Is the fear-of-missing-out contagious among cyptocurrency miners?
(One-day option-implied dividend rate reversals)

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Highlights

- One-day implied dividend rate reversals exist in the KOSPI200 index options market.
- Reversals are significant for the shortest maturity but weaker as the maturity lengthens.
- Reversals become more concentrated in shorter maturities post-COVID.

Abstract.

This study examines whether the options market experiences implied dividend rate reversals similar to the return reversals in the underlying market, and if there is a connection between the reversals in both markets. The findings show that the KOSPI200 index options market has one-day implied dividend rate reversals that are more significant than those in the underlying returns, particularly for short-term maturities. These short-maturity reversals do not appear to be driven by the underlying index dynamics, suggesting that options market participants may overreact when forecasting future dividend rates for reasons not attributable to preceding underlying index dynamics. These reversals have become more concentrated in short-term maturities after COVID, indicating that irrational behavior in the options markets for short maturities have increased post-crisis. Overall, this study highlights the presence of implied dividend rate reversals in the KOSPI200 index options market that are unique and specific to the options market.

Keywords: Implied dividend rate; Options market; Overreaction; Price reversals

JEL Classification: G12, G13, G14

1. Introduction

In classic financial theories, which assume the rationality of market participants, asset prices are defined as the sum of discounted future cash flows. Therefore, the theoretical stock price equals the sum of discounted future dividend payments, as emphasized by several recent studies (De La O and Myers, 2021; Kragt, De Jong, and Driessen, 2020; Krivenko, 2023). Thus, the market price of stocks is closely related to the present value of expected dividend payments. Kothari and Shanken (1992) demonstrate that approximately ninety percent of portfolio return variation can be explained by dividend and expected return variables. Lee (1995) reveals that the stock market responds significantly to both permanent and temporary shocks to dividends. Given the relationship between stock prices and dividend payments, if rational investors make well-aligned investment decisions across the markets for underlying assets and derivatives, the information on derivative market participants' expectations regarding future dividend rates may exhibit a close linkage with the underlying price dynamics.

However, a substantial body of literature reveals that irrational behavior significantly influences stock markets (Ameur, Ftiti, Louhichi, and Prigent, 2024; Baker and Wurgler, 2007; Summers, 1986), causing stock prices to deviate from the expected present value of future dividends. As pointed out by Hirshleifer, Subrahmanyam, and Titman (2006), investors frequently hold similar misconceptions and make common analytical mistakes. If this is the case, it is possible that the underlying and derivatives markets may not demonstrate consistency in their dynamics. Previous studies demonstrate that mispricings and investor sentiments do not always extend across the underlying and derivatives markets, as the proportion of rational and irrational traders is different between the two markets (Ofek, Richardson, and Whitelaw, 2004; Lemmon and Ni, 2014).

Thus, even when one of these markets exhibits a particular pattern in price dynamics known to result from irrational behavior, this pattern may not be observed in the other market, especially if it is not related to the fundamentals. For instance, reversals, which are well-known phenomena related to overreactions in financial markets, can display inconsistent patterns across the underlying and derivatives markets. Jegadeesh and Titman (1995) demonstrate that stock markets tend to overreact, revealing that most contrarian profits can be attributed to stock price overreactions. Ham, Webb, and Ryu (2022) show that investors are prone to overreacting overnight but respond more calmly during daytime trading hours. Given that return reversals in the stock market result from irrational market behavior, these reversals may not necessarily appear in the derivatives markets in a closely interrelated pattern.

Specifically, if we assume that irrational traders prefer the underlying market over the derivatives markets, as suggested by Ofek, Richardson, and Whitelaw (2004), then the return reversals in the underlying market will not affect options prices. This is because rational options market participants can see through the market overreaction and will not reflect the reversals in options prices. Instead, these rational traders will choose to trade in the underlying market when possible, trying to exploit potential arbitrage opportunities. By contrast, if the reversals appear to be significant in both markets and are closely linked to each other, it can serve as meaningful evidence that market participants in the two markets are at least considering both markets simultaneously when evaluating prices, thereby being informed and rational to some degree.

Other than these two cases, it is also possible that derivatives markets reveal irrational price dynamics that are not fully reflected in the underlying market. Although there are previous studies showing that irrational traders prefer underlying market to derivatives markets, another strand of literature demonstrates that irrational traders also exist in the latter (Poteshman and Serbin, 2003; Ryu, Ryu, and Yang, 2023; Yang, Choi, and Ryu, 2017). Hence, if irrational traders exist in options market while engaging in speculative and random transactions independently from the irrational traders in the underlying market, then the patterns in options price fluctuations that are alleged to be irrational may not be closely linked to the underlying price dynamics.

One possible pattern is reversals in the options markets. If reversals suggest the presence of overreactions in a market, reversals may also exist in options markets if there are irrational investors causing option prices to temporarily deviate from their fundamentals. In this study, we focus on the reversals of implied dividend rates, which can be interpreted as the options market participants' dividend rate expectations for the underlying asset. Kragt, de Jong, and Driessen (2020) demonstrate that about half of the stock index variation is explained by variables estimated with dividend futures data, suggesting that derivative market participants' expectations of future dividends are closely related to the fundamental value of the underlying asset. However, if speculative traders in the options market affect the relationship between the implied dividend rate and the fundamental value, the implied dividend rate may exhibit irrational dynamics such as reversals.

Based on this idea, we investigate the dynamics of implied dividend rates to determine whether implied dividend rate reversals exist. Additionally, we examine whether there is an interrelation between implied dividend rate reversals and underlying return reversals to explore how irrational behavior is related across the options markets and the underlying index. We calculate the daytime session and overnight changes in the option-implied dividend rate and the underlying index so that we can investigate the existence of reversals. We also examine the cross-relationship between implied dividend rate and underlying return reversals to determine whether the two reversals are interrelated.

The empirical results reveal that the KOSPI200 index options market exhibits one-day implied dividend rate reversals that are more significant than those found in the underlying index, especially for short maturities. The reversals for shorter maturities are found to be unrelated to the preceding underlying index overnight returns, implying that participants in the options market for short maturities may overreact when estimating future dividend rates for reasons not closely related to the underlying index dynamics. Furthermore, the reversals become more concentrated in shorter maturities post-COVID, suggesting that irrational behavior has strengthened after the crisis. It is also notable that the underlying return reversals become insignificant post-COVID, further implying that the implied dividend rate reversals are not significantly related to the underlying return reversals.

The rest of this paper is organized as follows: Section 2 describes the sample data collected from the KOSPI200 index options market. Section 3 outlines the empirical methodology, and Section 4 explains the findings of the empirical analysis. Section 5 concludes the paper.

2. Data

The KOSPI200 index and options data employed in this study span 108 months, from January 2015 to December 2023. The daily observations are reconstructed from one-minute KOSPI200 index data and KOSPI200 index options tick data, both of which are obtained from the Korea Exchange. Since the options data contain information on actual transactions, there is no need to approximate the market price from quotes using methods such as mid-point approximation.

To select the put-call pairs, we choose the strike price that is nearest-to-the-money at the time of snapshots. For each day, we select three maturities: the shortest, second-shortest, and third-shortest, after discarding options for which the time to maturity is less than seven days. We do not consider the day-maturity pairs for which there are no available put-call pair observations for the nearest-to-the-money strike price, addressing the illiquidity issue. As a result, there are 2,212, 2,178, and 1,407 observations for the shortest, second-shortest, and third-shortest maturities in our final sample. We retrieve the 91-day CD rate from the Bank of Korea Economic Statistics System, which we employ as the risk-free rate to calculate the implied dividend rate and introduce as a control variable. Table 1 presents the summary statistics for our daytime and overnight dividend rate changes.

[Table 1 about here]

3. Methodology

In this study, we examine the option-implied dividend rate derived from the put-call parity, which is defined as:

$$C_{t,\tau,K} - P_{t,\tau,K} = e^{-q\tau}S_t - e^{-r\tau}K, \quad (1)$$

where $C_{t,\tau,K}$ and $P_{t,\tau,K}$ are call and put prices for time to maturity τ and strike price K at time t. Here, q and r are the dividend and risk-free rates assumed to be fixed, and S_t is the underlying price at time t, respectively. By rearranging Equation (1), we can derive the dividend rate implied by $C_{t,\tau,K}$, $P_{t,\tau,K}$, r, and S_t as follows:

$$q = -\frac{1}{\tau} ln\left(\frac{C_{t,\tau,K} - P_{t,\tau,K} + e^{-r\tau}K}{S_t}\right). \quad (2)$$

Throughout this study, we calculate the implied dividend rate q with Equation (2).

From our dataset, we derive the daytime session and overnight changes in the option-implied dividend rate and the underlying index to investigate their existence and interrelationship. Hereafter, we refer to the changes in the underlying index as the underlying returns, defining them as percentages. The implied dividend rate changes and returns are defined as follows:

$$\Delta q_{daytime,t} = q_{C,t} - q_{O,t}, \quad (3)$$

$$\Delta q_{overnight,t} = q_{O,t} - q_{C,t-1}, \quad (4)$$

$$r_{daytime,t} = s_{C,t}/s_{O,t} - 1, \quad (5)$$

$$r_{overnight,t} = s_{O,t}/s_{C,t-1} - 1, \quad (6)$$

where $\Delta q_{daytime,t}$ and $\Delta q_{overnight,t}$ are the daytime session and overnight changes in implied dividend rate on day t, $q_{O,t}$ and $q_{C,t}$ are the opening and closing implied divided rate levels on day t, $r_{daytime,t}$ and $r_{overnight,t}$ are the daytime session and overnight underlying index returns on day t, $s_{O,t}$ and $s_{C,t}$ are the opening and closing underlying index levels on day t, respectively.

To determine the presence of reversals for implied dividend rate changes Δq and underlying returns r, we estimate the following baseline models:

$$\Delta q_{daytime,t} = \alpha + \beta \cdot \Delta q_{overnight,t} + \varepsilon_t, \tag{7}$$

$$r_{daytime,t} = \alpha + \beta \cdot r_{overnight,t} + \varepsilon_t. \tag{8}$$

Additionally, we estimate the following augmented models to consider the potential effects of relevant variables on the possible reversals:

$$\Delta q_{daytime,t} = \alpha + \beta \cdot \Delta q_{overnight,t} + \gamma \cdot r_{overnight,t} + \delta_0 \cdot r_{f,t} + \delta_1 \cdot ln(k_{O,t}/s_{O,t}) + \varepsilon_t, \tag{9}$$

$$r_{daytime,t} = \alpha + \beta \cdot r_{overnight,t} + \gamma \cdot \Delta q_{overnight,t} + \delta_0 \cdot r_{f,t} + \varepsilon_t, \tag{10}$$

where $r_{f,t}$ is the risk-free rate on day t, and $k_{O,t}$ is the strike price of the calls and puts that are used to calculate the implied dividend rate. Given the definition for $k_{O,t}$, $ln(k_{O,t}/s_{O,t})$ in Equation (7) can be interpreted as the log-moneyness for which the implied dividend rate is calculated, as of the options market opening on day t. We include the log-moneyness as a control variable to consider the possibility that the observed level of the implied dividend rate is a function of moneyness.

4. Empirical results

Table 2 provides a correlation matrix of $\Delta q_{daytime,t}$ and $\Delta q_{overnight,t}$ for the shortest, second-shortest, and thrid-shortest maturities, revealing three notable features. First, $\Delta q_{daytime,t}$ and $\Delta q_{overnight,t}$ tend to be negatively correlated with each other, suggesting the existence of implied dividend rate reversals. Specifically, when we focus on the $\Delta q_{daytime,t}$ and $\Delta q_{overnight,t}$ pair for a single maturity, the correlation coefficients range between -0.2 and -0.6, which can be interpreted as reliable evidence of implied dividend reversals for all maturities of interest in this study. Second, the negative correlation between $\Delta q_{daytime,t}$ and $\Delta q_{overnight,t}$ for a single maturity becomes more significant as the maturity shortens. The correlation coefficient is -0.555 for the shortest maturity, -0.455 for the second-shortest maturity, and -0.229 for the third-shortest maturity. This trend implies that the implied dividend rate reversals are stronger for shorter maturities. Third, $\Delta q_{daytime,t}$ is positively correlated across different maturities, as is the case with $\Delta q_{overnight,t}$. This positive correlation suggests that implied dividend rate dynamics are consistent across maturities.

[Table 2 about here]

To investigate the presence of implied dividend rate reversals in more detail, we estimate the regression models defined by Equations (7) and (9). Table 3 presents the estimation results, which exhibit two noteworthy characteristics. First, the results reveal a significantly negative relationship between $\Delta q_{daytime,t}$ and $\Delta q_{overnight,t}$, which can be regarded as evidence of implied dividend rate reversals, as demonstrated in Table 2. Second, the relationship between $\Delta q_{daytime,t}$ and $r_{overnight,t}$ are significantly negative for the third-shortest maturity but insignificant for the shorter maturities, implying that the strong implied dividend rate reversals for short maturities may not be closely related to the preceding underlying index return dynamics. Third, the negative relationship persists even after controlling for additional variables. Although the coefficient estimate for log-moneyness is significantly positive for the shortest maturity, the control variables are found to have an insignificant relationship with the implied dividend rate reversals in the other cases.

[Table 3 about here]

We next determine whether return reversals exist in the underlying KOSPI 200 index by estimating the models defined by Equations (8) and (10). Table 4 summarizes the estimation result, which show two interesting properties. First, the return reversals in the KOSPI 200 index are marginally insignificant at the 10% significance level, which is weaker than the implied dividend rate reversals. Given previous studies which show that stock price dynamics are more volatile than dividend rate dynamics (Malmendier, Pouzo, and Vanasco, 2020; Quaye and Tunaru, 2022), the more significant reversals in implied dividend rates suggest that the implied dividend rate reversals can be market-specific and not be driven by return reversals, which is consistent with the results for short-term maturities in Table 3. Second, the overnight implied dividend rate change, $\Delta q_{overnight,t}$, is not found to have a significant relationship with the daytime session index returns, $r_{daytime,t}$. Given that the overnight index returns, $r_{overnight,t}$, has a significantly negative relationship with daytime implied dividend rate change, $\Delta q_{daytime,t}$, for longer maturities, the relationship between implied dividend rates and underlying index returns is consistent to some degree with the fact that implied dividend rates are forecasts while index values are realizations.

[Table 4 about here]

We also investigate whether there exists a difference in implied dividend rate reversals between two sub-periods: the pre-COVID period from 2015 to 2019 and the post-COVID period from 2020 to 2023. We choose COVID-19 as the reference point given the findings of recent studies revealing that both actual dividend payouts and dividend forecasts have been affected by the pandemic (Cejnek, Randl, and Zechner, 2021; Gormsen and Koijen, 2020). We estimate the models defined by Equations (7) and (9) for each sub-period. Table 5 demonstrates the estimation results, highlighting two notable characteristics. First, the reversals become more concentrated in shorter maturities post-COVID, suggesting that irrational behavior has strengthened after the crisis. The coefficient estimates for $\Delta q_{overnight,t}$ almost double in magnitude post-COVID for the shortest and second-shortest maturities, whereas the estimate becomes insignificant for the third-shortest maturity. Second, the relationship between implied dividend rate changes and underlying index returns becomes significant for long maturities but turns insignificant for short maturities. The coefficent estimate for $r_{overnight,t}$ for the third-shortest maturity becomes significant at the 10% level in the post-COVID period, whereas the same estimate for the second-shortest maturity becomes insignificant.

[Table 5 about here]

Finally, we conduct another set of sub-period analyses for the underlying index returns to determine whether the reversals in the two markets exhibit any similarities or interrelations over time. Table 6 summarizes the estimation results, highlighting two interesting features. First, the one-day index return reversals are significant in the pre-COVID period but became insignificant in the post-COVID period, implying that market underreaction has weakened after the pandemic. This is contrary to the pattern shown in implied dividend rate reversals for short maturities, which again suggests that the implied dividend rate reversals may be market-specific and not significantly related to underlying return dynamics. Second, when overnight implied dividend rate changes and the risk-free rate are considered as additional independent variables, the explanatory power of overnight underlying returns is subsumed by the overnight implied dividend rate changes for the shortest maturity. This result implies that the options market for the shortest maturity may affect the underlying return dynamics, which contrasts with the markets for longer maturities that are found to be affected by overnight underlying index returns as shown in Tables 3 and 5. This difference implies a structure of the lead-lag relationship between the underlying index and options markets. The options market for the shortest maturity, which is most liquid, may lead the underlying index. By contrast, options markets for longer maturities are less liquid and, therefore, tend to follow the underlying index dynamics.

[Table 6 about here]

Overall, the empirical findings suggest the presence of one-day implied dividend rate reversals in the KOSPI200 index options market, and the reversals are particularly significant for shorter maturities. A comparison with return reversals in the underlying KOSPI200 index reveals that the implied dividend rate reversals are stronger than the underlying return reversals. The empirical results provide no evidence of an impact of underlying index dynamics on implied dividend rate reversals for shorter maturities, which can be interpreted as a results of options market overreaction for reasons not significantly relevant to the underlying return dynamics.

5. Conclusion

This study explores the presence and interrelationship of reversals in the KOSPI 200 index options market, examining the implied dividend rate reversals, and the underlying KOSPI 200 index. We analyze the one-day reversals by investigating how the overnight implied dividend rate changes and underlying returns affect the implied dividend rate and price dynamics during the following daytime trading session. The empirical findings suggest the presence of implied dividend rate reversals in the KOSPI 200 index options market that are unique and specific to the options market. We show that the KOSPI 200 index options market exhibits one-day implied dividend rate reversals, which are stronger than the return reversals in the underlying index. It is noteworthy that the implied dividend rate reversals are particularly significant for short-term maturities. Additionally, the implied dividend rate reversals for short maturities are found to be independent of the underlying index dynamics and are more concentrated post-COVID.

We suggest three relevant potential topics for future research. First, the relationship between implied dividend rate reversals and other option-implied information measures can be further explored. Second, the association between implied dividend rate and underlying return reversals can be examined in individual stock options markets. Third, the future-implied dividend rate can be examined to determine whether the futures market exhibits another idiosyncratic strand of implied dividend rate reversals.

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Table 1. Summary statistics

	$\Delta q_{daytime,t}$			$\Delta q_{overnight,t}$		
	Nearest maturity	Second-nearest	Third-nearest	Nearest maturity	Second-nearest	Third-nearest
Mean	-0.006	-0.001	0.000	0.006	0.001	0.000
Median	-0.005	-0.001	0.000	0.005	0.001	0.000
1st pct.	-0.121	-0.054	-0.060	-0.115	-0.063	-0.066
99th pct.	0.097	0.052	0.060	0.118	0.067	0.059
Std. dev.	0.039	0.022	0.023	0.043	0.023	0.022
Skewness	2.186	-5.707	1.384	-1.973	4.352	-1.108
Kurtosis	70.385	162.932	33.340	37.394	123.722	23.230
# of obs.	2,212	2,178	1,407	2,212	2,178	1,407

Table 2. Correlation matrix

		$\Delta q_{daytime,t}$			$\Delta q_{overnight,t}$		
		Shortest maturity	Second-shortest	Third-shortest	Shortest maturity	Second-shortest	Third-shortest
$\Delta q_{daytime,t}$	Shortest maturity	1.000					
	Second-shortest	0.301	1.000				
	Third-shortest	0.201	0.270	1.000			
$\Delta q_{overnight,t}$	Shortest maturity	-0.555	-0.166	-0.155	1.000		
	Second-shortest	-0.045	-0.455	0.058	0.279	1.000	
	Third-shortest	0.089	-0.008	-0.229	0.105	0.262	1.000

Table 3. One-day option-implied dividend rate reversals

	Shortest maturity		Second-shortest		Third-shortest	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta q_{overnight,t}$	-0.512***	-0.505***	-0.560***	-0.554***	-0.234**	-0.216**
	(-6.46)	(-5.99)	(-4.80)	(-4.63)	(-2.32)	(-2.02)
$r_{overnight,t}$		-0.151		-0.100		-0.348**
		(-0.65)		(-0.79)		(-2.02)
Risk-free rate		0.030		-0.009		-0.046
		(-0.42)		(-0.22)		(-0.75)
Log-moneyness		0.063*		-0.002		0.012
		(1.79)		(-0.15)		(-0.57)
Intercept	-0.003***	-0.007**	-0.001*	0.000	0.000	-0.002
	(-3.08)	(-2.25)	(-1.73)	(-0.06)	(-0.03)	(-0.37)
Adj. R^2	0.311	0.313	0.338	0.339	0.053	0.068
# of obs.	2,212	2,212	2,178	2,178	1,407	1,407

Table 4. One-day underlying asset return reversals

		(1)	(2)
$r_{overnight,t}$		-0.068	-0.086
		(-1.60)	(-1.42)
$\Delta q_{overnight,t}$	Shortest maturity		0.012
			(0.69)
	Second-shortest maturity		-0.007
			(-0.29)
	Third-shortest maturity		-0.007
			(-0.32)
Risk-free rate			-0.006
			(-0.25)
Intercept		0.000*	0.000
		(-1.96)	(-0.57)
Adj. R^2		0.003	0.010
# of obs.		2,212	1,387

Table 5. One-day option-implied dividend rate reversals: Pre- and post-COVID periods

Panel A. Pre-COVID period (2015–2019)

	Shortest maturity		Second-shortest		Third-shortest	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta q_{overnight,t}$	-0.336***	-0.331***	-0.372***	-0.356***	-0.475***	-0.465***
	(-5.26)	(-5.02)	(-7.53)	(-7.13)	(-3.32)	(-3.08)
$r_{overnight,t}$		-0.034		-0.206***		-0.210
		(-0.17)		(-2.68)		(-1.42)
Risk-free rate		-0.366		-0.171		-0.121
		(-0.76)		(-0.89)		(-0.36)
Log-moneyness		0.080*		-0.011		0.014
		(1.75)		(-0.65)		(0.59)
Intercept	-0.003***	-0.002	-0.001	0.004	0.000	-0.001
	(-3.52)	(-0.29)	(-1.33)	(0.95)	(0.09)	(-0.13)
Adj. R^2	0.145	0.149	0.183	0.189	0.227	0.233
# of obs.	1,226	1,226	1,222	1,222	856	856

Panel B. Post-COVID period (2020–2023)

	Shortest maturity		Second-shortest		Third-shortest	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta q_{overnight,t}$	-0.658***	-0.651***	-0.639***	-0.636***	-0.042	-0.017
	(-6.03)	(-5.64)	(-4.54)	(-4.45)	(-0.43)	(-0.17)
$r_{overnight,t}$		-0.297		-0.078		-0.449*
		(-1.11)		(-0.44)		(-1.86)
Risk-free rate		0.025		0.000		-0.046
		(0.32)		(0.01)		(-0.54)
Log-moneyness		0.037		0.006		0.011
		(0.74)		(0.21)		(0.30)
Intercept		-0.005	-0.001	-0.002	0.000	-0.002
		(-1.05)	(-1.21)	(-0.42)	(-0.21)	(-0.19)
Adj. R^2	0.484	0.487	0.410	0.410	0.002	0.027
# of obs.	986	986	956	956	551	551

Table 6. One-day underlying index return reversals: Pre- and post-COVID periods

		Pre-COVID period (2015–2019)		Post-COVID period (2020–2023)	
		(1)	(2)	(3)	(4)
$r_{overnight,t}$		-0.088**	-0.091	-0.057	-0.063
		(-2.06)	(-5.02)	(-0.97)	(-0.79)
$\Delta q_{overnight,t}$	Shortest maturity		-0.014**		0.033
			(-2.10)		(1.34)
	Second-shortest maturity		0.002		0.001
			(0.09)		(0.02)
	Third-shortest maturity		0.006		-0.016
			(0.33)		(-0.43)
Risk-free rate			-0.157		0.020
			(-1.38)		(0.55)
Intercept		0.000	0.002	0.000	-0.002
		(-1.17)	(1.35)	(-1.55)	(-1.26)
Adj. R^2		0.005	0.018	0.003	0.037
# of obs.		1,226	856	986	531