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Does futures exhibit maturity effect? New evidence from an extensive set of US and foreign futures contracts

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Abstract

In a seminal article, Samuelson (1965) [Samuelson, P. A. (1965), "Proof that properly anticipated prices fluctuate randomly," Industrial Management Review 6, 41–49.] proposes the maturity effect that the volatility of futures prices should increase as futures contract approaches maturity. This study provides new evidence on the maturity effect by examining a more extensive set of futures contracts than previous studies and analyzing each contract separately. Using 6805 futures contracts drawn from 61 commodities, including some data from non-US markets, we find that the maturity effect is absent in the majority of contracts. In addition, the maturity effect tends to be stronger in agricultural and energy commodities than in financial futures. We also examine the hypothesis in Bessembinder et al. (1996) [Bessembinder, H., J. F. Coughenour, P. J. Seguin, & M. M. Smoller (1996), "Is there a term structure of futures volatilities? Reevaluating the Samuelson hypothesis," Journal of Derivatives 4, 45–58.], which states that negative covariance between the spot price and net carry cost causes the maturity effect in futures. Our results provide very weak evidence in favor of this hypothesis.

JEL classification: C32; G12; G13; Q14
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1. Introduction

In a seminal article, Samuelson (1965) hypothesizes that the price variability increases as time-to-maturity decreases. This maturity effect is important in many aspects. For example, the relation between volatility and maturity is relevant for margin setting and hedging strategy. Specifically, the desired margin size is a positive function of futures price volatility. Therefore, if volatility increases near delivery, margins should also be set higher and hedging strategies should be monitored and adjusted as the delivery date approaches. Finally, because volatility is one of the factors determining the price of an option, the maturity effect should be taken into consideration with regard to the pricing of options on futures.

Many studies empirically test the validity of the Samuelson hypothesis. The vast majority of these studies examine a limited set of commodities. In order to provide more general results, this study employs a more extensive set of futures contracts than previous studies. Specifically, we utilize data from 6805 futures contracts drawn from 61 commodities. The data cover a longer time period (1960 to 2000) and include both US and non-US futures exchanges (London, Sydney, Tokyo and Winnipeg Futures). To our knowledge, these markets have not been included in previous studies. The use of the more extensive and new data also addresses the potential data snooping bias.

This paper uses an alternative approach to examine the maturity effect. Specifically, each individual contract is analyzed separately, as opposed to extant literature that aggregates the contracts by using constructed time series. This alternative methodology is advantageous because it avoids the aggregation problems that can distort empirical results.[1] We also present an analysis of the role of covariance between changes in spot prices and carry costs in explaining the maturity effect. Bessembinder, Coughenour, Seguin, and Smoller (1996, henceforth BCSS) hypothesize that if this covariance is negative, the maturity effect is likely to exist. Nevertheless, their empirical analysis does not directly link covariance of prices and carry costs with the maturity effect, as does this study.

Our primary results can be summarized as follows. First, the maturity effect is absent in the majority of futures contracts. This result is in contrast to the findings in most empirical studies. Our robustness tests suggest that the strong evidence in favor of the maturity effect is primarily due to the aggregate approach applied in the existing studies. In particular, when we pool the contracts using the conventional methods, we find that almost all commodities exhibit a significant maturity effect. Second, the maturity effect varies substantially across contracts and commodities. The evidence in favor of the maturity effect tends to be stronger for agricultural and energy commodities than for financial assets. Third, the evidence supporting the BCSS hypothesis is quite weak. There seem to be factors other than the negative covariance between prices and carry costs that can induce the maturity effect in futures prices.

The remainder of the paper is organized as follows. The next section presents a brief review of related literature. This is followed by a discussion of the methodology and the data. In the fourth section, the empirical results are reported. The paper closes with a summary and conclusions.

[1] Ma, Mercer and Walker (1992) provide a more detailed discussion on how aggregating contracts distorts the empirical results.