CHAPTER 4

RESEARCH METHODOLOGY AND DATA SETS

This chapter will be organized by showing the 3 hypothesis testing step by step. First, the market efficiency hypothesis (MEH) tests which is composed of the 4 step testing procedures and another 2 hypothesis tests, the rational expectation hypothesis (REH), and the no risk premium, are composted of 3 steps. The first step tests: stationary tests, to test whether the variables are nonstationary. Next, the second step tests; cointegration tests (developed by Engel and Granger(1987))[40], to see whether the variables are cointegrated. The third step tests; error correction model to examine the short run relationship between the variables (for market efficiency hypothesis tests). The final step, correlogram and Q-statistic test the serial correlation in residuals.

4.1 Test of Market Efficiency Hypothesis

The hypothesis of market efficiency implies that the current forward rate and the future spot rate (S_{t+1} and F_t) are "close together". Therefore, market efficiency implies that even if the spot and forward rate are non stationary, they never drift far apart so that they will be cointegrated.[41]

By definition, cointegration necessitates that the variables be integrated by the same order. Thus, before examining the cointegration test, it is necessary to know whether the variables S_{t+1} and F_t are stationary or not. For this purpose, this study will use the Augmented Dickey Fuller (ADF) test. If S_{t+1} and F_t are stationary, it is not necessary to proceed to the cointegration test since standard time series methods, ordinary least square (OLS) apply to stationary variables. If S_{t+1} and F_t are integrated of different orders, it is possible to conclude that they are not cointegrated.

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[40] Ibid., p.4.

[41] Hakkio and Rush. Ibid., p.8.

If S_{t+1} and F_t are stationary at the same order. For example, at the first differencing I(1) , then apply the Engle and Granger cointegration tests to estimate the long run relationship by

1. Estimating the regression model by ordinary least square (OLS)

$$S_{t+1} = \alpha + \beta F_t + \varepsilon_{t+1}$$

where S_{t+1} = Log spot exchange rate at time t+1

F_t = Log forward exchange rate at time t

ε_{t+1} = Residuals

2. Testing whether the residual term (ε_{t+1}) has a stationary process by using the Augmented Dickey Fuller Test (ADF).

If ε_{t+1} are stationary I(0), then this study can conclude that the spot (S_{t+1}) and forward (F_t) exchange rate are cointegrated. In contrast, if ε_{t+1} are not stationary then the spot (S_{t+1}) and forward (F_t) exchange rate are not cointegrated

According to the cointegration method, if S_{t+1} and F_t are integrated of the same order then the linear combination of them may be stationary. If that is the case, the results from using regression will not be spurious. Therefore, this study can conclude that they have long term relationship.

Remember, there are two popular ways of testing cointegration relation in Thailand: the Engle and Granger method (1987) and the Johansen and Juselius method (1990). Although these two method have some different applications, economists say that [42], with the small sample size data, they will not give very different result. Therefore, in this thesis, the Engel and Granger method is an appropriate model in the transmission mechanism.

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[42] Rungsarn Hataiseree, "Cointegration and Error Correction Approach: An Alternative Appliction of Thailand's Macroeconomic Model", *Thammasat Economic Journal* 13(3) :20-55

Then, use the correlogram and Q-statistic to test the serial correlation in the ε_{t+1} series. If there are no serial correlation, the conclusion is that the S_{t+1} and F_t are follow random walks.

Besides, if S_{t+1} and F_t are cointegrated of the same order, then they can be written in an error correction form.

By using generalizations of the error correction methods discussed in Engle and Granger (1987),this method is used to formulate long run relationship, by adjusting the short run mechanism with error correction terms. Therefore, write the model in the ECM and test the hypothesis to verify that the cointegrating factor is one and the error are white noise, by applying the corresponding tests on the coefficients of the ECM.

For simplicity, Specialize equation (10) to the spot and forward rates, and assume that no lagged terms enter the equation. Thus, if S_{t+1} and F_t are cointegrated, they can be written as an error correcting regression from equation (11) [43]

$$(S_{t+1} - S_t) = a(S_t - d F_{t-1}) + b(F_t - F_{t-1}) + U_t$$

$$\text{or} \quad \Delta S_{t+1} = C + \alpha U_t + \beta \Delta F_t + \varepsilon_t$$

where S_{t+1} = Log spot exchange rate at time t+1
S_t = Log spot exchange rate at time t
F_t = Log forward exchange rate at time t
F_{t-1} = Log forward exchange rate at time t-1
U_t = Residuals

Again, use the correlogram and Q-statistic to test the serial correlation in the ε_{t+1} series. If there are no serial correlation this study can apply the market

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[43] Hakkio and Rush, Ibid. p. 7.

efficient hypothesis. Then, we can use this error correction equation in estimation.

This study, like standard tests, examines the joint hypothesis of no risk premium and efficiency and rational use of information. Violation of either hypothesis can lead to rejection of MEH. Therefore, if the result from this part show that Thailand's foreign exchange market is inefficient, one will extend the study to find the reasons behind the rejection of the MEH that is due to the risk premium , expectational errors or both.

Before starting the tests of rational expectation hypothesis (REH) that concern 2 variables, spot (S_{t+1}) and expected spot exchange rate (E_tS_{t+1}). The spot exchange rate (S_{t+1}) is available from the survey data in the beginning of this thesis. The expected future spot exchange rate (E_tS_{t+1}) has no available source.

Similar to Phichet [44] , this study can obtain the expected future spot exchange rate (E_tS_{t+1}) from the regression estimation. If there are short run relationship, this study can predict the expected future spot exchange rate (E_tS_{t+1}) from the error correction model. However, if there are no short run relationships, this study cannot use the error correction model. Thus, this study can forecast the expected future spot exchange rate (E_tS_{t+1}) from the OLS regression.

4.2 Tests of the Rational Expectation Hypothesis

To test the rational expectations hypothesis (REH), begin by looking at the Augmented Dickey Fuller (ADF) of the expected future spot exchange rate (E_tS_{t+1}). If the expected future spot exchange rate E_tS_{t+1} that were obtained from the error correction estimation or the cointegration regression are stationary with

[44] Ibid., p. 9.

the same order with S_{t+1} , then test the cointegration of S_{t+1} and E_tS_{t+1} by estimating the regression model by using :

$$S_{t+1} = \alpha + \beta E_tS_{t+1} + \varepsilon_{t+1}$$

where S_{t+1} = Log spot exchange rate at time t+1

E_tS_{t+1} = Log expected future spot exchange rate at time t.

ε_{t+1} = Residuals.

Again test the stationary of residuals ε_{t+1} by using ADF. The S_{t+1} and E_tS_{t+1} which must be cointegrated with a cointegrating factor of one. Then, use the correlograms and Q-statistic to test the serial correlation in the ε_{t+1} series. If the results show no correlation in the ε_{t+1} , then the residuals are random and this study can conclude that the rational expectation in Thailand's foreign exchange market is accepted.

4.3 Tests of the No Risk Premium Hypothesis

To test of the no risk premium hypothesis , when the expected future spot exchange rate E_tS_{t+1} are stationary with the same order with F_t, then test the cointegration of F_t and E_tS_{t+1} by estimate the regression model by using :

$$F_t = \alpha + \beta E_tS_{t+1} + \varepsilon_{t+1}$$

where F_t = Log forward exchange rate at time t.

E_tS_{t+1} = Log expected future spot exchange rate at time t.

ε_t = Residuals.

Again test the stationary of residuals ε_t by using ADF. F_t and E_tS_{t+1} which must be cointegrated with a cointegrating factor of one. Then, use the corelograms and Q-statistic to test the serial correlation in the u_t series. If the results show no correlation in the ε_t then the residuals are random and the no risk premium hypothesis is accepted.

4.4 Data Sets

The parameters in the model have been estimated by applying, the daily spot rate S_t and one month forward rate F_t of Thai baht against the U.S. dollars during the period July 2, 1997 through February 23,1998 (169 observations) obtained from the Data Stream.

All the computations are in the logarithmic form. Most of the empirical research for exchange rates are in the logarithmic form. Moreover, Logs are use to make the analysis independent of whether exchange rates are expressed as units of domestic currency per unit of foreign currency or unit of foreign currency per unit of domestic currency. [45]

Along with the theoretical and practical foreign exchange trade among all participants in markets. It is necessary to match the forward rate with its forward date. This means , match the daily observations of the one month forward exchange rates with its future spot exchange rates.

The matching results are showed in Appendix E. After, preparing the data sets, there are 87 observations left for testing the 3 hypothesis.

Variables

S_{t+1} = log spot exchange rate at time t+1
F_t = log forward exchange rate at time t
E_tS_{t+1} = log expected future spot exchange rate at time t

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[45] For more detail see Michael Melvin, "Appendix : What is a Logarithm, and Why are They Used in Financial Research? " p. 96-98 in *International Money and Finance*, Second Edition. (New York : Harper & Row Publishers Inc.) 1989.

FIGURE 4.1 THE MARKET EFFICIENCY HYPOTHESIS (MEH) TESTS

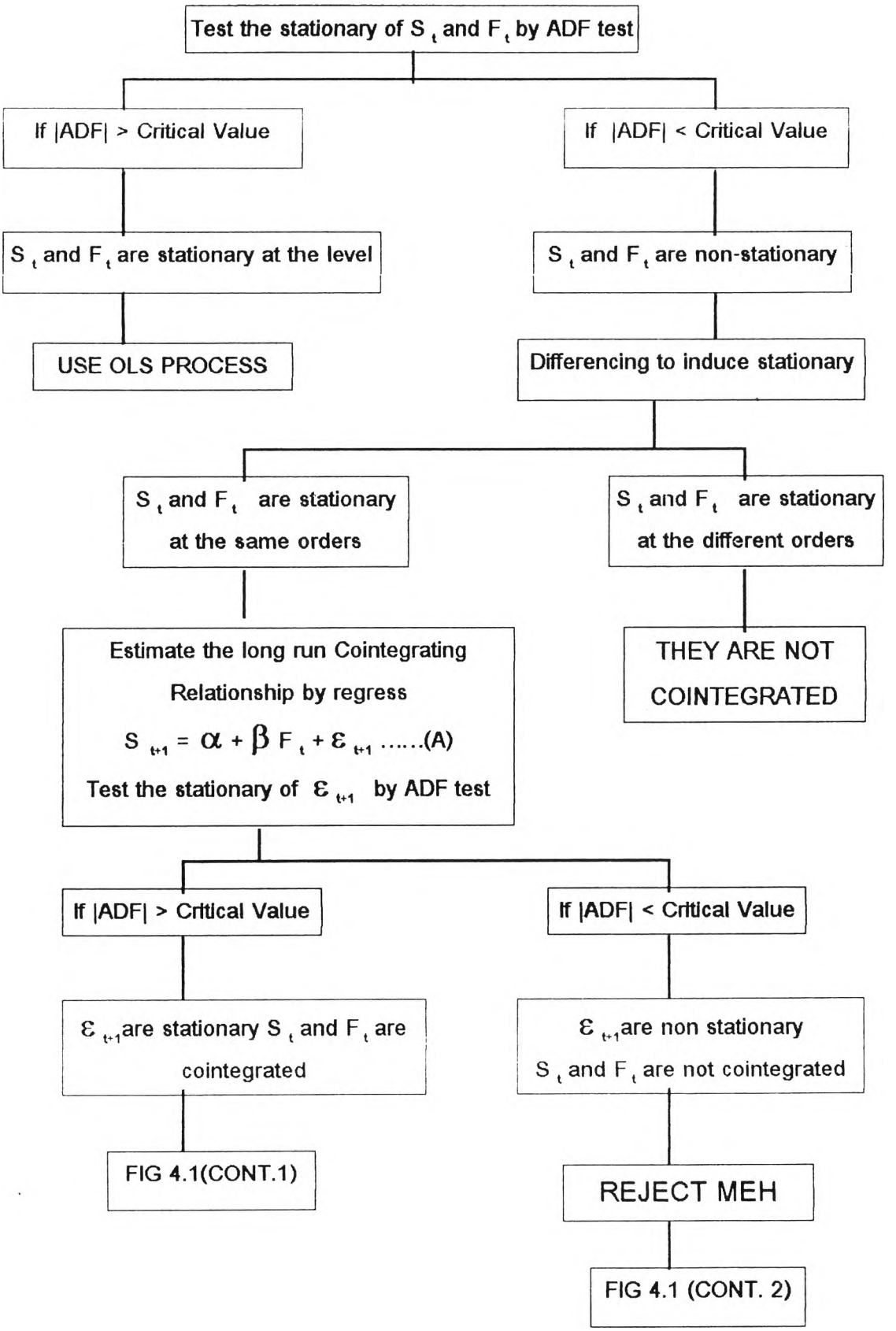

FIGURE 4.1 THE MARKET EFFICIENCY HYPOTHESIS (MEH) TESTS (CONTINUE 1)

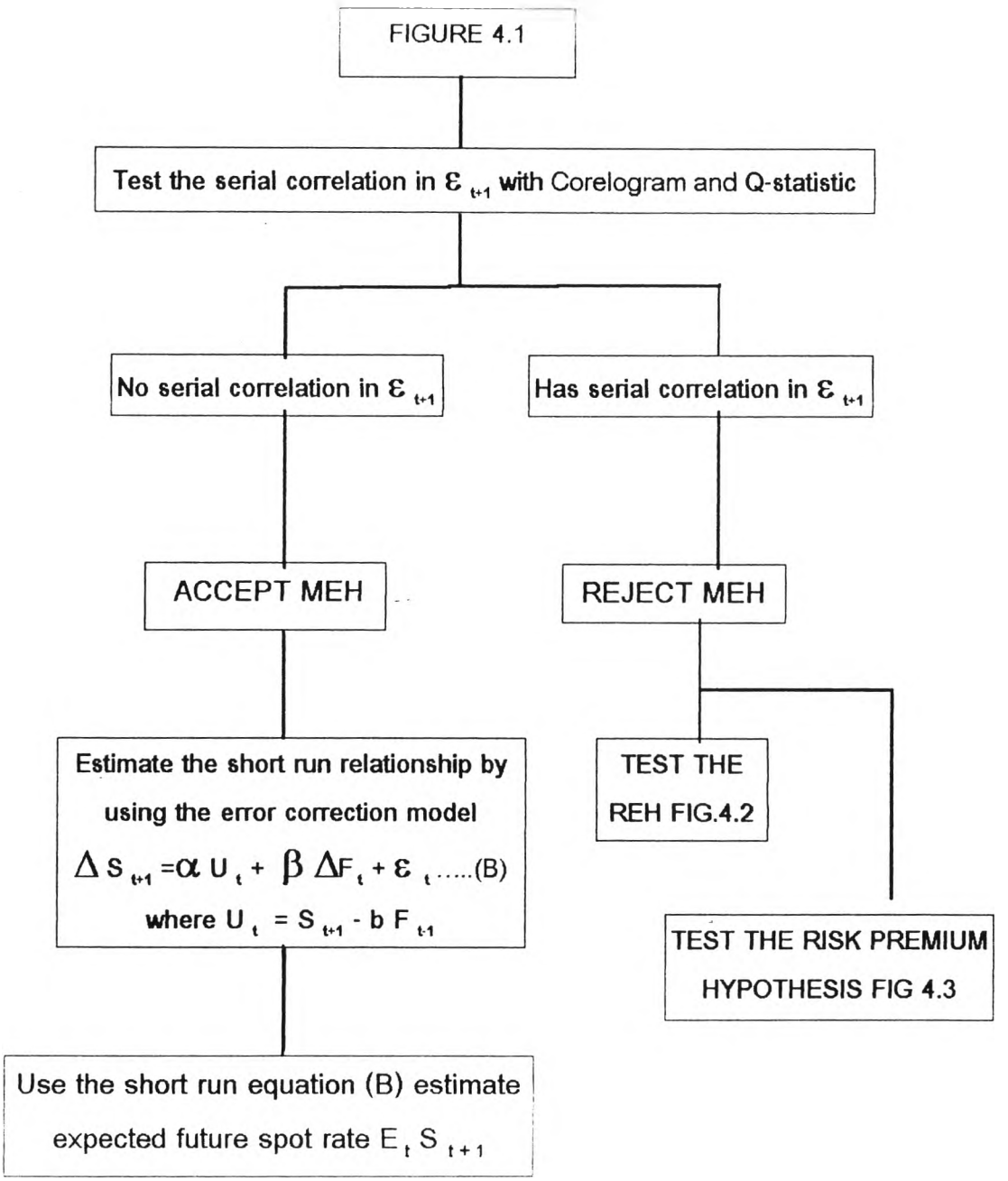

FIGURE 4.1 THE MARKET EFFICIENCY HYPOTHESIS (MEH) TESTS (CONTINUE 2)

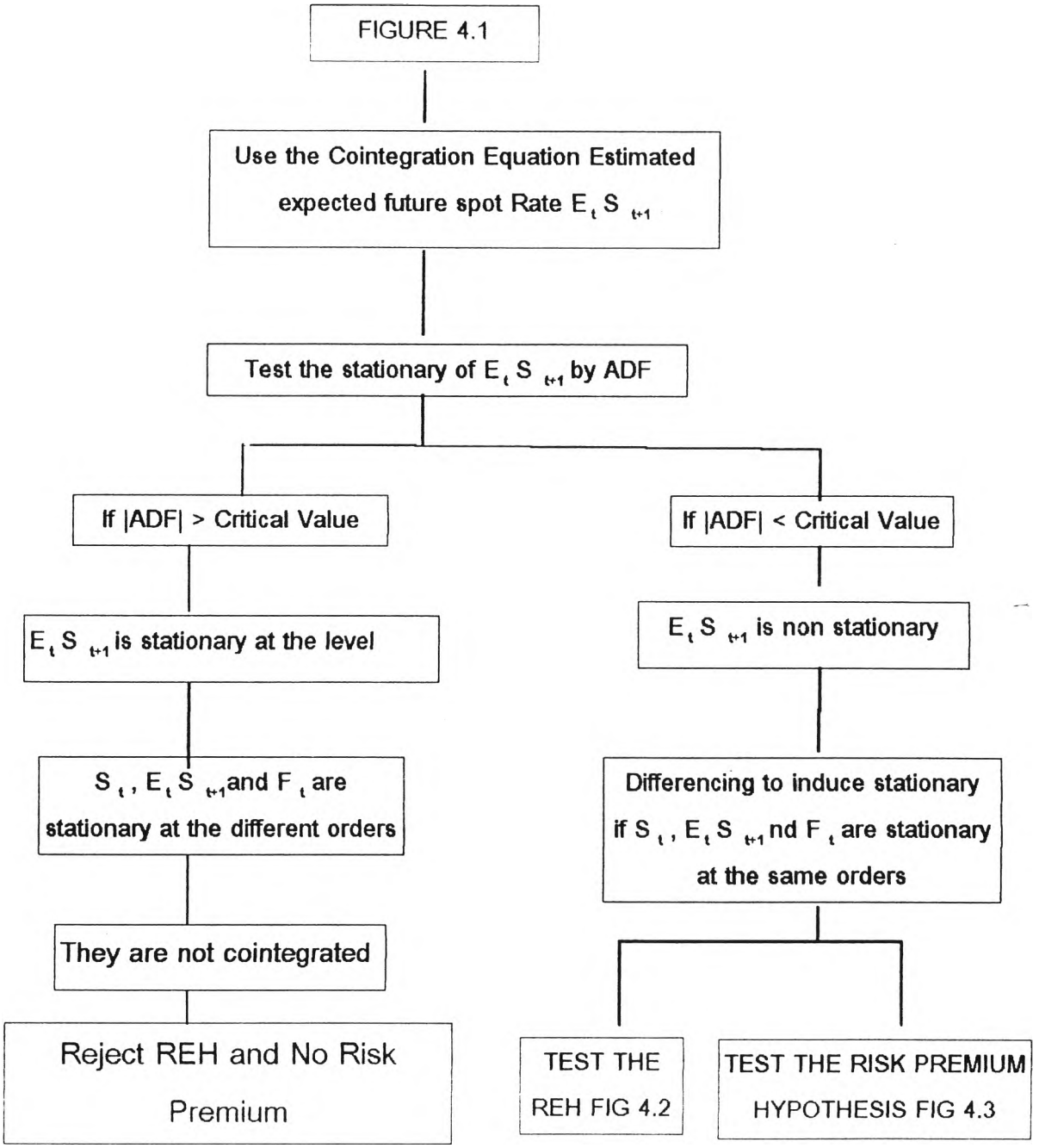

FIGURE 4.2 THE RATIONAL EXPECTATION HYPOTHESIS (REH) TESTS

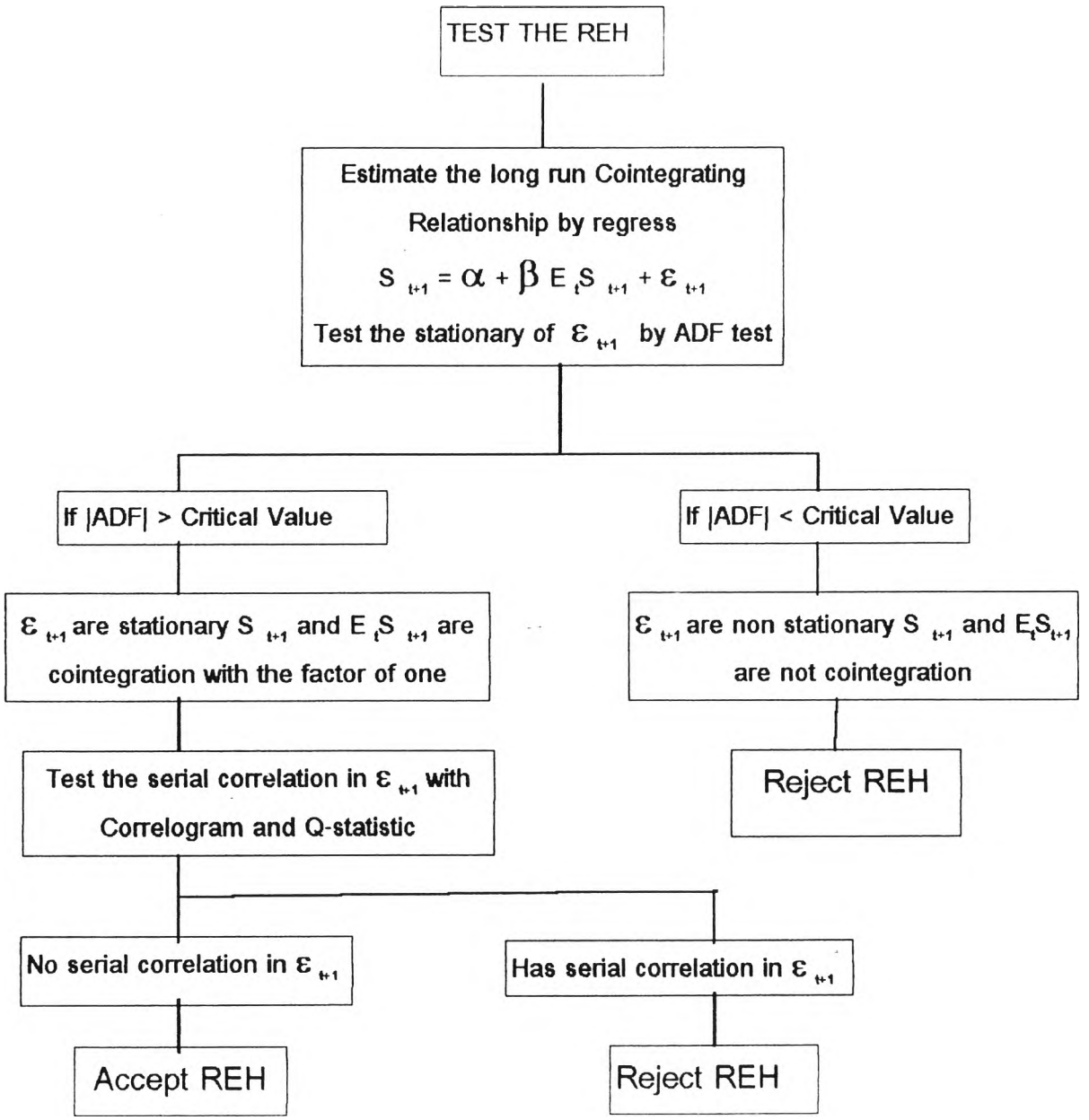

FIGURE 4.3 THE NO RISK PREMIUM HYPOTHESIS TESTS