Fisher hypothesis: East Asian evidence from panel unit root tests

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25 October 2007

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Abstract

This study finds evidence supportive of Fisher hypothesis in East Asian economies using panel unit root tests, which allow for cross-country variations in the estimation. Among others, one important implication is that monetary policy will be more effective in influencing long-term interest rates and long-run macroeconomic stability in these East Asian economies under regional collaboration.

1. Introduction

Irving Fisher hypothesized that there should be a long-run relationship in the adjustment of nominal interest rate corresponding to changes in expected inflation. If Fisher hypothesis holds, then short-term interest rates will be an efficient predictor of future inflation (Granville and Mallick, 2004). More importantly, monetary authority will then be able to influence the long-term interest yields to enhance long-run stabilization of macroeconomic policy in the country. Due to its importance, the hypothesis has been subjected to rigorous research. One commonly adopted method to scrutinize the hypothesis is to examine the stationarity of the real interest rates. In this respect, if the hypothesis holds, then the real interest rate should be stationary. Empirical findings

obtained from this approach are abundant but inconclusive thus far; see the works of Cooray (2003) and Johnson (2006) who provide excellence overview on the theoretical and empirical issues on Fisher effect and real interest rates.

One ready explanation of the contrasting evidence is the low power of conventional unit root tests with the relatively short span of data employed (Rapach and Wohar, 2002; Baharumshah *et al*. 2005). However, due to the unavailability of data, little study has been done to improve the power of test using longer span of data[1]. An alternative solution to circumvent the problem is to perform panel analysis, which allows the pooling of data. Besides, it has another advantage of allowing the consideration of cross-country financial markets interactions. Holmes (2002), for instance, demonstrates that by exploiting the cross-country variations of the data in estimation, panel analysis can yield higher test power than conventional unit root tests. Due to its potential usefulness, few researchers have adopted panel analysis in the study of stationarity of nominal interest rates (for instance, Wu and Chen, 2001) and real interest parity (Holmes, 2002; Baharumshah *et al*., 2005).

However, to the best of our knowledge, panel analysis is yet to be applied in the study of Fisher hypothesis. In the light of this, the current study takes up the testing of Fisher hypothesis using panel unit root tests. To accomplish this task, the stationarity of ten East Asian economies' real interest rates are examined. Baharumshah *et al*. (2005) have

[1] One exception is the recent work of Granville and Mallick (2004) who is able to provide evidence supportive of Fisher hypothesis by employing a century data covering from 1900 to 2000. In contrast, Rose (1988) is unable to find result in favor of the hypothesis using shorter span of data (1892 to 1970) for the US.

shown the interdependence of these real interest rates as a result of the increasing financial integration since the mid-1980s. As such, the stationarity of real interest rates in the context of East Asian economies in the presence of cross-country variations is an interesting topic for investigation.

2. Data and Methodology

This study analyses the stationarity of real interest rates of ten East Asian economies, namely China, Hong Kong, India, Indonesia, Malaysia, Singapore, South Korea, Taiwan, Thailand, and the Philippines. The sample data, which are obtained from the International Financial Statistics, Asian Development Bank (ADB) and Central Bank, spans from the first quarter of 2001 to the third quarter of 2006 (2001:Q1 to 2006:Q3). Two terms of interest rates are considered in this study: short-term and long-term. All long-term interest rates are proxied by 10-year government bond yield except Singapore (5-year). However, due to data availability, various short-term interest rates are considered: deposit rate (China), money market rate (India, Indonesia, South Korea, Taiwan and Thailand), 3-Months Treasury bill rate (Malaysia) and 90-day Treasury bill rate (Philippines). As for inflation rates, it is derived from the growth rates of consumer price indices. All data are in logarithmic form. The ex post real interest rate for each economy is obtained by subtracting the inflation rate from the nominal interest rate. For the Fisher hypothesis to hold, the resultant ex post real interest rate should be stationary. To serve this purpose, several panel unit root tests due to Maddala and Wu (1999), Breitung (2000), Choi (2001), Levin, Lin and Chu (2002), and Im, Pesaran, and Shin (2003) are adopted in this

study. Brief descriptions of panel unit roots methodologies can be found in Azali-Mohamed *et al*. (2001), Esaka (2003) and Baharumshah *et al*. (2005). For comparison purpose, the conventional univariate augmented Dickey-Fuller (ADF) and its improved version known as Generalized Least Squares Dickey-Fuller (DF-GLS, due to Ng and Perron, 2001) unit roots are included in this study.

3. Results

Table 1 summarizes the univariate unit root tests results for both short-term and long-term interest rates. It is clearly shown in the Column 2 of Table 1 that the null hypothesis of unit root cannot be rejected for all cases except Malaysia and Taiwan by the ADF test and the Philippines only by the DF-GLS test. This is implying that the Fisher hypothesis is only valid for Malaysia, Taiwan and Philippines. When the maturities term is extended to long-term, additional evidence in favor of Fisher hypothesis are obtained from China, Hong Kong, Indonesia, Singapore and South Korea (Column 3, Table 1).

[Insert Table 1 here]

The panel unit root tests results are presented in Table 2. It is observed from Column 2 of Table 2 that for the both the short- and long-term interest rates, the null hypothesis of nonstationarity can be rejected by the unit root tests by most of the tests at five percent significance level or better. Thus, it can be concluded that by incorporating cross-country variations, the East Asian real interest rates are stationary. This is in sharp contrast to the few stationary rates as suggested by univariate unit root tests, which do not allow for

regional interdependence of these real interest rates. This finding is consistent with Holmes (2002) who finds that panel unit root tests work better than univariate unit root tests in the case of real interest parity.

[Insert Table 2 here]

4. Conclusion

In general, long-run relationship in between nominal interest rates and inflation rates for all East Asian countries under investigation has been identified by the panel but not the univariate unit root tests. They key implications of this finding are: First, validity of Fisher hypothesis will be a good encouragement for the borrowers to make a more productive investment to promote a country's economy growth and develop better banking system (Pill and Pradhan, 1997). Second, the stationary finding of real interest rates provides convincing foundation for various capital asset pricing models (Johnson, 2006). Third, and perhaps more importantly, monetary policy can be used as an effective tool to influence long-term interest rates in these East Asian economies (Granville and Mallick, 2004). However, considering the fact that supportive evidence of Fisher hypothesis is only obtained when cross-country variations are incorporated in the estimation, it is expected that monetary policy will work better under regional collaboration.

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Table 1: ADF and DF-GLS Unit Root Tests Results

Column 1	Column 2		Column 3	
Economy	Short-Term		Long-Term	
	ADF	DF-GLS	ADF	DF-GLS
China	-1.9447(8) [T]	1.0247(8) [T]	-6.8532(7)** [T]	0.3616(8) [T]
Hong Kong	-1.8668(1) [T]	-2.1136(0) [T]	-3.1357(0)*	-1.0356(2)
Indonesia	-1.6247(3)	-1.6551(3)	-4.5121(0)**	-1.1940(2)
India	0.2860(7)	-1.4477(8)	-2.0140(7)	-1.0590(5)
Malaysia	-3.5352(6)** [T]	-2.4681(0) [T]	-2.7760(7)	-3.0077(7)**
Singapore	-1.4702(0) [T]	-1.5370(0) [T]	-2.4297(2)	-3.2315(0)**
South Korea	1.5329(5) [T]	-0.6587(8) [T]	-1.9749(0)	-2.0255(0)*
Thailand	0.9568(2) [T]	-0.6439(2) [T]	-2.9319(5)	-1.7184(2)
Taiwan	-3.5847(5)*	-1.0852(5)	-4.7515(1)** [T]	-4.9971(1)** [T]
The Philippines	-2.9433(0)	-2.0278(1)*	-2.6689(7) [T]	-2.7151(6) [T]
Critical Values (without trend)				
1%	-3.7529	-2.6693	-4.0044	-2.7406
5%	-2.9981	-1.9564	-3.0988	-1.9684
Critical Values (with trend)				
1%	-4.4163	-3.7700	-4.7283	-3.7700
5%	-3.6220	-3.1900	-3.7597	-3.1900

Notes: ** and * indicate the rejection of the null hypothesis of non-stationary at 1 and 5% significance levels respectively. The optimal lag lengths in ADF and DF-GLS tests are selected based on the AIC and Modified AIC respectively. [T] indicates the trend is included in the estimation.

Table 2: Panel Unit Root Tests Results

Column 1	Column 2	Column 3
Panel Unit Root Test[a]	Short-Term	Long-Term
	t-statistics [Probability]	*t*-statistics [Probability]
Levin, Lin & Chu (2002)	-0.5365 [0.2958]	-3.4870 [0.0002]**
Breitung (2000)	2.8271 [0.9977]	-0.3454 [0.3649]
Im, Pesaran and Shin (2003)	-3.4246 [0.0001]**	-2.8780 [0.0020]**
Maddala and Wu (1999)	34.9855 [0.0202]*	40.1678 [0.0048]**
Choi (2001)	58.1367 [0.0000]**	52.4616[0.0001]**

Note: [a] In all cases, trend and constant has been included in the estimation. ** and * denote the rejection of the null hypothesis of nonstationarity at 1 and 5% significance levels respectively.