State-dependent expectations and the Treasury bond's futures rates.

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Abstract

The formation of expectations is central to both economic policy decisions and asset pricing. In the paper at hand we examine whether information contained in the futures contracts for the 10 year Treasury bond yields, during the period 2000-2008, falls in the context of the rational expectations hypothesis. Departing from the standard linear formulation, we test whether expectations, as reflected in the pricing process of the T-Note futures contracts, are subject to structural changes. Thus, we employ an empirical framework that allows for non-linear long-run relations between futures and spot Treasury bond yields to be revealed. In particular, we test for existence of structural changes, in a non-linear cointegration framework and we find that during the period 2002-2003, the premium paid by investors of futures contracts in Treasury notes experienced was re-priced with the effects being positive and permanent.

Keywords: rational expectations, futures contracts, non-linear cointegration

JEL Classification: G12, G14, G15

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1. Introduction

The prices of contracts on assets to be delivered sometime in the future reflect expectations of the market participants on the future valuation of the asset. Furthermore, these expectations should be unbiased estimators of future spot prices, subject to the available set of information, in order for no arbitrage opportunities to exist, according to the rational expectations (RE) hypothesis. On the other hand the futures market for Treasury bonds has a unique significance among derivatives markets in that it quotes expectations on the benchmark long term rate whose implications, mostly as a key input in economic specifications extending from macroeconomic expectations to asset pricing. As a result, we deem that the examination of the unbiased pricing in futures contracts for Treasury bonds concentrates increased interest, both for academics and policy makers.

Our investigation is based on the concept of rational expectations hypothesis for futures contracts, by examining whether the expectations that are reflected in the futures contracts' pricing process, provide unbiased estimators for future Treasury bond yields. Recall that the unbiasedness hypothesis, extending to the efficiency of the Treasury futures market, dictates that the price of a futures' contract should unbiasedly predict future spot prices of the 'underlying asset'. However, our analysis is not restricted in providing just a simple binary ('yes' or 'no') answer to the underlying question. By employing a non-linear examination framework we provide time-varying answers, by allowing periods of rational expectations to be succeeded by periods of biased ones and vice versa.

These variations may be related to the characteristics of the underlying asset. In particular, in the case of Treasury bond yields such variations may stem from the, well established in previous empirical literature, regime switching properties of interest rates (see among others Ang and Bekaert 2002, Bansal *et al.*, 2004 and Tillmann 2007). As expectations are formed persistently (see among others Lee and Shields, 2000 and Orphanides and Williams, 2005) and interest rates are mean-reverting forecasters', previous trends may weight in the formation of expectations and thus re-adjusting to the new trend, once such a shift has occurred, may not be done in a timely manner. In this case, forecasts for next period's rates will be biased by the trend that prevailed during the previous period (see Hamilton, 1989). In due time, however, as observations from the new trend concentrate, it will start to weight in futures markets' participants forecasting tools; thus, forecasts re-gain their unbiased properties. Hence, such a mechanism could generate multiple solutions to the rational expectations hypothesis; periods in which futures prices are unbiased estimators of future spot prices may be followed by periods of biased expectations and so-forth.

To the best of our knowledge the paper at hand is the first to examine the rationality of expectations incorporated in Treasury bonds' futures, in a framework that allows for several, consecutive, underlying equilibrium solutions. The main objective of this paper is to contribute to the empirical examination of the unbiased estimation, focusing on the futures market for US Treasuries. Moreover, we deem that we provide a concrete view on the structural effects existing in the pricing procedure and potentially provide an economic reasoning behind the regime switching properties, of the asset prices that we examine.

The rest of the paper is organized as follows. Section 2 discusses the theoretical foundations of the investigation and reviews relevant previous literature. Section 3 presents the methodology incorporated for investigating the expectations formation process, while section 4 presents the results of the empirical investigation. Finally section 5 concludes the paper.

2. The concept of rational formation of expectations and futures contracts

2.1 Discussion of the literature

Initiated by Muth (1961), rational expectations lie in the centre of theoretical formulations of asset pricing; market participants' expectations should be formed rationally, otherwise arbitrage opportunities persist. Of course the formation of expectations has implications for other fields of the economic profession, as well, such as the monetary policy setting (see among others Gali and Gertler, 1999, Romer and Romer, 2000 and Orphanides and Williams, 2005) or the term structure of interest rates. Finally, before initiating the discussion on the specific issue to be investigated in the paper at hand, we deem that the critique of Akerloff (2007), who emphasizes on the need to abandon the steady-state (rational) equilibrium hypothesis as far as the formation of expectations, should be taken into account. As a result, we examine the rational formation of expectations for future spot Treasury bond yields, as a state-dependent hypothesis. For this reason, we employ a non-linear econometric framework that enables us to report changes in the equilibrium relations among the spot and futures bond yields.

Empirical assessments of the unbiasedness hypothesis, in futures markets, often involve the employment of cointegration methods based on the theoretical concept of the rational expectations as an equilibrium relation, in order to examine whether the pricing process o futures contracts provides unbiased estimators of future spot prices. The framework on which the relevant empirical examinations are based has been formulated by Brenner and Kronner (1995). In their paper Norrbin and Reffett (1996) confirm that forward rates are unbiased estimators of spot rates by establishing cointegration relations, while they also find that in the short run forward rates adjust, while spot rates are weakly exogenous. Kavussanos et al. (2004) have examined the unbiased pricing of freight arrangements by the OTC forward contracts. They employ cointegration tests and find that the specific derivative products offer unbiased estimations on future spot prices. Finally, Chow (2001) examines the unbiasedness hypothesis for futures on commodities through the application of cointegration analysis and reports mixed results; for silver the rationality of expectations, reflected by futures contracts prices, is confirmed while for gold it is rejected. Thus, the author states that the issue of market efficiency does not have a unique answer but rather varies across markets. Thus, we could state that there is not a unique answer to the question of rationality of expectations, incorporated in futures contracts; answers vary according to the underlying asset.

Our approach tests the unbiasedness / rational expectations hypothesis while combining changing economic and market conditions that may alter the long or short run assessment of the price discovery exercise outcome. Specifically, building, empirically, on recent methodological developments on the estimation of long run relations with regime shifts (see Gregory and Hansen, 1996) we take into account regime switches in the estimation of the system's equilibrium relations. Regime shifts are reported to govern the interest rates formulation processes (e.g. Ang and Bekaert 2002) thus introducing endogenous long and short run shifting characteristics in the underlying relations. From the point of view of economic reasoning, a source of regime switching properties of the data generation process can be related to revaluation of the forward premium between the futures and spot yields, resulting to mean reversion effects in the system.

2.2 Theoretical considerations

Under the assumption of rational expectations formulation, futures contract yields on government bonds (say with a time to delivery of *k* periods), must reflect all available information on spot bond yields realized in a point of time in the future, *k* periods ahead. Letting $F_{t|t-k}$ stand for the yield of a futures contract on US 10y Treasuries, in time, *t-k* delivered in *t*, S_t be the spot yield at time of delivery and Ω_{t-k} the set of information available to investors at time *t-k*, equation (1) presents the theoretically imposed restriction for efficient pricing of the future spot yields *k* periods ahead, through the trading of the relevant futures contract.

$$F_{t|t-k} = E_{t-k}\left(S_t \middle| \Omega_{t-k}\right) \qquad (1)$$

As a result the pricing of the futures contracts of the Treasury bonds should closely reflect the one corresponding to the spot market, in order for the no-arbitrage conditions to hold. A more relaxed relation, adopted by Brenner and Kronner, formulates the price of the futures contract as a function of spot prices and a cost-of-carry premium:

$$F_{t|t-k} = S_{t-k} \cdot C_{t|t-k} \qquad (2)$$

In relation 2 the differential $C_{t|t-k}$ represents the premium investors pay in futures markets in order to account for the interest gained in spot positions and the cost of financing the bond position (Upper and Werner 2002). Taking logs on (2) we obtain,

$$f_{t|t-k} = s_{t-k} + c_{t|t-k} \qquad (3)$$

Relation (3) dictates that under the rational expectations hypothesis futures contracts prices should be unbiased estimators of spot yields. In the latter relation lower case letters are used to indicate logged values of the variables in (2) while *c* stands for the logged value of the forward premium. Even though in the past the conditions of short-sale and frictionless markets, required in order for (3) to hold, nowadays they are a common ground for financial markets. Moreover no shortage of the underlying assets, that could otherwise cause problems in the efficient pricing of futures' yields, is evident in the Treasuries' spot markets.

Under the strict interpretation of the hypothesis of unbiasedness, the residuals of the difference between the futures and spot yields must be normally distributed with zero mean and normal standard deviation. Assuming that the variables f and s are $I(1)$, the stationarity of the (1 -1) cointegration relation, would confirm the RE hypothesis in the long run. Equation (4), briefly illustrates the examination in a bivariate cointegration framework.

$$(f_{t|t-k} - s_{t-k}) \sim N(0, \sigma) \qquad (4)$$

Relation (4), reported in its weak form, additionally counts for a stationary constant parameter (c) in the relevant cointegration vector, capturing the forward premium. Thus, we accept unbiasedness if the relation among the futures and spot government bond yields is illustrated as a stationary long run equilibrium. We adopt this weak form of the underlying hypothesis following among others views reported by Hodrick (1987), Cavaglia et al. (1994) and Villanueva (2007). Accepting the existence of a stationary premium we investigate the following long-run structure of the cointegration relations:

$$(f_{t|t-1} - s_{t-1}) - c'_{t|t-1} \sim I(0) \qquad (5)$$

Generalizing, the above relation must stand for every term of delivery (k), especially since the futures contracts on government bonds differ from other contracts, e.g. on commodities, as they are not held until delivery. As a result and in order to add practical value to our results from a bond dealer's perspective, the lag factor (k) is specified at one trading day, thus anticipating that, due to market efficiency the values of the futures contracts yields in day 1 will be reflected in the next day's spot yields.

Adopting this perspective, we extend the examination framework used in previous works for counting for regime switching effects as well. Specifically, we adopt the aforementioned researchers point of view and base our empirical examination on a regime switching data generation process of the underlying bond yields. Specifically, by introducing an unobserved state variable, denoted as v, in the data generation process, of the Treasury yields, the following relation occurs:

$$s_t = \mu_t(v) + A(v)s_{t-1} + u_t \qquad (6)$$

Then the regime switching properties obviously affect the result of the examination of the underlying hypothesis. Specifically, assuming that the regime switching occurs in time *t*, this should be equivalently reflected in the forward yields in order for the pricing mechanism to be efficient. As a result these effects should be incorporated in relation (5), thus leading to a reestablishment of the long run relations. Therefore, relation (5) takes the form:

$$(\beta(v^*)f_{t|t-1} - \gamma(v^*)s_{t-1}) - c'_{t|t-1}(v) \qquad (7)$$

Hence, in order for the prerequisite of stationary (1 -1)` relation to be confirmed in the empirical examination the $1 = \beta = \gamma$. Additionally, we adopt the perspective that the underlying regime switching could either affect the eigenvector of the long run equilibrium either through its coefficients (v*) or the restricted constant capturing the forward premium (v). In the first case shifting market conditions tend to establish a new spot-forward equilibrium. This should indicate a divergence away or convergence towards the unbiased estimation of the spot yields. On the other hand, should the regime switching lead to a re-estimation of the forward premium, leaving the (1 -1)` relation unaffected, then this should indicate stable conditions in the unbiased estimation of the spot yields through futures markets, while the premium investors pay in order to take forward positions would either be diminished or lifted. Of course in case $v \equiv v^*$, the regime switching leads to a re-estimation of the equilibrium relation that stems both from the new value of the premium and a change in the common trend. Finally, as a final step in our examination, end of day price discovery is performed taking into account regime switching properties, once more. In this case Markov Switching effects allow for a reflection of changing market conditions in the short run.

3. Empirical examination framework

The data set we use contains spot and futures yields to maturity of the US ten year benchmark government bonds in daily frequency (end of day). The source of the data is Thomson-Financial Datastream and we refer to yields formulated at the end-of-the-day on the respective most actively traded benchmark ten-year bond. The data set is of daily frequency, containing end of day yields and covers the period of 2000:01:01 up to 2008:01:01. End of day yields have been collected for the aforementioned time period, comprising a data set is informative on the price discovery mechanism. Specifically, compared to intraday data sets, the end of day pricing information provides finalized information, normalizing intraday cycles, thus permitting to extract robust conclusions on the UH and further on the price discovery of Treasury yields.

Following the theoretical foundations referred to earlier, stationarity characteristics of the bond yields data set are investigated first. Further on, we examine for cointegration relations among the futures and spot yields of the government bonds under investigation. Letting *X* denote the vector of the dependent variables (*f* and *s*) the, well-known, general cointegration relation can adequately describe the basic empirical examination equation (8).

$$\begin{aligned} &\Delta X_t = c_0 + \Pi X_{t-1} + \sum_{j=1}^{n} \sum_{l=1}^{k-1} \Gamma_{ji} \Delta X_{j\,t-l} + U_t, \\ &t = 1, 2, \ldots, T \\ &U_t \sim NID(0, \Sigma) \end{aligned} \tag{8}$$

Specifically, $c_0 = \Pi\mu$ while the formulation $\Pi = a\beta'$ stands for the cointegration vectors containing the equilibrium relations of the underlying variables. Initially we test for the rank of the cointegration space, thus performing the query of the existence of stationary common linear relations between the futures and spot yields I and the number of the non-stationary common stochastic trends left outside the cointegration space (*p*) (for a more detailed analysis of the cointegration rank tests see Johansen 1988 and Johansen and Juselius 1992). We estimate the rank of the Cointegration space by using the critical values provided by Osterwald-Lennum (1992) and McKinnon et al. (1999).

Additionally, β represents the long-run structure of the cointegration vectors while a the adjustment coefficients towards the long run relations. According to the UH we expect the cointegration vector's long run structure to follow a (1 -1)` pattern, with a stationary constant to stand for the forward premium. Should the restrictions imposed on the cointegration space be accepted, the hypothesis that futures contracts unbiasedly estimate future spot Treasury yields would be accepted. In this case, the bond portfolio manager should expect the spot yields to follow a close one to one relation with futures yields, with the lead effects being on the futures side. Additionally, from the formulation of equations (5) and (7) it is understood that a forward premium should also be taken into account.

Introducing structural characteristics in the present investigation we count for structural breaks occurring in the cointegration space. Specifically it would be rational to expect that the premium between the future and the spot yield would have been reassessed in the time period under investigation, according to differentiations of market conditions. Thus structural breaks would be evident in cointegration relations. As a result we employ the structural methodology introduced by Gregory and Hansen (1996) to account for structural breaks in the cointegration vectors. The representation of their methodological framework is given by relation (9) below.

$$f_{10y,t} = c_1 + c_2 v_{t\tau} + \alpha_{1_1} v_{2t} + \alpha_2 s_{10y,t} v_{t\tau} + e_t \qquad (9)$$

Specifically according to this formulation, potential regime shifts in the cointegration relation between two series (captured by the unobserved variable *v*) could be adequately explained as stemming from the constant parameter I, the trend coefficients (*a*) of the series or a full break of the system (both *c* and *a*) as illustrated by equation (9). Gregory and Hansen (1996) use the Philipps and Perron's Z statistic for the residual of the earlier relation's regression, in order to specify regime shifts. They state that in case cointegration for the underlying time span is rejected by the (non-) stationarity tests of Dickey and Fuller, the structural break characteristics of the system should be examined in order to reevaluate the initial results of the cointegration tests. However even if cointegration is evident (through e.g. Johansen rank tests) according to Trenkler (2005) and Lütkepohl, Saikkonen and Trenkler (2004) the structural stability of the vectors should be examined in order for the VECM relations to be reported in a robust way.

4. Empirical Results

In order to examine the information contained in futures contracts for future spot government yields we first need to establish the stationarity properties of the data set. Table 1 contains the results of the Dickey Fuller unit-root and KPSS stationarity tests, respectively. The results indicate stationarity of the 1st differences of the variables and non-stationarity of their levels ($I(1)$ series). Thus we proceed to the examination of the cointegration relations of the series.

Table 1: Unit Root and Stationarity Tests				
	Unit Root Tests (Dickey-Fuller)		Stationarity Tests (KPSS)	
	Levels	1st Differences	Levels	1st Differences
Spot T-Bond$_{10y}$	-1.614	-64.798*	70.022	0.118*
Future on T-Bond$_{10y}$	-2.740	-66.430*	66.255	0.125*
Critical Values (Tests for variables with constant, no trend, asterisk indicates significance on a 5% c.i.): D-F: 1%= -3.435 5%= -2.863, KPSS: 1%= 0.739, 5%= 0.463				

Table 2, below, contains the results of Johansen's trace and maximum eigenvalue tests specifying the cointegration rank.

Table 2: Estimation of the Cointegration Space				
Cointegration Rank Tests				
	$\lambda_{\max}$		λ_{trace}	
$\mathrm{H}_0 : p - r = 2$	38.63	15.88*	46.63	20.25*
$\mathrm{H}_0 : p - r = 1$	8.00	0.17*	8.00	9.17*
*Restrictions in the Cointegration Relations***				
$\mathrm{H}_0 : \beta_{T_{10y}} = 0$ 36.96 (0.00)	$\mathrm{H}_0 : \beta_{F_{10y}} = 0$		36.80 (0.00)	
L-R decomposition	X^2 (*p-value*)		Cointegration weights	
$\mathrm{H}_0 : (\beta_{F_{10y}} \quad \beta_{T_{10y}}) = (1 \quad -1)$	13.62 (0.00)		*c= 0*	
$\mathrm{H}_0 : (\beta_{F_{10y}} \quad \beta_{T_{10y}} \quad F.P.) = (1 \quad -1 \quad -c)$	7.38 (0.01)		*c= 0.27*	
$\mathrm{H}_0 : (\beta_{F_{10y}} \quad \beta_{T_{10y}} \quad F.P.) = (1 \quad \beta \quad -c)$	0.00 (0.98)		*β_T= -0.94, c= 0.547*	
* 95% Critical Values from McKinnon et al. (1999). p-values in parentheses ** X^2 Tests for cointegration space specification Johansen and Juselius (1992, 1994)				

Both tests indicate that a stationary linear combination of the spot and futures yields' series exists, eliminating a common stochastic component from both series. In other words there exists a cointegration vector that captures the co-movements of the series, leaving only one common stochastic trend to drive the data. This result is essential in revealing the informational value of the futures yields for the spot bond yields. Next, in order to specify in a robust fashion the structure of the relationship, as described by relations (4) and (5), we examine the composition of the cointegration vector. First we test for the long run exclusion hypothesis (namely $\mathrm{H}_0 : \beta_i = 0$), investigating the potential exclusion of each of the series from the long run equilibrium relation. As indicated in Table 2, both futures and spot yields cannot be excluded from the cointegration vector.

Next, we estimate the structure of the long run equilibrium relation by imposing restrictions dictated by the unbiasedness hypothesis. The initial results indicate rejection of relation (4); that is, according to the linear specification, investors in futures contracts, at best, pay a premium over the spot Treasury yields. This is supported by the finding of the X^2 test which indicates that relation (5) may be accepted, for a 1% confidence interval. As a result, a constant parameter equal to 27 basis points is indicated to exist as a residual of the (1 -1)` long run relation, capturing the premium that futures contracts holders demand as discount, in order to balance the increased uncertainty in time of delivery and/or liquidity effects of the futures market. However, the small size of the confidence interval that we have to adopt, in order to accept this result, lives room for doubts. Furthermore, if we relax the underlying assumption of the (1 -1) relation the resulting accepted structure indicates that the relation is very close to that imposed by the UH, however the forward premium is much elevated, reaching approximately 55 basis points.

Could these results be reflecting that expectations reflected by futures contracts on Treasury bond yields are not rational? In our point of view potential changes in the structure of the underlying long run relations should be first taken into consideration, before finalizing the results of this empirical examination. Taking into mind that our data sample contains several cyclical effects that existed in financial markets, the need for examination of structural breaks in the long run equilibrium, arises. Intuitively, it seems straightforward that a reassessment of the forward premium must have taken place more than once in the period of 2071 trading days that we examine.

Table 3: G-H Tests of Structural Breaks in the Long Run Equilibrium Relations

Sample	*Z-Statistic*
2000:1:1 – 2008:01:01	-8.295* (2001:12:05)
2000:1:1 – 2001:12:05	-5.562** (2000:05:10)
2001:12:05 – 2008:01:01	-8.072* (2003:06:06)
2001:12:05 – 2003:06:06	-7.891* (2001:01:05)
2003:06:06 – 2007:01:01	-5.456 (2004:11:29)

C. V.: 1% -5.97 and 5% -5.50, ** significance in a 1% c.l., * significance in 5% c.l.

In order to count for shifts in the long run equilibrium, we apply the Gregory and Hansen's (1996) methodology for tracing structural breaks in cointegration vectors and we examine the fullbreak model presented by relation (9), which examines the existence of a structural break both in the intercept and in the trend of the cointegration relation. Table 3 reports the structural examination findings. We run the tests for structural breaks, initially for the whole of the data set and then we repeat the tests for the specified sub-samples until the results of the tests indicate non-existence of structural breaks. In case a structural break is specified we next test for cointegration in the underlying sub-samples, following usual Johansen cointegration analysis techniques and we repeat this process until no structural breaks are present or until the sample contains not enough observations to continue the tests.

A significant structural break is indicated approximately two years from the beginning of the sample at 2001:12:05 and further more breaks occurring during the period under examination. The next significant re-valuation occurs in the third quarter of 2003, where the structural break is identified at 2003:06:06. The results of the tests, presented in Table 3 indicate that the future-spot relation for Treasuries has been re-estimated in the turbulent period between early 2002 and mid-2003.

During this period 2002-2003 futures contracts on Treasury bonds exhibited concentrated increased trading activity, with the participation of more traders from over seas. This development led the CFTC committee to permit the direct placement of orders from foreign investors through a dedicated electronic platform. Of course, the same period was also characterized by the sharp interest rates cuts from the Fed. We deem that these two explanations might serve to understand the following findings. Next, we divide the sample in sub-periods in order to estimate the underlying cointegration characteristics of the futures and spot bond yields.

Table 4: Johansen's Cointegration Tests for the Sub-Periods

Sub-Period	λ_{trace}	$H_0:(\beta_F \quad -\beta_T - c) = (1 \quad -1 \quad c)$**	β_{F10y}	$-\beta_{T10y}$	$+c$
2000:01:01 – 2001:12:05	21.04*	4.20 (0.04)	1	-1	+ 0.202
2001:12:05 – 2003:06:06	21.38*	17.29 (0.00)	1	-0.912	+ 0.671
2003:06:06– 2008:01:01	24.75*	2.61 (0.11)	1	-1	+ 0.282

* Indicate 5% significance according to McKinnon et al. (1999) critical values
** X^2 Tests for cointegration space specification Johansen and Juselius (1992, 1994)

As is shown in Table 4 significant modifications are evident among the three separate sub-periods we have estimated with the G-H tests. A common characteristic is the confirmation of the significant long run cointegrating relation among the futures and spot government bond yields. However there exist significant differences in the underlying relation and the constant factor that captures the forward premium. Specifically in the first sub-period (2000:01:01 – 2001:12:05) the UH is confirmed in its weak form and the estimated premium for futures markets investors is estimated at 20 basis points. In the second period the long run equilibrium relation is even further relaxed deviating from the UH restrictions. The specified cointegration vector contains a long run component capturing the spot yields that is close to 1 (specifically 0.912) while in the same time, the strict (1 -1)` structure is rejected. Furthermore, the constant factor of the cointegrating relation for the period between 2002 and mid-2003 is much elevated compared to the first sub-period. The period specified by the first break (2002:1-2003:6) is characterized by a divergence away from the unbiased estimation of spot yields by the futures market and it coincides with turbulent market conditions leading portfolio managers to restructure their holdings. This stems from the indication that the initial rejection of the underlying hypothesis, in the linear specification, may be due to the formulation of a new long run relation. This shift has lead to the re-pricing of the premium, during the second sub-period. In the last sub-period (2003:06:06 – 2008:01:01), the relation between the spot and futures bond yields returns to the unbiased path. However, the forward premium has increased at 28 basis points. This result indicates that a re-evaluation of the equilibrium relation between the futures and the spot bond yields has occured in the interim period. Specifically, comparing the initial (pre-2002) and final equilibriums (post-2003:6) the shift is indicated to have resulted to the increase of the forward premium by 8 b.p.

5. Concluding remarks

Our findings support the reasoning of examining the futures market for Treasury bonds, under a time-varying concept of efficiency. In particular, we find that expectations embodied in the futures contracts for the benchmark Treasury bond are found to be biased when examined in a linear formulation. However, this result is clarified to a great extend, in case non-linear effects, probably caused by persistent formation of expectations, are introduced in the examination framework.

Specifically, we find that although the futures and spot yields of US government bonds, formulate stationary long run relations, the restrictions of the hypothesis that futures contracts are unbiased estimators of future spot bond yields, is not confirmed. This result indicates, first, that the pricing processes of the Treasuries and their futures contracts are closely related and, second, that either the futures market for the T-notes is not efficient, or that data properties blur the results of the standard linear specification.

On the other hand, this results are clarified when regime shifts are incorporated in the econometric specification. In particular, introducing shifts in the long run structure reveals that in large futures contracts yields are unbiased estimators of future spot bond yields, although in the period examined herein there existed a period in which the premium paid by futures contracts investors has increased. This re-pricing that occurs during the period 20020-2003, resulted in the rejection of the unbiasedness hypothesis restrictions under the linear model. Moreover, under the new equilibrium this premium embodies a permanent positive component; probable explanations for this effect can be related to the changes in the market's investors base that occurred during this period.

The results reported in the paper at hand highlight the changing nature of the asset pricing process, which has been found to vary with institutional structures and market conditions. Finally, we deem that the recently stated skepticism on the rational formation of expectations and the efficient market hypothesis, if combined with the econometric concept of state-dependence of time series, may form a fertile ground for future research in fields extending from asset pricing to economic policy.

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