

The Relationship between Stock Indices and Stock Index Futures from 3:00 to 3:15: A Clarification

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There is a debate regarding the overnight and weekend price patterns of stock index futures. Maberly (1989), in response to an article by Phillips-Patrick and Schneeweis (1988), maintains that the expectation of dividend payments (for stocks going ex-dividend) and the reduced financial carrying costs of the spot index (due to time passage) should be reflected in the futures prices of the current day's 3:00–3:15 PM trading period.¹ The purpose of this communication is to reexamine these arguments. Conclusions contrary to Maberly and in support of Phillips-Patrick and Schneeweis (hereafter, PS) are presented.

PS present a simple logic regarding the price patterns for stock index futures based on the following model:

$$SFP = SCP + r(SCP) - INC \quad (1)$$

where SFP = stock index futures price, SCP = stock index cash price, r = interest rate applicable in the period to delivery, and INC = dividend income (per unit of the index) to be received prior to futures delivery. PS make two contributions: first, they show that a reduction in INC on an ex-dividend date does not (theoretically) affect either the current or subsequent futures price since this event also causes the cash price, SCP , to fall by a like amount²; second, they show that the passage of time reduces the value of leverage implicit in the futures contract and thereby

The helpful comments of an anonymous referee are greatly appreciated.

¹Stock index futures markets continue to trade until 3:15 PM CST; 15 minutes past the daily 3:00 PM CST close of the NYSE and other stock exchanges. The information that is reflected in the futures prices of this 15-minute period is the focus of the controversy. Maberly states: "The downward bias hypothesized by Phillips-Patrick and Schneeweis in futures prices from Friday's close to Monday's opening should be reflected in Friday's closing price. The implication is that Friday's mean futures return from 3:00–3:15 PM CST should be negative, not Monday's mean nontrading period return" (p. 279). The Phillips-Patrick and Schneeweis article is primarily concerned with (partially) explaining the weekend price effect documented in the literature; Maberly's critique primarily addresses the weekend analysis. Nevertheless, the arguments which follow are equally valid for all days of the week. In particular, futures prices will reflect a relative loss in leverage value as each calendar day expires, regardless of whether it occurs over a weekend or any other day of the week.

²That is, an equal reduction in INC and SCP will be offsetting since they enter the relationship with opposite signs. However, ex-dividend days will cause the basis (futures price less cash price) to widen since cash prices will fall while futures prices are unaffected.

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causes (other things constant) the next day's opening price for futures to be less than the previous day's close.³

Maberly (1989) notes that since stock index futures generally stop trading at 3:15 PM, 15 minutes later than the stock market, closing index futures prices reflect a more updated set of information during this period. In particular, he maintains that:

The futures price during this period is decoupled from the spot price and, therefore, the equality in eq. (1) need not hold. Although the spot index is constant from 3:00–3:15 p.m. C.S.T., the futures price will respond to any known information during this fifteen minute interval that will affect the next day's spot price, i.e., *anticipated dividend payments and reduced carry costs of the spot index* (emphasis added) (p.271).

The conclusion drawn is that the two pricing factors, described by PS and mentioned above, should be reflected in the 3:00–3:15 futures return rather than at the next trading day's opening price. While this logic may, at first, seem akin to that of efficient markets, it overlooks the micromechanics of pricing.

As PS point out and discussed above, the presence of ex-dividend stocks does not affect the futures price. Consequently, one should not see this effect at 3:00–3:15 PM or at any other time.⁴ Therefore, Maberly's argument is more correctly directed at the price impact due to the passage of time.

The key to PS's argument is that the reduced costs of carry due to the passage of time are not reflected in the futures prices until time indeed passes. Maberly's supposition that the Friday 3:00–3:15 futures return reflects this reduction in leverage value treats the weekend as if it does not exist. To further clarify this issue, one might ask why a new long in stock index futures should not pay (via a higher futures price) for the leverage value obtained over a weekend simply because the purchase was between 3:00–3:15 PM Friday rather than shortly before? The leverage value clearly has nothing to do with whether the stock market is open or closed but is reflective of the smaller financing costs of a long futures position vis á vis a long spot position. Given that futures transactions are generally settled at the end of a trading day, the leverage value received in a long futures position does not differ whether the position is entered into at the opening, at 3:00 PM, at the close, or at any other time during that trading day. In effect, the futures price does not decline until the leverage advantage is lost (given a constant financing rate), i.e., with the passage of time.⁵

³The per delivery interest rate, r , is a combination of two factors: (1) the annual financing rate, and (2) the number of days remaining until delivery. That is, $r = \text{annual rate} \times (\text{days to delivery}/365)$. It is clear from eq. (1) that, as time erodes, cash and futures prices will converge until they are equal at delivery. PS state that, given a constant stock index price, the futures price will decline by the amount of leverage value that has eroded with the number of calendar days that have passed. Alternatively, given an expected increase in stock prices consistent with the earning of a risk-adjusted return on invested capital, the above relationship can be restated. Here the price appreciation of the futures price would be less than the price appreciation of the cash index by the amount of leverage benefit lost. As an aside, note that the net effect of a reduction in leverage value is to narrow the basis, opposite of the ex-dividend day effect.

⁴Note, however, that the spot index will indeed respond at the opening of the ex-dividend day.

⁵An analogy to Maberly's position would presuppose that the price of a stock should decline by the amount of its dividend the day before (at the close) it goes ex-dividend rather than at its opening on the ex-dividend day. Clearly, there is a fallacy here. It is not until the occurrence of a specific day that a stock loses its claim to dividends. The same holds true for the leverage value of stock index futures. Only as time passes is this value reduced (since it is based on the remaining days to delivery).

Some additional questions further illustrate this point. Why should the pricing of index futures be any different simply because the cash market is not open? Such a case was experienced during the 1987 stock crash (especially for MMI futures). Is not the logic of eq. (1) still the basis for futures pricing even if the cash price cannot be observed? And, if index futures trade on Saturday or Sunday, say in a foreign market, would one not expect the leverage value to be reduced on a daily basis in line with lending practices of institutions and not all at once on Friday?⁶ Finally, what about the pricing of other derivative instruments? French (1984) notes that, since interest is charged on a calendar day basis, options should be priced to reflect the remaining leverage value, which is calculated using the number of calendar days remaining to expiration. In particular, weekends are included.

So what do 3:00–3:15 PM futures returns reflect? This communication suggests that it is not anticipated ex-dividend events or reduced leverage value (carrying costs) as is suggested by Maberly. A list of remaining factors still need to be explored. For instance, Harris (1989) finds that a large positive mean price change is observed on the last daily NYSE transaction for a stock. He suggests that closing prices, therefore, may not represent true stock values. Could index futures prices during the 3:00–3:15 PM period represent a price reversion back to some “true value” once the cash market is closed; or, are index futures also subject to the same effect found by Harris? This and other lines of analysis must proceed before any firm conclusions can be drawn about 3:00–3:15 PM stock index futures prices.

Bibliography

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⁶Financing of stock exchange collateral is generally for one day or some multiple thereof. While this practice may be altered with the advent of 24-hour trading markets, current practices are based on daily lending.

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