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Term Structure Examination of Indonesian Money Market: Some Efficiency Issue

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ABSTRACT

This paper examines efficiency of Indonesian term structure as imposed by the country's central bank. The rate, widely understood as the Bank Indonesia (BI) Rate varying from 30-day, 60-day, and 180-day, usually stated as the plain-vanilla cost of capital of interbank debt financing depending on their time length. In general, this rate will consequently impact various other sorts of interest rates in the country's debt market as a whole. When dealing with market efficiency, statistical inference shows that short-term BI Rate's is not the best predictor of its long-term one due to some uncertain asymmetric information. This finding may lead to further adjustment in risk management strategy for hedging with interest rate.

Keywords: term structure, risk premia, expectation hypothesis (EH), market efficiency, cointegration, volatility spillover, expansionary monetary policy

1. Introduction

Uncertainty risk causes debt market to work inefficiently, resulting in a shift in long-term premium. If a debt market is efficient, a today's long-term interest rate as the cost of capital is an unbiased predictor of future certain period interest rate (Lamba, 2005; Levich, 2001; Hull, 2005). It follows the Expectation Hypotheses (EH) law that:

$$S_t = E(L_t)$$

Where the short-term interest rate (S_t) is the best estimator of future long-term interest rate (or date) of period (*t+1*) or L_t. For instance, a 30-days BI rate of 9% fluctuation will exactly result in similar pattern of the same realized spot interest rate 180 days ahead, under perfectly unbiased and efficient condition.

Yet sometimes there are factors that avoid forward market from working efficiently. Risk premia, is the main reason why the market reponses to the uncertainty. The market demands higher yield due to asymmetric information. Arroyo (1994) whose view recently supported by Wagner (2008) noted that economic shocks drive underlying assumptions to shift from optimistic market sentiments. For instance, if today's US interest rate is risen up by The Federal Reserves, the US currency rate will likely to strengthen in the following days, causing an importer to suffer from higher risk unless he/she hedge his/her position.

This time-varying risk uncertainty leads market to the changing risk premia, causing efficiency to shift. Besides, information asymmetry causes the term structure to deviate from its converging pattern (Hull, 2005). This is

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because the real market interest rate does not necessarily reflect market's real certainty. Wagner (2008) in his research on six currencies from 1977 – 2005 also supports such view, which he pointed as 'forward bias', stimulating some market participants to speculate.

In addition, Arroyo (1994) suggests that period of utility function can also reduce efficiency due to its interaction between production and consumption pattern. When production cycle reaches its peak and full capacity, market equilibrium will adjust to lower price causing inflation premium to decrease and uncertainty reduced. In times of economic turbulence, consumption and production pattern will robust and causes more uncertainty.

2. Literature Review

As elaborated, the issue of efficiency in the financial market deals with predictability of future interest rates on the basis of current rate ones. Mankiw and Summers (1984) as well as Mankiw and Miron (1986) discussed their finding of 3-month explanatory power over the 6-month US interest rates, although the pattern was unsteady after establishment of the Federal Reserve System. Campbell and Shiller (1987,1991) found that the EH do not hold, but that the US spread explains the direction of changes in short-term rates. However, the predicted changes were small, indicating possible time varying risk or term premium between lags.

EH was for example found by Hardouvelis (1994), who used quarterly data of various G-7 countries, and rates of return from three month and 10 year bonds. He concluded that the future aggregate movements in short term rates confirmed the theory, and significantly rejected the presupposed hypothesis that their spread did not explain substantially. Balaban and Kunter (1996) tested the Turkish financial market efficiency, including its overninght (O/N) interbank money market interest rates from 1989-1995, and found that the term structure was not efficient.

Wolters and Hassler (2001) provide evidence on the presence of EH in Germany in particular between 1, 3, 6 and 12 month rates of the German inter bank money market.

Bredin and Cuthbertson (2000) found that EH held in the Irish money market. MacDonald and Speight (1988, 1991), as well as Engsted and Tanggard (1994), and da Fonseca (2002) found proof of sound validity of the EH for the short-term, and highly volatile interest rates. In studies on Asian markets, Shen (1998) investigated the EH on Taiwan money market by employing the 10 day short and 30, 90 and 180 day long commercial paper rates. He concluded that the theory is rejected for shorter maturities but cannot be rejected for longer maturities. The only comparable study we came across for the Indian money market is Verma (1997) where it is found that the Indian money market lacks a well defined yield curve.

Cassola and Morana (2008) modeled the short-term interest rate in the European money market by employing Minimum Bid rate (MBR) spreads data, and found a common cobreaking in 1-week interest rates in the Euro area. It later challenges the European Central Bank (ECB) to improve its degree of precision in monetary policy targeting. Shivam and Jayadev (2005) investigated term structure efficient hypothesis in Indian money market, by employing five different rates data from September 3, 2001 to June 30, 2003, and found that the market was efficient. All data reflected cointegration and long-term relationship predictability.

3. Data and Methodology

Term structure refers to interest rate behavior in financial market. Since numerous assets are heavily related to interest rate (eg. credits, loans), it is becoming urgent to understand its movement as a variant of risk driver as well.

3.1. Data: The Indonesian BI Rate

The Indonesian financial authorities regularly underpin their policies on the *Sertifkat Bank Indonesia* (Bank Indonesia's rate, the SBI) rate as a control mechanism to the financial markets.

As a monetary policy instrument, the BI Rate is destined to reduce inflation and control its magnitude periodically. It is determined regularly by the central bank's Board of Directors, and has an immediate impact on interbank lending rate. When managed well during expansionary monetary policy, the rate can stimulate inflation stabilization, government budget expansion, and enhance the capital market index to improve.

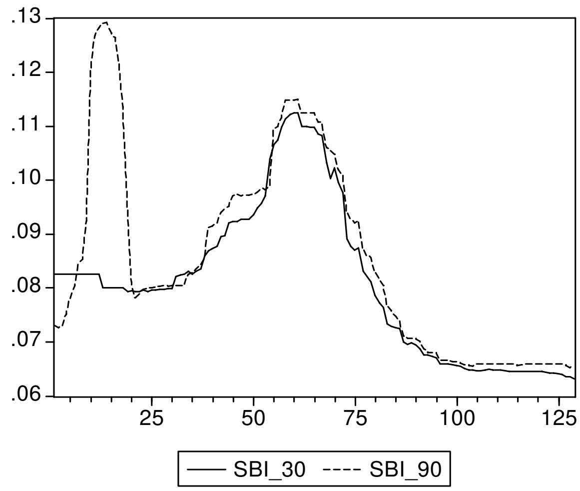

Figure 1. Indonesian 30-Day and 90-Day BI Rate
1 January 2005 – 1 January 2011

We collect the data of Indonesia's central bank rate (or SBI, later on The BI Rate) of 30-days and 90-days, as presented in Graph 1 above. Observation of 129 weekly-announced rates extending from 1 January 2005 to 1 January 2011, covering up to a period of last five years. The graph suspects a presumable existence of cointegration between the two term structure variables in the long term, although volatility spillover took a place during the first quantile of observation.

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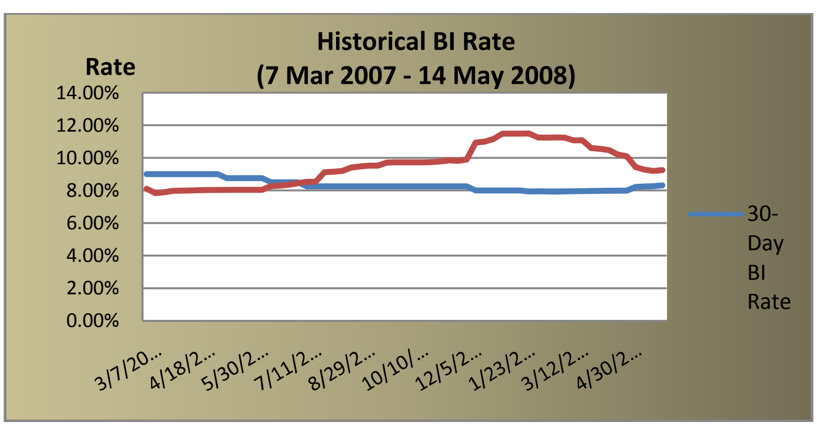

Source: Bank Indonesia, 2009

Figure 2. Historical BI Rate

In brief, all datasets can be summed up as follows:

Table 1. Controlled Term Structure Variables

No.	Term Structure	Observation Window	Source
1.	30-Day BI Rate	1 January 2005 – 1 January 2011	Bank Indonesia
2.	90-Day BI Rate	1 January 2005 – 1 January 2011	Bank Indonesia
3.	180-Day BI Rate	7 Mar 2007 - 14 May 2008	Bank Indonesia

3.2. Methodology

The study centers on the movement of interest rate terms in Indonesian debt market. Trends, cyclicality and long-term relationship are observed. Hence, exploration is needed to be done with the use of cointegration, Vector Autoregressive (VAR), and Error Correction Method (ECM).

3.2.1. Parameters Restriction

When the market is efficient and Efficiency Hypothesis (EH) holds, the short-term interest rate reflects future expectation of its term structure perfectly. Given the absence of other explaining variables, the 30-day BI Rate variation would perfectly reflect future longer term 90-day BI Rate.

Hence, the parameter coefficient estimates would equal a restriction of 1 (one). A Wald Test over parameters restriction is produced to further examine this hypothesized efficiency.

3.2.2. Stationarity and Johansen's Cointegration

A time series is deemed stationary, as its variance is constant across all lags (Gujarati, 1996; Maddala, 2001; Koop, 2006). Unless a series of observable parametric variables are stationary in its stochastic trend, any regression estimation will be spurious. This will result in possible inefficiency of predictor tools, causing estimator from achieving the BLUE criteria of estimation objective.

The serial correlation problem arises when residual error term (ε_t) is not a white noise process. Dickey and Fuller (1984) suggested estimation of the following equation, later on named the Augmented Dickey-Fuller (ADF) Test, to diagnose such non-stationary series:

$$y_t = \gamma + \delta_t + \alpha y_{t-1} + \sum_{j=1}^{k} \theta_j \Delta y_{t-j} + e_t$$

Where the terms y_{t-1} and Δy_{t-j} is used to include the autoregressive (AR) process in this augmented equation. The non-stationary series are later to be differenced until stationarity is achieved and captured by such ADF Test. Since the main aim of econometric modeling is how best to model dynamic economic variables, the issue of stationarity has increasingly demanded more attention than the estimation aspect itself (Maddala, 2001).

It was further argued by Gujarati (1996) as well as Maddala and Kim (1988) that as the spreads are mean reverting, all variables will have a long-term relationship, which is referred to as cointegration. This mean will only be achieved, as stationary condition is fulfilled. A time series is said to be integrated at order 1 or I(1), if Δy_t or the ($y_t - y_{t-1}$) term is stationary. In a case of I(0), it is hence deemed stationary. Similarly holds when the series is integrated at the order of 2, or I(2), meaning that $\Delta y_t \sim I(1)$. Consequently, when two series of y_t and x_t where:

$$y_x \sim I(2)$$
$$x_t \sim I(2)$$

They are said to be cointegrated. To clarify, suppose that both of them are taken into the following linear relationship of:

$$y_t = \beta x_t + u_t$$

It can be said that x_t does not drift away from y_t so that the long-run equilibrium relationship holds between them. Otherwise, the regression taken involving those variables may lead to spurious modeling.

3.2.3. Vector Autoregression (VAR)

VAR extends the AR process by involving more than just one equation. Hence, there are more than one dependent variables which are explained by historical observation lags of all the variables included in the study. For example:

$$Y_t = \alpha_1 + \delta_1 t + \varphi_{11}Y_{t-1} + \cdots + \varphi_{1p}Y_{t-p} + \beta_{11}X_{t-1} + \cdots + \beta_{1q}X_{t-q} + e_{1t}$$

and

$$X_t = \alpha_2 + \delta_2 t + \varphi_{21}Y_{t-1} + \cdots . + \varphi_{2p}Y_{t-p} + \beta_{21}X_{t-1} + \cdots \beta_{2q}X_{1-q} + e_{2t}$$

Those two equations comprise a VAR. Each dependent variables of Y_t and X_t are

$$Y_t = \alpha_1 + \varphi_{11}Y_{t-1} + \beta_{11}X_{t-1} + e_{1t}$$
$$X_t = \alpha_2 + \varphi_{21}Y_{t-1} + \beta_{21}X_{t-1} + e_{2t}$$

or

$$\begin{bmatrix} Y_t \\ X_t \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \end{bmatrix} + \begin{bmatrix} Y_{t-1} & X_{t-1} \\ Y_{t-1} & X_{t-1} \end{bmatrix} \begin{bmatrix} \varphi_{11} & \varphi_{21} \\ \beta_{11} & \beta_{21} \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix}$$

VAR is useful to capture a large scale equations modeling, which is to be done simultaneously. And due to its autoregressive enrichment, this modeling method will also provide a capture of cyclical impact of the historical data to the dependent variable being estimated.

3.2.4. Error Correction Model (ECM)

When two series are cointegrated, for instance by I(1), it means that they produce causality the the predefined differenced lag of 1, given a causal relationship between them. As found by Engle and Granger (1987), historical series may vary substantially across observation diverging from its current state in the long-run, causing a disequilibrium. The Error Correction Model (ECM) enables a self-regulating mechanism to fix this disequilibrium, so that the long-run equation can be readjusted towards its equilibrium.

The ECM is established when variables are cointegrated. With the following basic equation to illustrate:

$$\Delta Y_t = \varphi + \lambda e_{t-1} + \omega_0 \Delta X_t + \varepsilon_t$$

The ECM focuses on the change of dependent variable (ΔY_t) with respect to a change of independent one (ΔX_t), and its relationship as a function of previous lag's error term of e_{t-1}. This controlled error term, or much referred to as error correction term (ECT), is obtained from direct regression of Y and X where:

$$e_{t-1} = Y_{t-1} - \alpha - \beta X_{t-1}$$

Hence in the ECM, ΔY_t depends on e_{t-1}, which explains how the self-controlling mechanism of disequilibrium may hold for the long-run. Initial observation on it was conducted by Davidson, Hendry, Srba and Yeo (1978) on the consumption and income functions relationship in UK, which was in cases largely proclaimed the foundation of this latter advancement.

4. Empirical Findings

4.1. Testing for Efficiency

The term structure of interest rate predicts a relationship between short-term and long-term interest rate. The OLS estimation of the following model:

$$R_{L,t} = \beta_0 + \beta_1 R_{S,t} + u_t$$

Results in output as given in Table 14 It reveals that 30-Day BI Rate has a strong negative relationship with the 180-Day one. It can be inferred from statistical p-value, which is significant at all levels. The model has a good explaining power, indicated by a relatively high adjusted R-square, approaching 81 percent. However, a high autocorrelation seems to be presumably possible as implied by the DW statictics which is less than one. Later on in this Chapter, the error terms will be discussed.

Table 2. Equation Estimation of 30-Day and 180-Day BI Rate Efficiency

Parameter Estimates (Dependent Variable: SBI_180)	Estimated Coefficients	T-Statistic	Standard Error
C	0.347362 ***	21.55681	0.016114
SBI_30	-3.025250 ***	-15.67170	0.193039
Goodness of Fit:			
Coefficient of Determination	0.808329		

However, it is interestingly observed that there is a negative relationship between the 30-Day BI Rate (short-term) and the 180-Day one (long-term). This finding somehow indicates that the central bank (BI) imposes a trade-off interest rate policy in maintaining targeted inflation. When economic uncertainty is assumed to be high, the bank stimulates lending market to shift their funding to shorter period. As depicted in Graph 2 above, Indonesia's historical BI Rate trend displays substantial increase in the long-term rate particularly after May 2007.

To companies or business policymakers, such finding advises that the short-term interest rate can not be utilized to predict future cost of funds or credits and their trends. Risk perception tends to be shorten in terms of time perspective, given by undesirable long-term interest rate.

If the term is efficient and short-term interest rate is a best estimator of the long-term one, coefficient estimate of long-term interest rate variable will consequently equal one and the constant remains zero. To examine it, a Wald test should be taken with respect to the following restriction:

$$\beta_0 = 0, \qquad \beta_1 = 1$$

As the result suggests in Table 3, the p-value of statictical Chi-Square leads to rejection of null hypothesis, which is $\beta_0 = 0$ and $\beta_1 = 1$. It can therefore be concluded that the constant and 30-Day BI Rate coefficient estimate are not significantly equal zero and one respectively. Or statistically, there is no proof for efficiency or unbiasedness of the short-term BI rate as the best estimator of the long-term one.

Table 3. Wald Test Result of BI Rate Efficiency

Wald Test:
Equation: WALD

Test Statistic	Value	df	Probability
F-statistic	361.4533	(2, 57)	0.0000
Chi-square	722.9067	2	0.0000

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(1)	0.347362	0.016114
-1 + C(2)	-4.025250	0.193039

Restrictions are linear in coefficients.

Nevertheless, historical financial data usually exhibits strong autocorrelation between lags. Inspecting the correlogram of preceding OLS residuals in Table 4, we can observe a continuous autocorrelation between errors across all lags even up to 10 (ten) lags. It takes a form of autoregressive (AR) until lag 9, and turns out into moving average (MA) at lag ten onwards.

Moreover, all lags show significant p-value at all levels. This finding indicates that historical interest rate (in this case of SBI) has a strong relationship with past information. The determination of today's current rate is influenced heavily by previous data or setting up policy.

Table 4. Correlogram of OLS Residuals
10 Lags

Date: 04/03/11 Time: 22:07
Sample: 1 59
Included observations: 59

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Autocorrelation</td><td>Partial Correlation</td><td>AC</td><td>PAC</td><td>Q-Stat</td><td>Prob</td></tr>
<tr><td>.</td><td>.</td><td>0</td><td>0.</td><td>5</td><td>0</td></tr>
<tr><td>|*******|</td><td>|*******|</td><td>.905</td><td>905</td><td>0.803</td><td>.000</td></tr>
<tr><td>.</td><td>.</td><td>0</td><td>-</td><td>9</td><td>0</td></tr>
<tr><td>|****** |</td><td>| . |</td><td>.809</td><td>0.052</td><td>2.164</td><td>.000</td></tr>
<tr><td>.</td><td>.</td><td>0</td><td>0.</td><td>1</td><td>0</td></tr>
<tr><td>|****** |</td><td>| . |</td><td>.726</td><td>012</td><td>26.01</td><td>.000</td></tr>
<tr><td>.</td><td></td><td>0</td><td>-</td><td>1</td><td>0</td></tr>
<tr><td>|***** |</td><td>.*| . |</td><td>.624</td><td>0.147</td><td>51.52</td><td>.000</td></tr>
<tr><td>.</td><td></td><td>0</td><td>-</td><td>1</td><td>0</td></tr>
<tr><td>|**** |</td><td>**| . |</td><td>.494</td><td>0.220</td><td>67.81</td><td>.000</td></tr>
<tr><td>.</td><td></td><td>0</td><td>-</td><td>1</td><td>0</td></tr>
<tr><td>|*** |</td><td>**| . |</td><td>.346</td><td>0.212</td><td>75.95</td><td>.000</td></tr>
<tr><td>.</td><td>.</td><td>0</td><td>0.</td><td>1</td><td>0</td></tr>
<tr><td>|** |</td><td>| . |</td><td>.226</td><td>028</td><td>79.49</td><td>.000</td></tr>
<tr><td>.</td><td></td><td>0</td><td>-</td><td>1</td><td>0</td></tr>
<tr><td>|*. |</td><td>.*| . |</td><td>.104</td><td>0.094</td><td>80.26</td><td>.000</td></tr>
<tr><td>. | .</td><td>.</td><td>-</td><td>-</td><td>1</td><td>0</td></tr>
<tr><td>|</td><td>| . |</td><td>0.017</td><td>0.048</td><td>80.28</td><td>.000</td></tr>
<tr><td>.*|</td><td>.</td><td>-</td><td>-</td><td>1</td><td>0</td></tr>
<tr><td>. |</td><td>| . |</td><td>(0.122</td><td>0.013</td><td>81.38</td><td>.000</td></tr>
</table>

4.2. Testing For Unit Roots

Stationarity is a main issue in achieving an efficient estimator effort. A unit root test is run to inspect series' stationarity with the following hypotheses specification:

H_0: the series has a unit root
H_1: the series does not have a unit root

Shall the series contain unit roots, they may lead to spurious regression, in which treatment to be taken is to difference all observed variables by lags (Gujarati, 1995). Results are presented in Table 5 below.

Table 5. Unit Root Test

Series	n (No. of lags)	ADF stat*	Conclusion
SBI_30	12	-2.640460*	H_0 accepted, the series is I(1)
SBI_90	12	-6.271961*	H_0 accepted, the series is I(1)
SBI_180	12	-6.247707***	H_0 accepted, the series is I(1)

*Note of significance: at 1%=***, 5%=**, 10%=**

As seen above, all series are not proven stationary at the first step, and observed stationary at lag 1. It can hence be proceeded later on with cointegrating analysis.

4.3. The Long-Run Relationship Expectation: Cointegration Test

As a long-term relationship was expected to indicate an efficiency of term structure in Indonesian debt market, the Johansen-Juselius test provided no proof of this hypothesis. We run the test of this long-term relationship and found the result in the Table 6.

Table 6. Johansen-Juselius Test of Cointegration for Indonesian Term Structure, 30 – 90 Day BI Rate.

	No. of CE	Test Statistic	Critical Value*	
			1%	5%
Trace Statistics	None	7.038272	20.04	15.41
	At most 1	2.408250	6.65	3.76
Max-Eigenvalue	None	4.630022	18.63	14.07
	At most 1	2.408250	6.65	3.76

**: Given in Johansen and Juselius (1990), CE stands for Cointegrating Equiations*

The result shows that both Trace and Eigenvalue statistics do not show proof for any cointegrating equations at all levels. We hence may conclude that tere is no suspected long-term relationship between those two variables.

Table 7. Johansen-Juselius Test of Cointegration for Indonesian Term Structure, 30-180 Day BI Rate.

	No. of CE	**Test Statistic**	**Critical Value***	
			5%	**1%**
Trace Statistics	None	15.78991	15.41	20.04
	At most 1	4.581041	3.76	6.65
Max-Eigenvalue	None	11.20886	14.07	18.63
	At most 1	4.581041	3.76	6.65

**: Given in Johansen and Juselius (1990), CE stands for Cointegrating Equiations*

Furthermore, inspection for cointegration process between 30-Day BI Rate and 180-BI Rate shows that the long-term relationship holds. As both Trace and Maximum Eigenvalue test result reveal, there is one cointegrating equation at both 1% and 5% levels (Table 7), indicating a presence of relationship between economic variables in the long-run. This relationship is best explained by lag 5.

4.4. Information Cyclicality Issues in The Indonesian Money Market: VAR (1,2)

Since VAR assumes all historical data stationarity as proven in Table 8, it can be concluded that all included independent term structure variables are stationary at 1st difference level. As VAR conducted, all explored observations lead to the best VAR lags of (1,2). The model shows best robustness within the lagged range of observation. Furthermore, the justification of both Akaike AIC and Schwarz SC values lead to the optimal lag length of least value when compared to other lag length being tested in the model.

Table 8. VAR (1,2) Estimation of Indonesian 30-Day and 180-Day Term Structure
7 Mar 2007 - 14 May 2008

Vector Autoregression Estimates
Date: 05/21/11 Time: 09:45
Sample(adjusted): 3 59
Included observations: 57 after adjusting endpoints
Standard errors in ( ) & t-statistics in [ ]

	SBI_180	SBI_30
SBI_180(-1)	1.198986	-0.057339
	(0.15840)	(0.05357)
	[7.56955]	[-1.07041]
SBI_180(-2)	-0.256072	0.047762
	(0.15697)	(0.05308)
	[-1.63134]	[0.89973]
SBI_30(-1)	0.271354	0.826383
	(0.48591)	(0.16433)
	[0.55845]	[5.02895]
SBI_30(-2)	-0.349243	0.089220
	(0.47702)	(0.16132)
	[-0.73213]	[0.55306]
C	0.012176	0.007819
	(0.02068)	(0.00699)
	[0.58870]	[1.11790]
R-squared	0.969946	0.958511
Adj. R-squared	0.967634	0.955320
Sum sq. resids	0.000238	2.73E-05
S.E. equation	0.002141	0.000724
F-statistic	419.5557	300.3390
Log likelihood	272.0771	333.8747
Akaike AIC	-9.371127	-11.53946
Schwarz SC	-9.191912	-11.36025
Mean dependent	0.095602	0.083167
S.D. dependent	0.011903	0.003426
Determinant Residual Covariance		1.74E-12
Log Likelihood (d.f. adjusted)		609.9943
Akaike Information Criteria		-21.05243
Schwarz Criteria		-20.69400

4.5. Revisiting Indonesian Risk Premia Adjustment In The Long Run: Error Correction Model (ECM)

As cointegration theory developed, understanding of economic variables can be expanded to observation of short run and long run behavior among them. The incremental change in estimated dependent variable is a linear function of its past error-term, later on referred to as error correction variable (ECV), and historical changes in its independent explaining variables:

$$\Delta Y_t = \varphi + \lambda e_{t-1} + \omega_0 \Delta X_t + \varepsilon_t$$

where e_{t-1} is the past error-correction term or ECV, and ΔX_t represents the historical changes in independent explaining factor.

Since the instrument operates in assumption that long-term equilibrium is achieved, all factors affecting this condition are statistically accounted. In such case, economic factors may cause satisfactory long-term equilibrium to be fulfilled and distorted such that it shifts to disequilibrium condition. This disrupting error term is denoted under the ECV. Graph 3 below for instance, depicts fitted error terms of Indonesian 30-day and 180-day historical relationship.

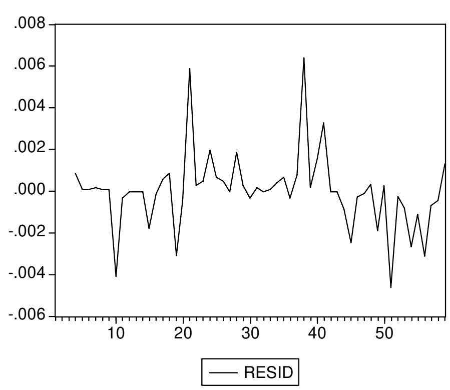

Figure 3.Fitted Error Terms

Essential in this step is hence to control such error-correction variable (ECV) in the model specification, and run with estimation. The result shows in Table 9 below.

Table 9. ECM Term Estimation Result

Variables	Estimated Coefficients	T-stats (Std. Error in parentheses)
Constant	4.54E-05	0.179846 (0.000252)
D(SBI_30)	-1.587655***	-4.665754 (0.340278)
ECV(-1)	-0.165043	-0.481913 (0.342474)

Note: *** significant at 1% level

The result exhibits adjustment mechanism between the two risk premia, by which deviation from the long-term equilibrium is expected to be automatically self-corrected. Hence rewriting the estimated ECM we have the following long-term equilibrium equation:

d (*SBI_180*) = 4.54E-0.5 – 1.587555 d(*SBI_30*)
(0.179846) (-4.665754)***
(0.000252) (0.340278)

– 0.165043 *ECV*
(-0.481913)
(0.342474)

We expect the Error Correction parameter estimate to equal zero to adjust the equation into more sustainable long-term equilibrium. The expected negative relationship sign of ECV indicates that the 180-day BI rate fell below its equilibrium value. Further interpretation shows that the error correction variable is not statistically significant in influencing the 180-day BI rate. This ECM finding is consistent with the Wald test result in Table 3 that there is no suspected efficiency between the two rates in the future.

5. Conclusion and Recommendation

This finding proves that the short-term interest rate is not the best predictor of its medium-term one, given the proof of the absence of cointegration between the 30-day and 90-day BI Rates. Yet statistical result led to evidence of short-term and long-term BI rate relationship, proven by cointegration at lag 5 between both the 30-day and 180-day BI rates.

It concludes that efficiency is fulfilled in Indonesian money market term structure, with 30-day and 180-day interest rates in particular. Or it suffices to say, that it holds between the short and long-term risk premia. The error correction modeling result is consistent with the mean estimation result, where both two variables have negative relationship. VAR analysis also contributes to reveal that past information was contained and take effect in the short and long-term interest rates, significantly from lag 1 and 2.

However, the Wald test result shows that this efficiency is not statistically significant. It is consistent with the Johansen cointegration and ECM estimation result that satisfy same outcome. Though there are relationships between these interest rate variables, their future term structure cannot be predicted using the 30-day short-rate. It means that market practitioners or investors, moneylenders and depositors in particular would still have to be more cautious in expecting for future possible rates movement. In terms of public policy, the Indonesian central bank will have to further improve its interest rate targeting policy, so that better shocks-based bias risk avoidance can be implied and information may possibly be absorbed efficiently.

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