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PREDICTIVE MODEL TO MONITOR THE VARIATION ON FUTURE PRICE OF ALUMINIUM PRODUCT THROUGH LOWER AND UPPER BOUNDARY CONDITION IN NIGERIA MARKET

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Variation Of future prices in construction product has been thoroughly expressed, the model were derived in several condition in the system, because the products are influenced by several conditions in its qualitative brown, the product experiences variation due to competition from other products, demand from consumers are reflected on the variation of future prices, these are determined from the quality of the products from other brown in the market, the development of marketing strategy are also reflected on the demand rate of aluminum products in the market thus influences on the rate of variation of the product. The model express numerous conditions in the system that generated the derived equation to establish the model, expression from future prices are determined by all the stated variables that influences the variation of aluminum product in Nigeria market.

Keywords: predictive model, future prices, upper and lower boundary

INTRODUCTION

An early discussion of the valuation of the quality option appears in Cox, Ingersoll, and Ross (1981) in which they state that their valuation can be applied to futures with the quality option when the single spot bond price is replaced with the minimum from the deliverable set. Hemler (1988) uses Margrabe's (1978) exchange option formula to price the quality option but the pricing formula becomes intractable as the number of deliverable bonds increases. Carr (1988) was the first to use factor models to price the quality option and Carr and Chen (1996) extend the Carr model to include a second factor. Ritchken and Sankarasubramanian (1992) use the Heath- Jarrow-Morton (1992) framework to find the quality option value. Livingston (1987) analyzes the quality option on the forward contract. Timing options in general have no closed form solutions and are therefore studied with lattice methods. Kane and Marcus (1986a) lay out a general framework for analyzing the wild card option. In their analysis, discounting is not considered in the wild card period. Broadie and Sundaresan (1987) develop a lattice model to value the end-of-month option. Their focus is strictly on the futures price in the end-of-month period. Boyle (1989) uses a two-period model to show that the timing option could have a significant impact. His analysis assumes constant interest rates and does not directly apply to T bond futures. The paper is organized as follows. The next section studies the quality option. We first study the quality option under continuous marking to market, including upper and lower boundary in Nigeria market or MTM (i.e. both futures and bond markets are open all the time). Then we show that the futures price with the quality option Carr and Chen (1996), Kilcollin (1982), Benninga and Smirloc (1985), Kane and Marcus (1986b), and Hedge (1990 Arak and Goodman (1987), Hedge (1988), Gay and Manaster (1986). These bounds are not to be violated, or arbitrage profits should take place. As it will become clear (in Section IV), in the case of the upper bound that is model free, a simple trading strategy can be formed to arbitrage against the violation (under perfect markets). In the case of the model-dependent lower bound, arbitrage profits exist only if the assumed model is correct (Ren-Raw Chen.2005 Chowdry, 1986)

THEORETICAL BACKGROUND

The emancipation options in coffers bond futures are usually known as the fineness option and three timing options. The quality alternative gives the short the right to deliver any qualified bond (no less than 15 years to maturity or first call) and various timing alternatives give the short the suppleness of making the delivery pronouncement any time in the delivery month. Mostly at the end-of-month timing alternative refers to the deliveries taking place at the last 7 commerce days in the delivery month when the futures market is closed to trading. For the outstanding about 15 business days of the delivery month, the untamed card timing choice refers to the period from in the western nations like united state where from 2:00 p.m. to 8:00 p.m. (Chicago time) every day when the futures market is closed but the bond market is open while the accrued interest timing option refers to the period from 7:20 a.m. to 2:00 p.m. when both futures and its fundamental bond markets are open. Delivery options in T bond futures are hard to price. A recursive use of the lattice representation is inevitable for valuing such options, as Boyle (1989) demonstrates, in that the futures price is efficiently a forward price. Furthermore, as we shall reveal later, the untamed card timing alternative is actually a compound forward price – one on top of the other, which cannot be priced accurately without a multi-recursive system. As a result, an accurate valuation of these deliveries choices is very costly. The goal of this study consequently is to derive fast bounds for the T bond futures price. These bounds can be computed quickly and offer a crude conventional approximation for the T bond futures price Empiricists in universal agree that the fineness alternative has a non-trivial value.1 However, unlike the confirmation for the superiority option, the confirmation for the timing choice is not so clear. This is because most studies do not differentiate between the quality option value and the value from the other timing options, let alone values among various timing options. The Treasury bond futures contract is one of the mainly liquid and broadly traded interest rate derivative contracts universal. The bid-ask spread is tight and the volume is large. Usually this is the market that practitioners use to calibrate the models they use to price other less liquid contracts. Hence, a pricing model that prices precisely both the excellence and timing choices must be derived in direct to do such a task. However, as we shall exhibit later in the study, such a model may be too expensive to be implemented since it involves a recursive search for the futures price at the beginning of the delivery month.

3. Governing equation

Nomenclature

r	=	Finance cost
y	=	Cash yield on underlying asset
p	=	Cash market price [₦] of the underlying asset
f	=	Future price [₦]

Expressing the system mathematically, it is denoted in the following expression

Upper boundary condition

$$f = P + P(r_B - y)$$

Lower boundary condition

$$f = P + P(r_n - y)$$

Integrating the equation into derivative function it is expressed in this form:

$$P\frac{df}{dt} = \frac{df}{dt}(r_B - y) + \frac{df}{dt}(r_L - y) \qquad - \quad - \quad - \quad - \qquad (1)$$

The concept of application, these can achieved the functions of the variables in the governing equation as it is expressed in the study; we could achieve several condition that may led to derivation of numerous results regarding the lower and upper bounds for the futures price. First, we could also derive both bounds in a model-free format. We prove that the model-free upper bond is the cost of carry model that in is a closed-form. The lower bond is the format of an expectation. The analytical solutions for futures price are on the quality option on the stated variables, this serves as a tighter upper bound for the Treasury bond futures price. Forward price shows when the futures market is closed, the bond market is open. This dimension provides the theoretical analysis thus derives lower and upper bounds for the futures price. These derive lower bounds for futures price under both quality which express option including the timing. This situation implies that it is better to show the preference-free cost of carry formula which is an upper bound for the futures price.

$$\frac{df}{dt}r_B - y = df\ r_B - y \qquad - \quad - \quad - \quad - \qquad (2)$$

$$\left.\begin{array}{l} t = 0 \\ f_{(o)} = 0 \\ \left.\dfrac{df_1}{dt}\right|_{t=0} = 0 \end{array}\right\} \qquad - \quad - \quad - \quad - \qquad (3)$$

$$P\frac{df_2}{dt} = \frac{df}{dt} r_L - Y \qquad - \quad - \quad - \quad - \qquad (4)$$

$$\left.\begin{array}{l} t = 0 \\ f_{(o)} = 0 \\ \left.\dfrac{df_3}{dt}\right|_{t=0,\,B} = 0 \end{array}\right\} \qquad - \quad - \quad - \quad - \qquad (5)$$

$$P\frac{df_3}{dt} = r_B - Y = \frac{df_3}{dt} r_L - Y \qquad - \quad - \quad - \quad - \qquad (6)$$

$$\begin{array}{l} t = 0 \\ f_o = 0 \end{array} \qquad - \quad - \quad - \quad - \qquad (7)$$

Apply direct integration on (2) we have

$$P\frac{dp}{dt} = r_B - Y + K_1 \qquad - \quad - \quad - \quad - \qquad (8)$$

Again, integrating equation (8) directly, yields

$$P = r_B - Y + K_1 + K_2 \qquad - \quad - \quad - \quad - \qquad (9)$$

Subject to equation (3) we have

$$Pf_o = K_2 \qquad - \quad - \quad - \quad - \qquad (10)$$

And subjecting equation (8) and (5)

At $\left.\dfrac{df_1}{dt}\right|_{t=0,\,B} = 0 \quad f_{(o)} = f_o$

Yield $0 = r_B - Y K_2$

$$\Rightarrow K_1 = -r_B - Y f_o \qquad - \quad - \quad - \quad - \qquad (11)$$

So that, we put (10) and (11) into (9), we have

$$Pf_1 = r_B - Y f_{1t} - r_B - Y f_{ot} + Pf_o \qquad - \quad - \quad - \quad - \qquad (12)$$

$$Pf_1 = r_B - Y f_{1t} = Pf_o - r_B - Y f_{ot} \qquad - \quad - \quad - \quad - \qquad (13)$$

$$\Rightarrow f_1\left[P_1 - r_B - Y_t\right] = f_o\left[P_o - r_B - Y\right]$$

$$f_1 = f_o \qquad - \quad - \quad - \quad - \qquad (14)$$

Hence equation (14) implies that at any given time we have a constant price of the commodity in some time, but in the system these condition are determined on the quantity of products available in the market, timing are determine with respect to the product competing with other brown.

$$P\frac{df_2}{dt} = \frac{df}{dt} r_L - Y \qquad - \ - - - \qquad (4)$$

We approach the system, by using the Bernoulli's method of separation of variables

$$f_2 = ZT \qquad - \quad - \quad - \quad - \qquad (15)$$

$$\frac{df_2}{dt} = ZT^1 \qquad - \quad - \quad - \quad - \qquad (16)$$

$$\frac{df_2}{dt} = ZT^1 \qquad - \quad - \quad - \quad - \qquad (17)$$

Put (16) and (17) into (15), so that we have

$$PZT \;=\; r_L - Y\,ZT^1 \qquad - \quad - \quad - \quad - \qquad (18)$$

i.e. $P\frac{T^1}{T} \;=\; r_L - Y\frac{T^1}{T} \;= -\lambda^2$ - - - - (19)

Hence

$$P\frac{T^1}{T} + \lambda^2 = 0 \qquad - \quad - \quad - \quad - \qquad (20)$$

$$r_L - YT^1 + \lambda^2 T \;=\; 0 \qquad - \quad - \quad - \quad - \qquad (21)$$

$$r_L - YT^1 + \lambda^2 T \;=\; 0 \qquad - \quad - \quad - \quad - \qquad (22)$$

From (21) $t \;=\; A\,Cos\,\frac{\lambda}{B}t \;+\; B\,Sin\frac{\lambda}{\sqrt{P}}t$ - - - - (23)

And (16) gives

$$T \;=\; f\ell^{\frac{\lambda^2}{r_L - Y}t} \qquad - \quad - \quad - \quad - \qquad (24)$$

By substituting (23) and (24) into (15), we get

$$F_2\left[A\,Cos\,\frac{\lambda}{P}t \;+\; B\,Sin\frac{\lambda}{P}t\right] f\ell^{\frac{-\lambda^2}{r_L - Y}t} \qquad - \quad - \quad - \quad - \qquad (25)$$

Subject equation (25) to condition in (5), so that we have

$$F_o \;=\; AC \qquad - \quad - \quad - \quad - \qquad (26)$$

Equation (26) becomes

$$F_2\;F_o\ell^{\frac{-\lambda^2}{r_L - Y}t}\,Cos\,\frac{\lambda}{P}t \qquad - \quad - \quad - \quad - \qquad (27)$$

Again at $\left.\frac{df_2}{dt}\right|_{t\,=\,0,\,B} \;=\; 0 \quad t = 0$

Equation (27) becomes

$$\frac{df_2}{dt} = \frac{\lambda^2}{P}\,F_o\ell^{\frac{-\lambda^2}{r_L - Y}t}\,Sin\,\frac{\lambda}{P} \qquad - \quad - \quad - \quad - \qquad (28)$$

This is the growth rate of the price in future:

The growth rates of commodity prices are influenced by several factors, the behaviour of the consumers express the impact of the consumer behaviour in the market, these condition will definitely need experts to monitor the quality of other brown in the market, ability to thorough assess the browns in the market determine the marketing strategy that will be applied to improve the growth rate of the commodities including prices.

$$0 \;=\; -f_o\frac{\lambda}{P}\;Sin\,\frac{\lambda}{P}B \qquad - \quad - \quad - \quad - \qquad (29)$$

$$\Rightarrow \frac{\lambda}{P} \;=\; \frac{n\pi}{P}\;n = 1,2,3 \qquad - \quad - \quad - \quad - \qquad (30)$$

$$\Rightarrow \lambda \;=\; \frac{n\pi\sqrt{P}}{2} \qquad - \quad - \quad - \quad - \qquad (31)$$

So that equation (27) becomes

$$F_2 \;=\; F_o\ell^{\frac{n^2\pi^2P}{2r_L - Y}t}\,Cos\,\frac{n\pi\sqrt{P}}{2\sqrt{P}}t \qquad - \quad - \quad - \quad - \qquad (32)$$

$$\Rightarrow\; F_2 \;=\; F_o\ell^{\frac{-n^2\pi^2P}{2r_L - Y}t}\,Cos\,\frac{n\pi}{2}t \qquad - \quad - \quad - \quad - \qquad (33)$$

Now we consider equation (6) which is steady price rate of the system

The commodity may experience constant prices in the market, the product may be found in this condition, the express derived solution consider this condition in the system as the product constant prices may be influenced by the quality of the product, most especially construction material, there lots of circumstance that may be observed to developed constant prices in most cases, the product of the brown may experience depreciation in quality reflecting on the demand of the product.

$$\frac{df}{dt} r_B - Y + \frac{df}{dt} r_L - Y$$

Applying Bernoulli's method, we have

$$f_3 = ZT \quad - \quad - \quad - \quad - \quad (34)$$

$$\frac{df}{dt} = ZT^1 \quad - \quad - \quad - \quad - \quad (35)$$

$$\frac{df}{dt} = ZT^1 \quad - \quad - \quad - \quad - \quad (36)$$

Put (35) and (36) into (6), so that we have

$$r_B - Y \frac{T^1}{T} = r_L - Y \frac{T^1}{T} = \varphi \quad - \quad - \quad - \quad - \quad (37)$$

$$r_B - Y \frac{T^1}{T} = \varphi \quad - \quad - \quad - \quad - \quad (38)$$

$$r_L - Y \frac{T^1}{T} = \varphi \quad - \quad - \quad - \quad - \quad (39)$$

$$T = A\ell^{\frac{\varphi}{r_B - Y}t} \quad - \quad - \quad - \quad - \quad (40)$$

$$T = P\ell^{\frac{\varphi}{r_B - Y}t} \quad - \quad - \quad - \quad - \quad (41)$$

Put (41) and (42) into (34) gives

$$F_3 = A\ell^{\frac{\varphi}{r_L - Y}t} \bullet B\ell^{\frac{-\varphi}{r_L - Y}t} \quad - \quad - \quad - \quad - \quad (42)$$

$$F_3 = AB\ell^{(x-x)} \frac{\varphi}{r_L - Y} \quad - \quad - \quad - \quad - \quad (43)$$

Subject equation (44) to (7) yield

$$F_3 = 0 = F_o \quad - \quad - \quad - \quad - \quad (44)$$

So that equation (45), becomes

$$F_3 = F_o\ell^{(x-x)} \frac{\varphi}{r_L - Y} \quad - \quad - \quad - \quad - \quad (45)$$

Now assuming that at the steady price rate, there is no high demand, therefore, the increase of price rate here is zero, so that equation (46) becomes

$$F_3 = 0 \quad - \quad - \quad - \quad - \quad (46)$$

$$F = F_1 + F_2 + F_3 \quad - \quad - \quad - \quad - \quad (47)$$

We now substitute (14), (33) and (47) into (48) so that we have the model

$$F = F_o + F_o \, \ell^{\frac{n^2\pi^2 P}{2r_L - Y}t} Cos \frac{n\pi}{2} t \quad - \quad - \quad - \quad - \quad (48)$$

$$F = F_o \; 1 + F_o \, \ell^{\frac{-n^2\pi^2 P}{2r_L - Y}t} Cos \frac{n\pi}{2} t \quad - \quad - \quad - \quad - \quad (49)$$

The delivery choice has the most financial values known to be the excellence option that gives short future contract the right to choose the cheapest bond to deliver at the delivery date. Other delivery options that are embedded in *T* bond futures known as the three timing options. The short time can select any time in the release month to make a delivery. The short time can make a delivery even when the futures market is closed. At the end of the delivery month, for 7 business days, the futures market is closed but the short can still make a delivery. This is understood as the end-of-month timing option. For the remaining about several business days in the delivery month, e.g. fifteen days; the shortest period product that can deliver is either in between short period depending on the time it is applied, both the futures market and the underlying bond market are open or after certain period that it may vary. When the futures market is closed. The former timing option is called accrued interest timing option and the latter timing option is also known as the daily wild card play. From the developed model, the derived model equation state how futures contract with the quality option is equivalent to a futures contract without the quality option (only first bond is eligible for delivery) with an exchange option held by the short

CONCLUSION

In this study, derived solution results are on different condition considered, regarding the lower and upper bounds for the futures price. First, we derive both bounds in a model-free format. We prove that the model-free upper bond is the cost of carry model, which is closed-form. The lower bond is in the format of an expectation. Since the bounds are model free, violating the bounds implies arbitrage profits. Secondly, such reflection with the two-factor from similar expert's model, we derive an analytical solution to the futures price with the quality option, which serves as a tighter upper bound for the Treasury bond futures price. Lastly, we derive an analytical lower bound for the Treasury bond futures price under the formulated system that generated the derived model, several condition were considered from other experts that has applied different concept to monitor future price in upper and lower boundary in aluminium products, other variables were consider that sound insignificant in the system that generated the model, but were introduced when the study found it imperative, the expressed model will definitely be useful as a tool in monitoring future prices in aluminium product.

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