

Statistically, both within and between-treatment comparisons appear naturally in our experiment. The within-treatments comparisons analyze whether for a given treatment (*Ind* or *Cor*), domestic prices are affected by the foreign dividend. There are thus four within-treatments comparisons, and according to Hypothesis H1, (a) in treatment *Ind*, domestic prices do not depend on the foreign

[7] The average price paths at the group level in Online Appendix G.1 reveal very similar patterns. Our findings regarding the foreign market can, therefore, be considered robust with respect to the different groups. All individual foreign trades are graphically shown in Online Appendix H.1.

[8] Recall from the earlier Footnote 3 that the unbalance in conditions may slightly bias the price paths in favor of the situation with sequential information and without short-selling, which is taken into account by our statistical analysis.

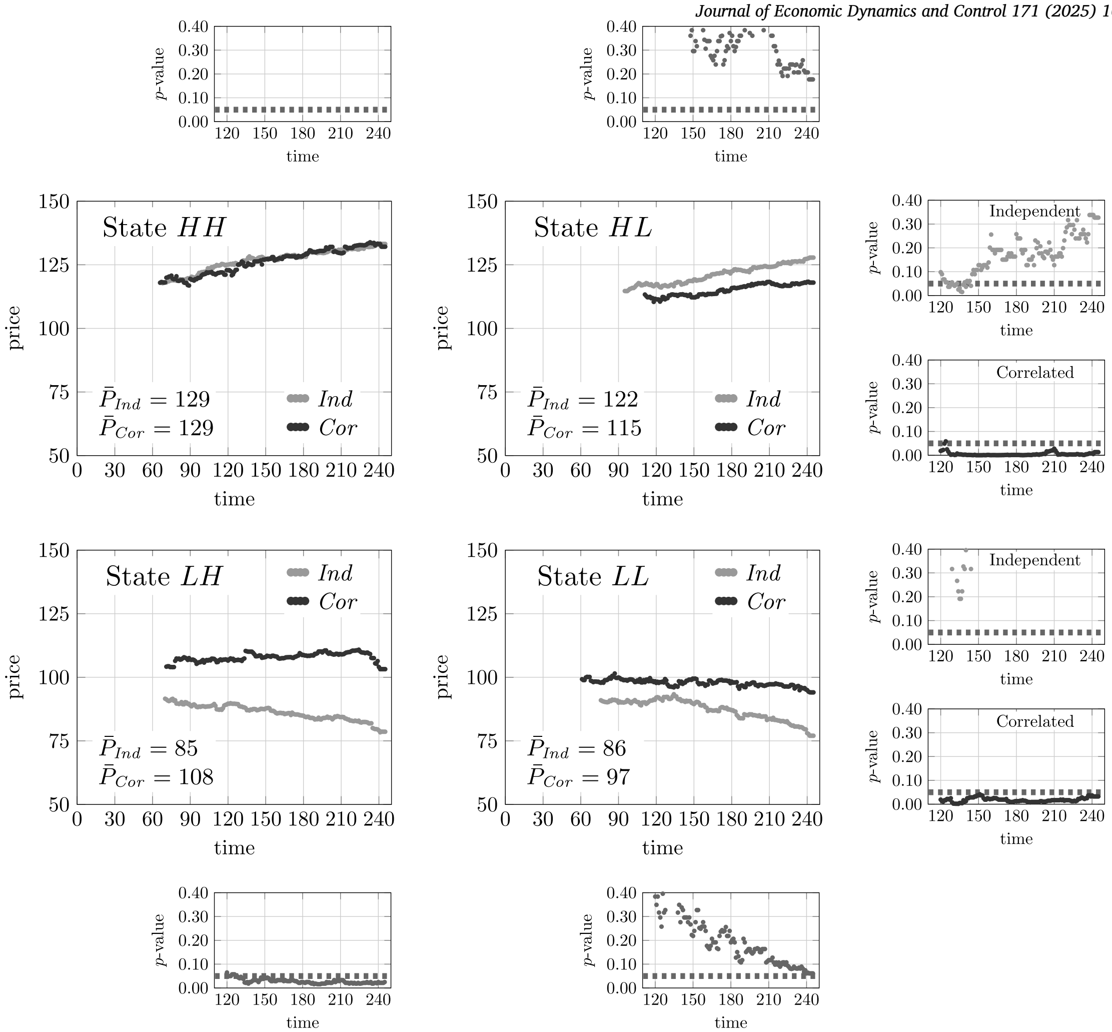


Fig. 2. Average price paths in the domestic market. The four large panels display, for each state, the average price paths in the two treatments (*Ind* and *Cor*), pooled over the three conditions. The graphs to the right of these panels show, for each treatment and time period from $t = 120$ onwards, the p-value for the comparisons of prices across states where the dividend of the domestic market is the same but the dividend of the foreign market differs. The graphs directly above and below the large panels show, for each state and time period from $t = 120$ onwards, the p-value for the comparisons of prices between the two treatments. All reported p-values are one-sided (two-sided) if Hypothesis H1 is directional (predicts equality). Only p-values in the range $[0.00, 0.40]$ are plotted, all missing values are above 0.4. The 5% threshold is highlighted via the dashed line.

dividend and (b) in treatment *Cor*, domestic prices are weakly increasing in the foreign dividend. We employ Wilcoxon signed-ranked tests with independent observations at the group level to test for the within-treatments comparison. Note that we have a total of 18 truly independent groups per treatment (six groups for each of the three conditions). For each group, the truly independent observation is the average price path in each of the four possible states.[9] We run independent Wilcoxon signed-rank tests for each $t \geq 120$. The resulting time series of p-values in the four small panels to the right of the average price paths support Hypothesis H1. The two-sided p-values in *Ind* are only in very specific instances below the 5% threshold. The median two-sided p-value over the range is 0.163 for the comparison between HH and HL and 0.811 for the comparison between LH and LL. The results for *Cor* are strikingly different. The one-sided p-values are almost always below the 5% threshold, and the median one-sided p-value over the range is 0.002 for the comparison between HH and HL, and 0.017 for the comparison between LH and LL.

Result 1 *(R1)*. If dividends are correlated, domestic prices increase with the foreign dividend ($p^{Cor}_{HH} > p^{Cor}_{HL}$ and $p^{Cor}_{LH} > p^{Cor}_{LL}$). In contrast, if dividends are independent, domestic prices remain unaffected by the foreign dividend ($p^{Ind}_{HH} = p^{Ind}_{HL}$ and $p^{Ind}_{LH} = p^{Ind}_{LL}$).

[9] We refer to Online Appendix G.2 for average price paths of each group and to Online Appendix H.2 for all individual domestic trades.

There are also four between-treatments comparisons. According to Hypothesis H1, prices are the same in both treatments in HH, prices are weakly higher in *Ind* in HL and LL, and prices are weakly higher in *Cor* in LH. We employ a non-parametric permutation test (two-sided for HH and one-sided for the other three states), which takes explicitly into account the unbalanced design, in order to statistically evaluate this hypothesis.

Fix a state s. Let $G^{Cor} = \{g^{Cor}_{i,c}\}_{(i,c)\in\{1,2,\ldots,6\}\times\{Seq,Par,ShS\}}$ be the set of 18 groups that belong to treatment Cor. In this notation, $(i,c) = (3, Seq)$ refers to the third group of condition *Seq*. The set of groups G^{Ind} is defined accordingly. We randomly match each group $g^{Cor}_{i,c} \in G^{Cor}$ to another group $g^{Ind}_{i',c'} \in G^{Ind}$ in such way that $c' = c$; that is, groups are only matched within their conditions. Thus, we obtain a bijection (one-to-one function) $G^{Cor} \to G^{Ind}$. We randomly create for each point in time $t \geq 120$ a total of $K = 1000$ bijections, denoted by $\mu^k(t) : G^{Cor} \to G^{Ind}$, where $k \in \{1,\ldots,K\}$ and $t \geq 120$.

Let $k(t) \in \{1,\ldots,K\}$. For each pair of matched groups (g, g') at $\mu^k(t)$, denote by $\Delta^k_g(t)$ the difference in the average price paths for state s between groups g and g' at time t. With the measurements of the differences in hand, we apply a Wilcoxon signed-rank test to analyze whether the median of the vector differences $\Delta^k(t) = (\Delta^k_g(t))_{g\in G^{Cor}}$ is significantly different from 0. Let $p(t) = (p^1(t),\ldots,p^K(t))$ be the distribution of p-values at time t. A well-known summary statistic of $p(t)$ is twice its median (Rüger, 1978; Vovk and Wang, 2020), which we denote by $\tilde{p}(t)$. The small panels above and below the average price paths in Fig. 2 graphically show $\tilde{p}(t)$ for all $t \geq 120$. We can see from these panels that $\tilde{p}(t)$ is only in state LH consistently below the 5% threshold, and, as predicted, in this state, prices are lower in *Cor* than in *Ind*. The median $\tilde{p}(t)$ over the range $t \geq 120$ is 1.000 in HH, 0.360 in HL, 0.025 in LH, and 0.168 in LL. The robustness analysis in Section 3.4 shows that the non-significance in LL can be traced back to condition *ShS*.

Result 2 *(R2)*. If the domestic dividend is low and the foreign dividend is high, domestic prices are significantly higher in treatment *Cor* than in treatment *Ind* ($p^{Cor}_{LH} > p^{Ind}_{LH}$). There are no other significant effects between treatments regarding the domestic price ($p^{Cor}_{HH} = p^{Ind}_{HH}$, $p^{Cor}_{HL} = p^{Ind}_{HL}$, and $p^{Cor}_{LL} = p^{Ind}_{LL}$).

3.3. Domestic market: payoffs

Hypothesis H2, which is about the within- and between-treatments comparisons of the payoff difference between the informed and the uninformed traders, is a direct consequence of Hypothesis H1. The informed traders are expected to buy shares from the uninformed traders if the domestic dividend is high, but they should sell to the uninformed traders if the domestic asset pays a low dividend. So, lower prices are expected to be beneficial for the informed traders, at the cost of the uninformed traders, when the domestic dividend is high. Similarly, higher prices are supposed to be better for informed traders when the domestic dividend is low. The payoff analysis can thus be interpreted as a consistency test that indicates whether the price formation process is the expected one; i.e., whether trades take place in the expected direction.

The four panels of Fig. 3 show the average payoffs of the informed and the uninformed traders, with the y-axis being centered at the no-trade payoff (600 ECU for the high and 200 ECU for the low domestic dividend). The p-values of the within-treatments comparisons regarding the average payoff difference between the two types of traders are displayed to the right of the main panels, the p-values of the between-treatments comparisons are in the inside of these. The non-parametric tests are constructed in the same way as before for prices, the only difference is that we now obtain a sole number for each independent group (instead of a time series) because payoffs are realized just once at the end of the round.

An immediate insight from Fig. 3 is that the informed traders always earn more than the uninformed traders: in each panel and for each treatment, the solid line is always above the dashed line. With respect to the within-treatments tests, the only significant effect regards the comparison between HH and HL in treatment *Cor*. The payoff difference between the two types of traders is 115 ECU in HH and 185 ECU in HL, which is consistent with Hypothesis H2. The other three within-treatments comparisons are far away from being significant.

Result 3 *(R3)*. In treatment *Cor*, when the domestic dividend is high, the payoff difference between informed and uninformed traders is larger for the low foreign dividend than for the high foreign dividend ($d^{Cor}_{HH} < d^{Cor}_{HL}$). Beyond this, there are no other significant effects on the payoff difference within treatments ($d^{Cor}_{LH} = d^{Cor}_{LL}$, $d^{Ind}_{HH} = d^{Ind}_{HL}$, and $d^{Ind}_{LH} = d^{Ind}_{LL}$).

The analysis of the average price paths in Fig. 2 revealed that the correlated asset structure has a significant adversarial effect on information dissemination in state LH. Since the informed traders sell shares to the uninformed traders if the domestic dividend is low, it is natural to expect that the payoff difference between the two types of traders is in this state larger in *Cor* than in *Ind*. The data is consistent with this hypothesis since the payoff difference is 42 ECU in *Ind* and 167 ECU in *Cor*, but we do not find a significant treatment effect at the 5% level (the one-sided p-value is 0.182). Since the change in the payoff difference from *Ind* to *Cor* (167 ECU − 42 ECU = 125 ECU) is quite substantial, the no-significance in LH is likely due to group heterogeneity. Finally, in the other three states, there is no significant treatment effect either, which is consistent with Result 2.

Result 4 *(R4)*. For all possible states, the payoff difference between informed and uninformed traders in treatment *Ind* is not significantly different from that in treatment *Cor* ($d^{Cor}_{HH} = d^{Ind}_{HH}$, $d^{Cor}_{HL} = d^{Ind}_{HL}$, $d^{Cor}_{LH} = d^{Ind}_{LH}$, and $d^{Cor}_{LL} = d^{Ind}_{LL}$).

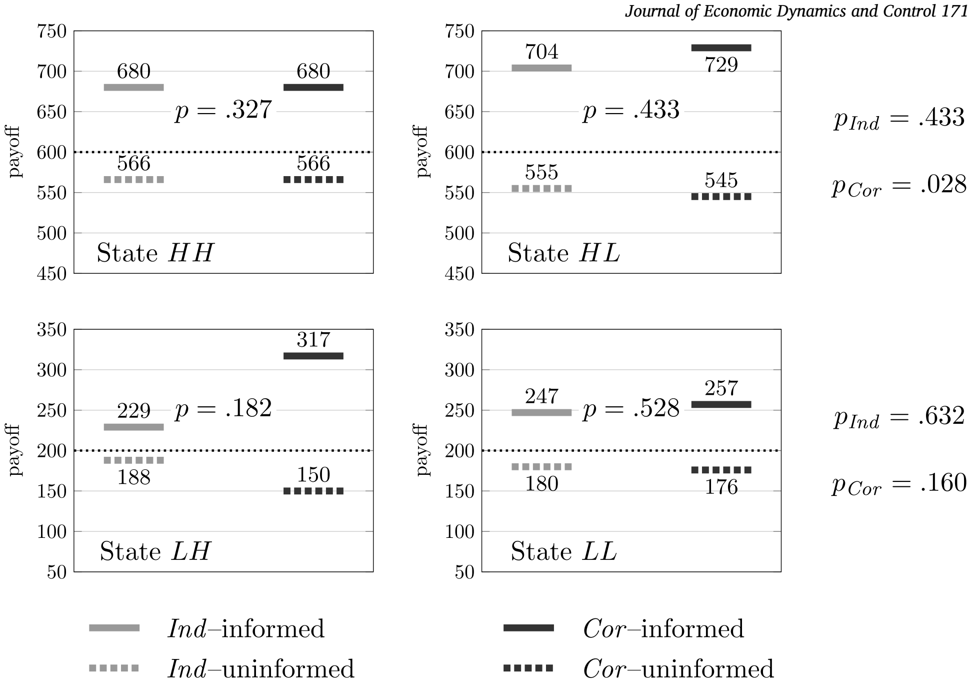


Fig. 3. Average payoffs in the domestic market. The four panels display, for each state, the average payoff of the informed (solid) and uninformed (dotted) traders in the two treatments (*Ind* and *Cor*), pooled over the three conditions. The vertical axis is centered around the no-trade payoffs in the respective states, which we marked via the dotted line (at the payoff of 600 ECU for states HH and HL and at the payoff of 200 ECU for states LH and LL). The p-values presented within the panels concern the comparison of payoff differences between treatments in the respective state. The p-values to the right of the panels concern, for each treatment, the comparison of payoff differences across states where the dividend of the domestic market is the same but the dividend of the foreign market differs. The reported p-values are one-sided (two-sided) if Hypothesis H2 is directional (predicts equality).

3.4. Robustness

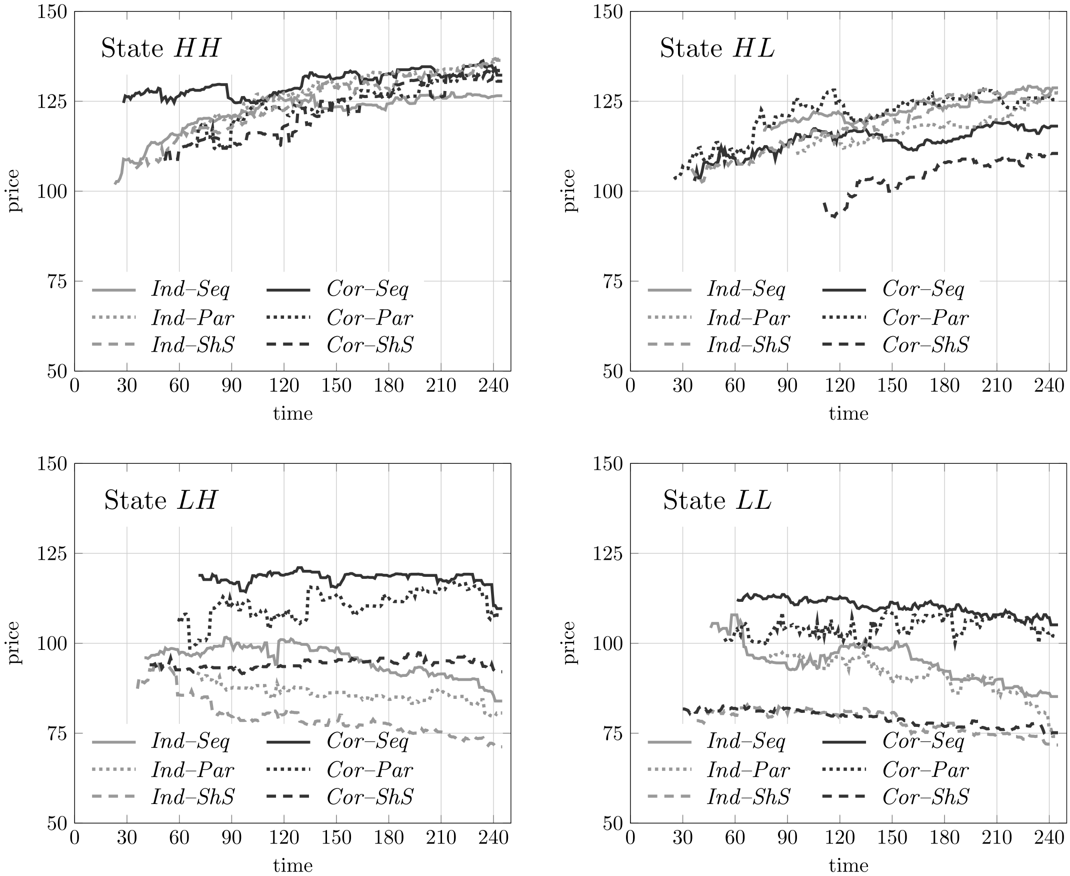
The aggregated data analysis has revealed that a correlated asset structure potentially distorts the dissemination of information. In the remainder of our analysis, we address the question whether there are crucial differences between the three conditions *Seq*, *Par* and *ShS*. To do so, we take *Seq* as our benchmark condition, and study if prices differ between *Seq* and *Par* and between *Seq* and *ShS*. Due to the reduced number of independent observations in this disaggregated analysis (6 per condition) we are only able to identify very large effects, but the average price paths and the p-values of the statistical tests nevertheless turn out to be very indicative.

Fig. 4 presents the insights of the disaggregated analysis. Each of the four panels, one for each state, contains six average price paths. Each of the six average price paths within a given panel corresponds to one of the settings *Ind-Seq*, *Ind-Par*, *Ind-ShS*, *Cor-Seq*, *Cor-Par* and *Cor-ShS*. The following observations can be made. First, in state HH the differences between the six paths are minor as time progresses, which is what we expect to see. Second, Hypothesis H1 does not rule out for state HL that prices are higher in *Ind* than in *Cor*, and this is what the aggregate data in Fig. 2 indeed indicates. However, this price difference has not been significant on the aggregate, and this lack of significance is probably due to condition *Par*. In fact, according to the top-right panel of Fig. 4, prices are, if anything, higher in *Cor-Par* than in *Ind-Par*, whereas in the other two conditions, prices are higher in *Ind* than in *Cor*. One plausible explanation for this is that it is more difficult for traders to condition their behavior on foreign prices in condition *Par*. And, since the information from the foreign market is misleading in HL, there is less of a negative impact on information dissemination in *Par*. Third, probably the most important aggregate finding regards state LH: prices in *Cor* are *significantly* higher than in *Ind*. The disaggregated analysis adds that this result is not driven by any particular condition. To see this, we refer to the bottom-left panel of Fig. 4, which reveals that each of the three average price paths belonging to treatment *Cor* is above all three average price paths of treatment *Ind*. This is a strong finding. In order to claim that the aggregate analysis is not affected by the different conditions, one would want to observe that for each of the three conditions, the average price path in treatment *Cor* is above the corresponding price path in treatment *Ind*; that is, prices in *Cor-Seq* should be higher than in *Ind-Seq*, prices in *Cor-Par* should be higher than in *Ind-Par*, and prices in *Cor-ShS* should be higher than in *Ind-ShS*. However, there is no way to order, for example, *Cor-Seq* and *Ind-Par* a priori. In this respect, it is also worth noting that the ordering of the conditions (*Seq*, *Par*, and *ShS*) is the same within both treatments in that prices are highest in *Seq* and lowest *ShS*.

Finally, the bottom-right panel of Fig. 4, which corresponds to state LL, is, apart from one crucial difference, identical to the bottom-left panel. From a regulator's perspective, short-selling constraints are useful for crisis management (i.e., during the Global Financial Crisis of 2007–2008), but in "normal" circumstances, it is desirable that negative beliefs are fully incorporated into prices. The role of short-selling constraints is thus important to understand. We find that while our qualitative results for state LH remain the same if existing short-selling constraints are relaxed (prices are higher in *Cor* than in *Ind*), this is not the same for state LL. In

	Ind	*Cor*
Seq vs. *Par*	1.000	1.000
Seq vs. *ShS*	1.000	1.000

	Ind	*Cor*
Seq vs. *Par*	1.000	0.803
Seq vs. *ShS*	1.000	1.000



	Ind	*Cor*
Seq vs. *Par*	1.000	0.803
Seq vs. *ShS*	0.589	0.723

	Ind	*Cor*
Seq vs. *Par*	1.000	1.000
Seq vs. *ShS*	0.803	0.118

Fig. 4. Average price paths in the domestic market for each of the six conditions. The four large panels display average market prices over time for the various states for the two treatments (*Ind* and *Cor*) and the three conditions (*Seq*, *Par* and *ShS*). For each state, treatment and time period between 120 and 245, we compare prices in the baseline conditions *Seq* to those in the alternative conditions *Par* and *ShS*. The tables above/below the panels present the median p-values over the time range. All p-values are two-sided.

fact, in LL, prices are higher in *Cor* than in *Ind* if traders are not allowed to sell the asset short (conditions *Seq* and *Par*); yet, prices are lowest and almost identical to each other in *Cor-ShS* and *Ind-ShS*. Consequently, correlated dividends have a negative impact on information dissemination in state LL only if traders cannot sell the asset short. As soon as these short-selling constraints are relaxed, there are no treatment differences in this state, which is consistent with Hypothesis H1.[10]

In order to test for differences between conditions, we apply again for each $t \geq 120$ a permutation test. This provides us again with a time series of two-sided p-values, and the tables above and below the four main panels show the median p-values over these time series. Given the small number of independent observations it is not surprising that we do not find significant differences, but

[10] While the discussion concentrates on the robustness of the between-treatments effects (Result 2), it is also important to note that the within-treatments effects of Result 1 are not caused by the presence of deep pockets traders together with the absence of short-selling constraints: in the second half of the experiment, average domestic prices are independent of the foreign dividend in setting *Ind-ShS* ($p_{HH} = 130 \approx 123 = p_{HL}$ and $p_{LH} = 76 = p_{LL}$) but increasing in setting *Cor-ShS* ($p_{HH} = 126 > 105 = p_{HL}$ and $p_{LH} = 94 > 77 = p_{LL}$).

the p-values provide some insights in which cases one could expect to find a significant difference in case the number of independent observations was increased. It is clear that the only "close" case is the comparison between *Cor-Seq* and *Cor-ShS* in state LL, which has a median two-sided p-value of 0.118. Consistent with our argument from above, this is because the relaxation of short-selling constraints leads to much lower prices in this state.

3.5. Discussion

Our study bears some important similarities and differences with Trevino (2020), who experimentally investigates a two-country setting (domestic and foreign) in which agents buy securities to finance governmental debt. Players decide between rolling over their loan and withdrawing it before maturity. Rolling over the loan is the risky option: the loan earns interest if the country is solvent at maturity, but the investment is lost if the country defaults. Solvency depends on the fundamentals of the economy and the number of players within the country who withdrew their loan prematurely. The fundamentals (states) of the countries are potentially correlated, and the prior state distributions are common knowledge. The game proceeds as follows. States are realized, and all players receive a noisy private signal about the state in their country. In period 1, foreign players make decisions simultaneously. At the beginning of period 2, domestic players received a public signal regarding the number of players in the foreign country who withdrew their loans. Finally, domestic players make decisions simultaneously, and payoffs are realized.

Within this global game structure, Trevino (2020) distinguishes between two channels of financial contagion. The *fundamental channel* regards the correlation of the prior distributions, while the *social learning channel* refers to the dependency of domestic decisions on foreign behavior. Her experimental data reveals two behavioral patterns that are at odds with the equilibrium predictions. First, there is an overreaction or imitation bias regarding the social learning channel because domestic decisions depend on the public signal, even if the fundamentals are uncorrelated. Second, there is a base-rate neglect, meaning that subjects partially ignore the information conveyed through private signals when the prior distributions are correlated.

It can be argued that base-rate neglect is irrelevant in our experiment because private information is perfect. Also, our social learning component is more involved because both domestic prices (domestic social learning channel) and foreign prices (foreign social learning channel) provide public information about the domestic dividend. If dividends are uncorrelated, then both the fundamental and the foreign social learning link are inactive. And, as predicted, we find that the domestic price is independent of the foreign dividend. Consequently, there is no overreaction bias. One possible reason for this difference with Trevino (2020) is precisely the domestic social learning channel. Domestic prices not only serve as an important feedback mechanism, a possible overreaction bias of the uninformed traders might also get arbitraged away by the informed traders. If dividends are correlated, the fundamentals can potentially shape behavior and, thereby, the equilibrium. We argue next that both the fundamental and the social learning channels play a decisive role in explaining our results, and for that, we distinguish between the high and the low domestic dividend.

First, if the domestic dividend is high, the fundamental channel is suppressed because both from a RE and a PI perspective, the equilibrium price is unaffected by this link. Moreover, by definition traders do not take into account domestic prices in the PI equilibrium, that is, the domestic social learning channel is also inactive from that perspective. Taken these two points together, we should thus attribute the finding that domestic prices are increasing in the foreign dividend entirely to the foreign social learning component.

We have also seen that correlated dividends lead to higher prices (but not significantly so) when the domestic dividend is high and the foreign dividend is low. This means that even though the between-treatments effect goes in the correct direction, the foreign social learning channel alone is not sufficient to make this difference significant. In this respect, it is worth noting that the non-significance is likely to be caused by the condition where the two markets run in parallel, which is arguably the condition where the foreign social learning channel is minimized.

Second, if the domestic dividend is low, the fundamental and the foreign social learning channels are active and unsuppressed from a PI perspective because the equilibrium price is shaped by the beliefs of the uninformed traders, which are affected by the correlation with the foreign market. Also, the domestic social learning channel is inactive. The finding that domestic prices are increasing in the foreign dividend is thus a compound effect of the fundamental and the foreign social learning channels.

Correlated dividends lead to significantly higher prices whenever the domestic dividend is low, and the foreign dividend is high. This is again a compound effect of the fundamental and the foreign social learning channel. Since the symmetric result for the high domestic and low foreign dividend is not significant and since, in that case, the fundamental channel is suppressed, it can be suggested that the uniformed traders take the underlying prior distributions indeed into account.

The takeaway from the above discussion is that three forces determine the outcome of our market experiment. The domestic social learning channel (i.e., learning from domestic prices) could be the reason why we do not find the overreaction bias of Trevino (2020) when dividends are uncorrelated. Also, while this domestic social learning channel has the potential to lead to an efficient outcome when there is room for financial contagion, which is due to the superior information of the informed traders, it is not strong enough to override the other two channels. In fact, if dividends are correlated, the PI equilibrium provides a much better account of our data than the RE equilibrium. Thus, due to the fundamental and foreign social learning links, financial contagion can occur even in the presence of corrective market forces.

4. Conclusion

In this paper, we experimentally examined the effects of correlated asset structures between two separate markets on their ability to integrate private information. Our key experimental findings are twofold: First, domestic prices increase in response to higher foreign dividends, but only when dividends are correlated. Second, while correlated dividends do not affect information dissemination when the domestic dividend is high, they tend to worsen it when the domestic dividend is low and the foreign dividend is high. These findings are robust to short-selling and to the way in which foreign prices are presented to domestic traders.

Our experiment provides valuable insights into financial contagion, particularly by revealing the microeconomic mechanisms driving it, and there are several promising avenues for future research. First, exploring how different information and dividend structures impact market efficiency under correlated asset fundamentals could yield further insights. Our study assumes perfect private information and common dividends; considering scenarios involving imperfect private information or private dividends would be an interesting next step. Additionally, examining the role of behavioral factors, such as trader psychology and decision-making biases, could deepen our understanding of how information is processed and acted upon in financial markets. Finally, it would be very fruitful to investigate the effects of correlated fundamentals in other economic environments, such as the asset bubble framework of Smith et al. (1988) or the capital irrelevance theorem of Modigliani and Miller (1958).

Smith et al. (1988) conducted seminal experiments demonstrating the formation of price bubbles, where asset prices diverge significantly from fundamental values. Similarly, our study explores how information dissemination and market conditions can lead to such deviations. Extending the classical Smith et al. (1988) experiment to include correlated assets would be a natural progression.

The Modigliani-Miller theorem posits that, in a perfect market, a firm's value is unaffected by its capital structure, assuming no taxes, transaction costs, or information asymmetries. Our findings challenge some of these assumptions, showing how correlated fundamentals and information asymmetries can significantly impact market outcomes. Macias (2024) experimentally studied the Modigliani-Miller theorem in the structural credit risk framework of Merton (1974), showing that information asymmetries about the firm value negatively affect market efficiency. Connecting the experimental literature on financial contagion with the Modigliani-Miller theorem would thus be a compelling future research direction.

Our findings also carry important implications for financial market regulation. Policymakers should carefully consider the role of short-selling in promoting market efficiency and the potential risks posed by correlated asset structures. By identifying the conditions that exacerbate financial contagion, regulators can better design interventions aimed at stabilizing markets during periods of economic uncertainty.

Appendix A. Supplementary material

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.jedc.2024.105033.

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