Renminbi Arbitrage among Taiwan, Hong Kong and Mainland China

Kuo-chun YEH
National Taiwan University

Tai-kuang HO
National Taiwan University

Ya-chi LIN
Feng Chia University

1. Introduction

- On 31st of August 2012, Taiwan and mainland China signed an **MOU on Cross-Strait Currency Settlement Cooperation** (海峽兩岸貨幣清算合作備忘錄), which established the basic principles and cooperative framework of a currency clearing mechanism for the two sides of the Taiwan Strait.
- Since 1st of September 2014, Taiwan has established an **offshore RMB market** with exchange rates and interbank loan rates on the basis of the MOU.
- From now on **the RMB markets in the so-called Great Chinese Economic Area have been completed**.

1. Introduction

- Due to the close trade link with China, Taiwan accumulated 300 billion RMB deposit pool.

Selected RMB offshore Markets (bil. RMB)

	Hong Kong	Taiwan	Singapore	London	Seoul
Transaction share	71%	2.6%	5.1%	5.3%	2.8%
RMB deposit	851.1	319.4	225.0	20.0	30.2
RMB bond	68.7	31.2	12.7	10.0	-
RQFII	270	100	100	80	80
Currency swap	400	-	300	350	360

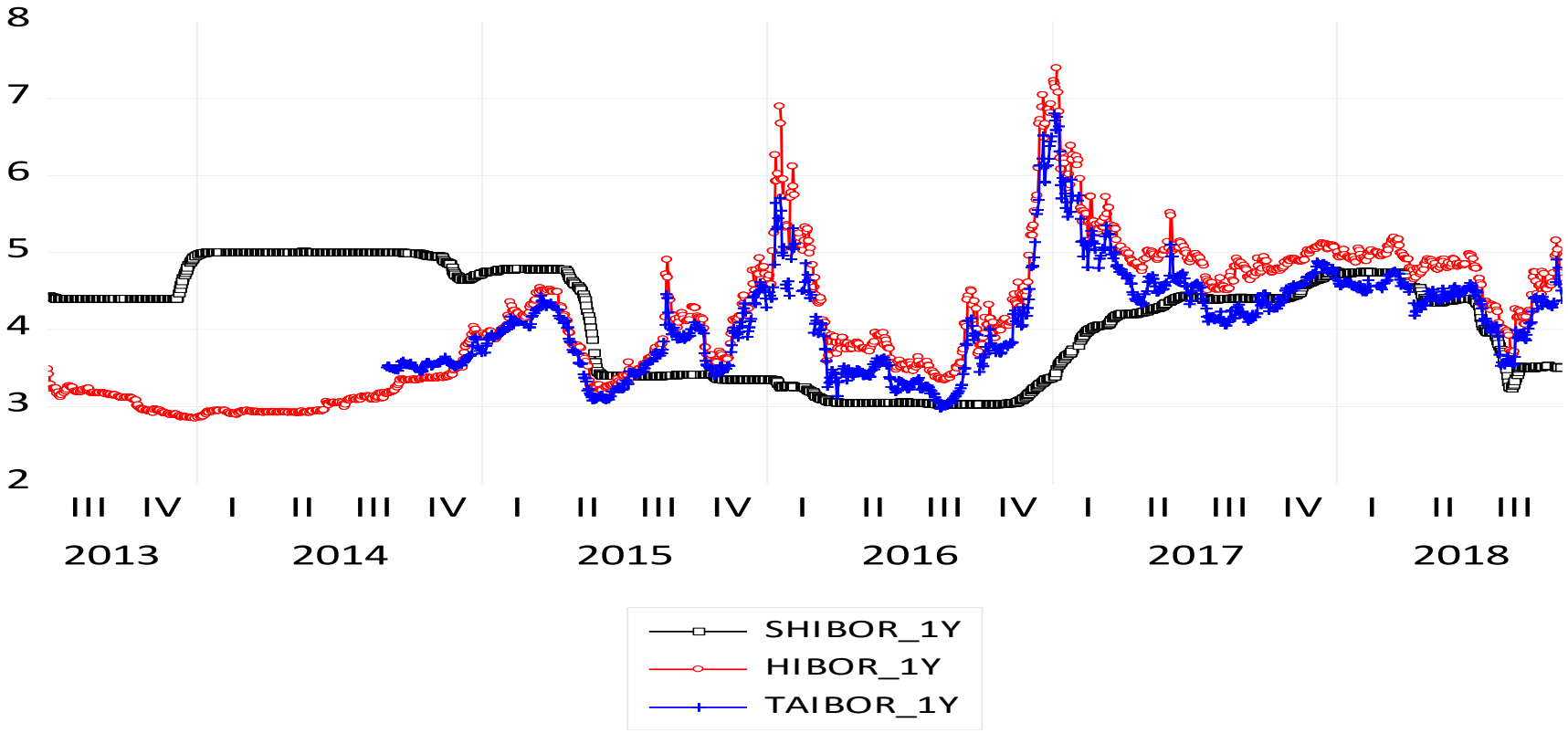
Source: SWIFT, central banks' information till 2015.

1. Introduction

- The established markets do not mean no arbitrage opportunities exist among the three markets. Although RMB internationalization should be an excellent opportunity for Taiwan's financial development, it also has been a national security concern since China's monetary policy can affect Taiwan's financial stability.
- Taiwan's political affairs, e.g., the 2016 Taiwan election, which lent support to independence, could reduce reliance on the Chinese economy. Postponing of the Cross-strait Service Trade Agreement has also impeded further financial development.

1. Introduction

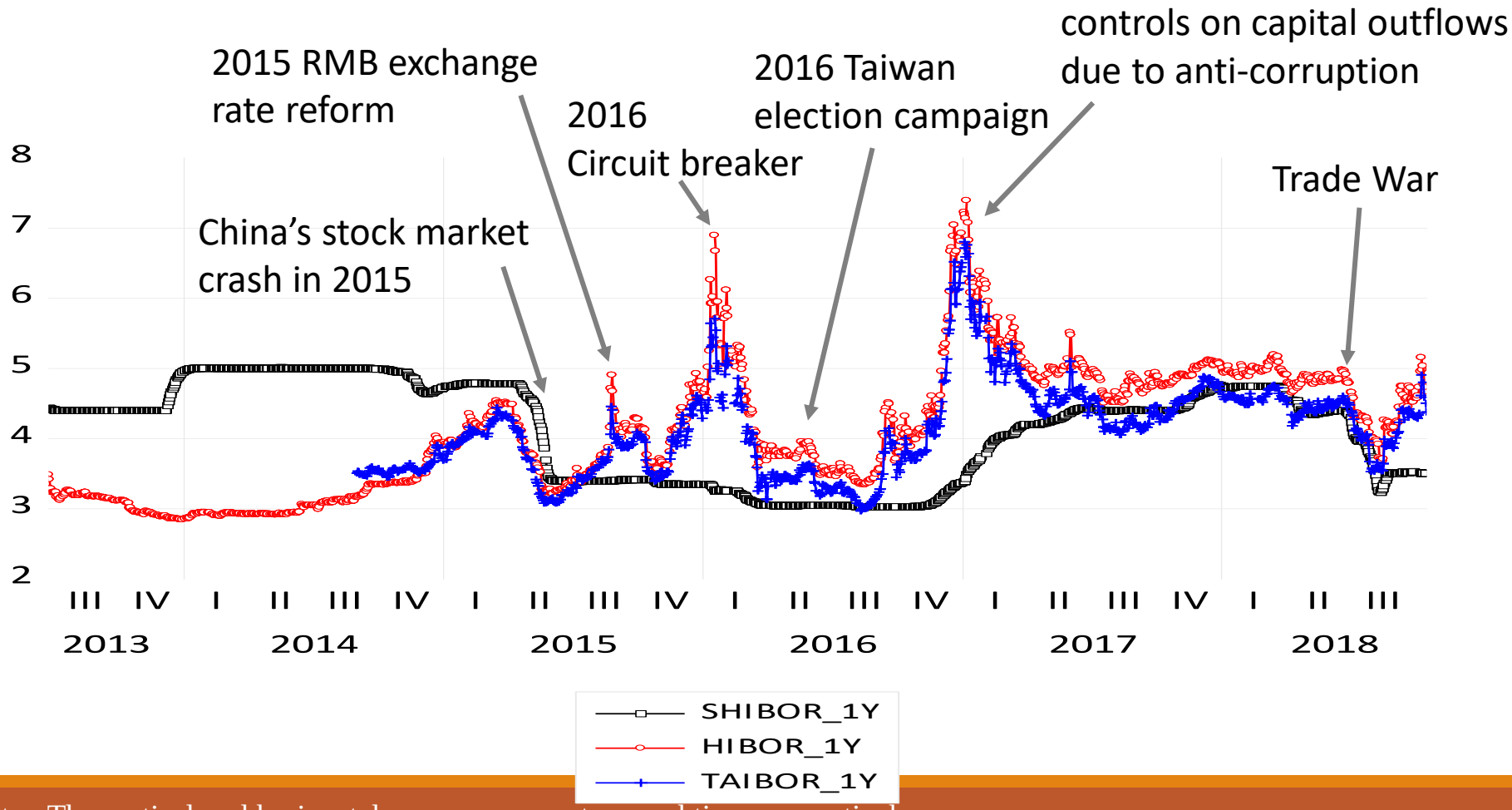
- It seems divergence of SHIBOR and the other two offshore RMB market. RMB arbitrage exists among offshore and onshore markets.



Note : The vertical and horizontal axes are percentage and time, respectively.
Source: WIND

1. Introduction

- It seems divergence of SHIBOR and the other two offshore RMB market. RMB arbitrage exists among offshore and onshore markets.



Note : The vertical and horizontal axes are percentage and time, respectively.
Source: WIND

1. Introduction

- According to the uncovered interest parity (UIP), RMB arbitrage remained means that the RMB markets return converge.
- Conventional approaches apply unit root test to investigate the convergence of returns. **But it has a few disadvantages:**
  - ✓ Rejecting the unit-root hypothesis does not imply that the RMB returns across countries converge to the same level, there still exists arbitrage opportunities for investors.
  - ✓ When the common factor is nonstationary, the return differentials may retain non-stationary characteristics.
- Our research apply sigma-convergence test (or log t test) (Phillips & Sul, 2007; Kong et al., 2019), which investigates the variance convergence of the cross-sectional returns over time.

1. Introduction

The research questions of this paper are as follows:

1. Is RMB arbitrage remained among the RMB markets in Great Chinese Economic Area?
   - ✓ We use the log t test by Phillips & Sul (2007) to provide a more precise determination for convergence of the RMB markets.
2. How the political and economic shocks since 2014 impact on the RMB market return?
3. Does there exist club convergence among the RMB markets?

2. The Model

- With risk-averse investors, the hold of uncovered interest parity (UIP)

$$i_{j,t} - i_t^* = E_t(s_{j,t+1} - s_{j,t}) + \omega_{j,t+1}$$

$r_t^e = i_t - E_t \Delta s_{t+1}$ is the return for investors.

- The relationship among the three RMB markets is as follows:

$$r^e_{CNY,t} - \omega_{CNY,t+1} = r^e_{CNH,t} - \omega_{CNH,t+1} = r^e_{CNT,t} - \omega_{CNT,t+1}$$

- If investors are risk neutral,

$$r^e_{CNY,t} = r^e_{CNH,t} = r^e_{CNT,t}$$

3. The log t Test

- This paper applies the sigma-convergence test of Phillips and Sul (2007) to examine the convergence of return.
- Assume that the return is composed into systematic risk and idiosyncratic risk.

$$r_{jt} = a_{jt} + \lambda_{jt}\mu_t ,$$

- To separate the common component from idiosyncratic components, the return is re-written as:

$$r_{jt} = \left(\frac{a_{jt}}{\mu_t} + \lambda_{jt} \right) \mu_t = b_{jt}\mu_t ,$$

- To examine the joint hypothesis of return convergence,

$$H_0 : b_{j,t} \to b \quad \text{for all } j$$
$$H_A : b_{j,t} \not\to b \quad \text{for some } j$$

3. The log t Test

- The common factor could be removed by dividing the cross-section mean of returns.

$$h_{it} = \frac{r_{it}}{N^{-1}\sum_{i=1}^{N} r_{it}} = \frac{b_{it}}{N^{-1}\sum_{i=1}^{N} b_{it}}$$

- The cross-sectional variance is derived by $\mathrm{H_t} = \mathrm{N^{-1}}\sum_{\mathrm{i=1}}^{\mathrm{N}}\left(\mathrm{h_{it}} - 1\right)^2$
- The convergence test provided by Phillips and Sul (2007) is also called the sigma-convergence test.

$$\log\frac{H_1}{H_t} - 2\log\left(\log t\right) = \beta_0 + \beta_1 \log t + u_t \qquad t = T_0, \ldots, T$$

$$T_0 = [cT] \text{ for some } c > 0$$

If $\beta_1 < 0$, the long-run convergence of returns is rejected.

4. Empirical Results

- Conventional unit root and co-integration Tests of r_{CNY}, r_{CNH} and r_{CNT}

	1-month	3-month	6-month	1-year
Augmented Dickey–Fuller test				
r_{CNY} (since Oct.16, 2006)	-2.27	-0.66	0.93	-0.85
r_{CNH} (since Jun.24, 2013)	2.29	1.37	1.39	0.60
r_{CNT} (since Sep.01, 2014)	1.02	1.43	1.09	0.92
Co-integration test [2]				
Trace	0.10 ***	0.06	0.06	0.05
Maximum Eigenvalue	0.10 ***	0.06	0.06	0.05
Granger causality test				
$r_{CNK} \nrightarrow r_{CNY}$	0.76	0.13	0.04	0.26
$r_{CNT} \nrightarrow r_{CNY}$	0.50	0.05	0.01	0.25
$r_{CNY} \nrightarrow r_{CNH}$	5.58 *	5.22 *	3.04	2.92
$r_{CNT} \nrightarrow r_{CNH}$	19.87 ***	6.87 **	5.35*	0.77
$r_{CNY} \nrightarrow r_{CNT}$	3.65	4.28	4.40	9.73
$r_{CNH} \nrightarrow r_{CNT}$	5.97 *	2.08	21.19***	37.43

Note:
1. *, **, *** imply significance at the 10%, 5%, 1% level, respectively.
2. The Johansen co-integration test statistics is based on the hypothesis of zero cointegration equation.

4. Empirical Results

The log t Tests of r_{CNY}, r_{CNH} and r_{CNT}

	2014/09/01 ~2017/12/20		2014/09/01 ~2015/6/30		2014/09/01 ~2016/5/20	
C	ξ_1	(t-stat.)	ξ_1	(t-stat.)	ξ_1	(t-stat.)
0.20	-0.94	(-3.62)	1.34	(55.41)	-1.65	(-6.68)
0.21	-0.89	(-4.27)	1.37	(63.93)	-1.78	(-6.74)
0.22	-0.82	(-7.22)	1.40	(73.70)	-1.95	(-6.83)
0.23	-0.68	(-8.07)	1.43	(84.78)	-2.09	(-6.93)
0.24	-0.48	(-0.99)	1.48	(103.67)	-2.27	(-7.08)
0.25	-0.25	(-0.30)	1.51	(117.34)	-2.43	(-7.23)
0.26	0.04	(0.04)	1.54	(131.15)	-2.63	(-7.47)
0.27	0.31	(0.44)	1.57	(144.12)	-2.79	(-7.72)
0.28	0.53	(0.93)	1.60	(155.07)	-3.01	(-8.10)
0.29	0.75	(1.76)	1.63	(162.80)	-3.19	(-8.49)
0.30	0.94	(2.86)	1.68	(163.81)	-3.42	(-9.12)

4. Empirical Results

- Club Convergence

	log *t*	t-stat.	Countries or Regions
2014/09/01~2016/5/20			
Club convergence	--	--	None
Independent trend	--	--	CNY, CNH, CNT

4. Empirical Results

- We are also interested in the impact of US and global factors on RBM markets.

The log t Tests of r_{CNY}, r_{CNH}, r_{CNT}, r_{LIBOR}, and TBR return

	2014/09/01 ~2017/12/20		2014/09/01 ~2015/6/30		2014/09/01 ~2016/5/20	
C	ξ_1	(t-stat.)	ξ_1	(t-stat.)	ξ_1	(t-stat.)
0.20	0.15	(3.10)	-0.27	(-34.99)	-0.01	(-2.03)
0.21	0.16	(3.12)	-0.26	(-38.28)	-0.01	(-1.52)
0.22	0.16	(3.14)	-0.26	(-41.82)	0.00	(0.14)
0.23	0.17	(3.17)	-0.25	(-45.60)	0.01	(5.18)
0.24	0.17	(3.21)	-0.25	(-51.67)	0.01	(7.75)
0.25	0.18	(3.24)	-0.24	(-55.95)	0.02	(5.91)
0.26	0.18	(3.29)	-0.24	(-60.37)	0.02	(4.72)
0.27	0.19	(3.34)	-0.24	(-64.89)	0.03	(4.16)
0.28	0.19	(3.38)	-0.23	(-69.43)	0.03	(3.72)
0.29	0.20	(3.43)	-0.23	(-73.94)	0.04	(3.51)
0.30	0.20	(3.48)	-0.22	(-80.45)	0.04	(3.36)

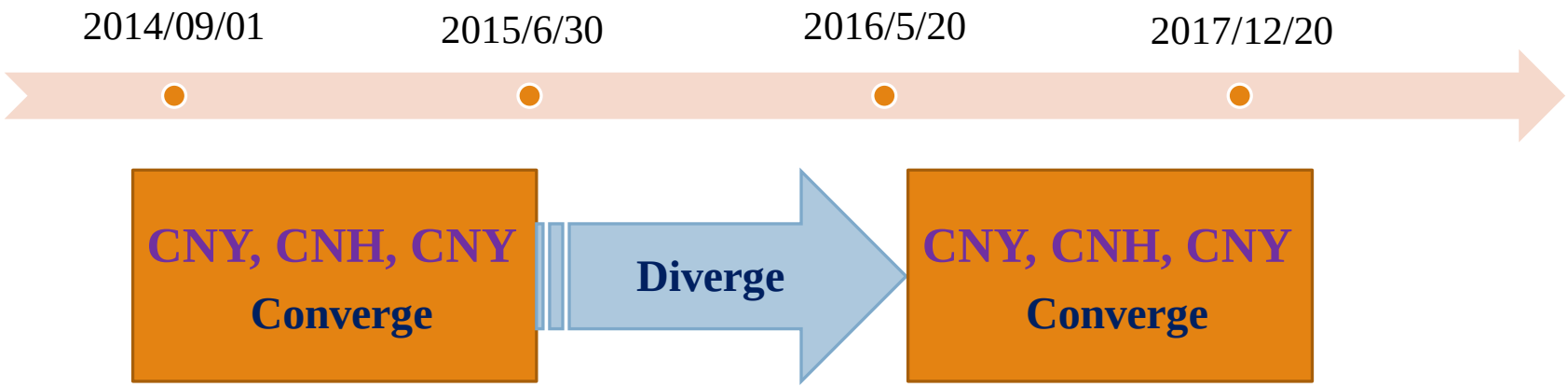
4. Empirical Results

- Club Convergence

	log *t*	t-stat.	Countries or Regions
2014/09/01~2015/6/30			
Club convergence	1.43	(84.78)	CNY, CNH, CNT
Independent trends	--	--	LIBOR, TBR

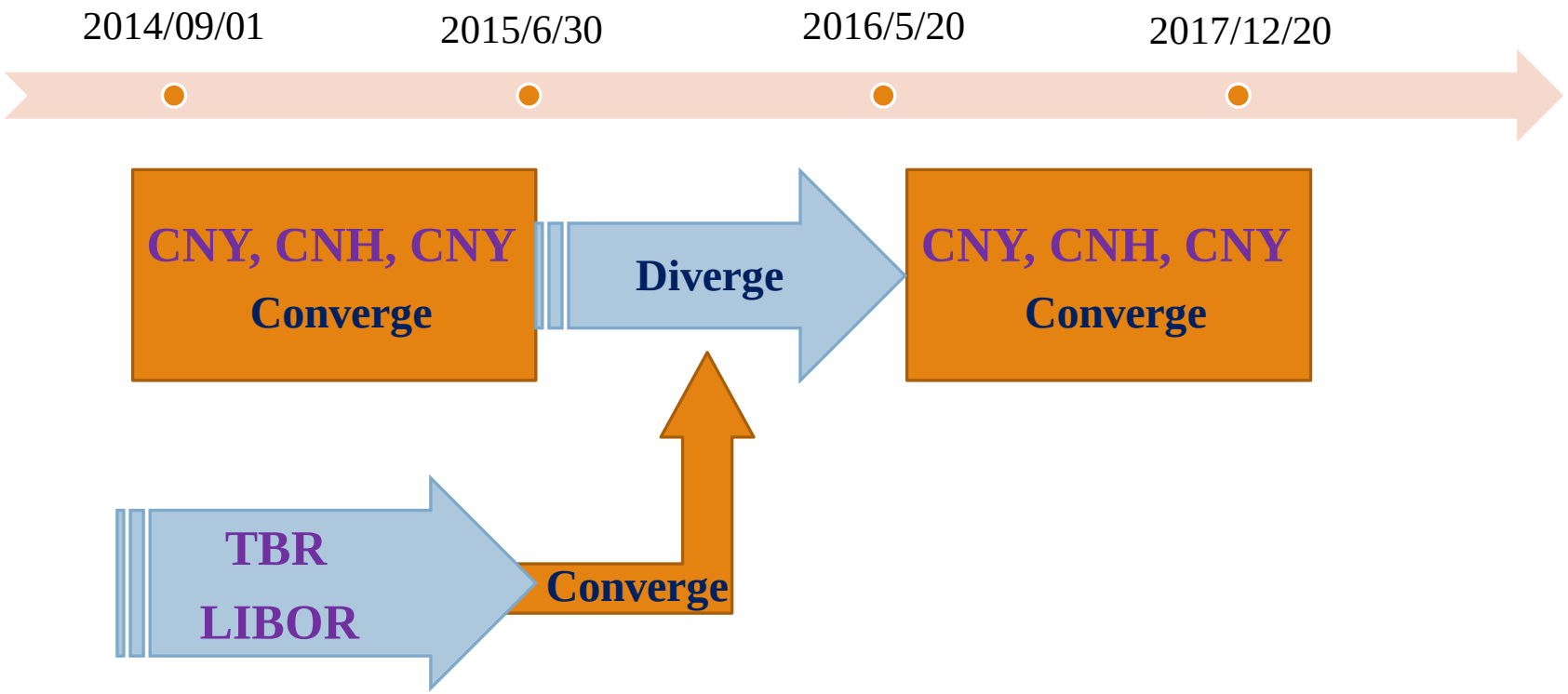
4. Empirical Results

- Summary and Policy Implications



4. Empirical Results

- Summary and Policy Implications

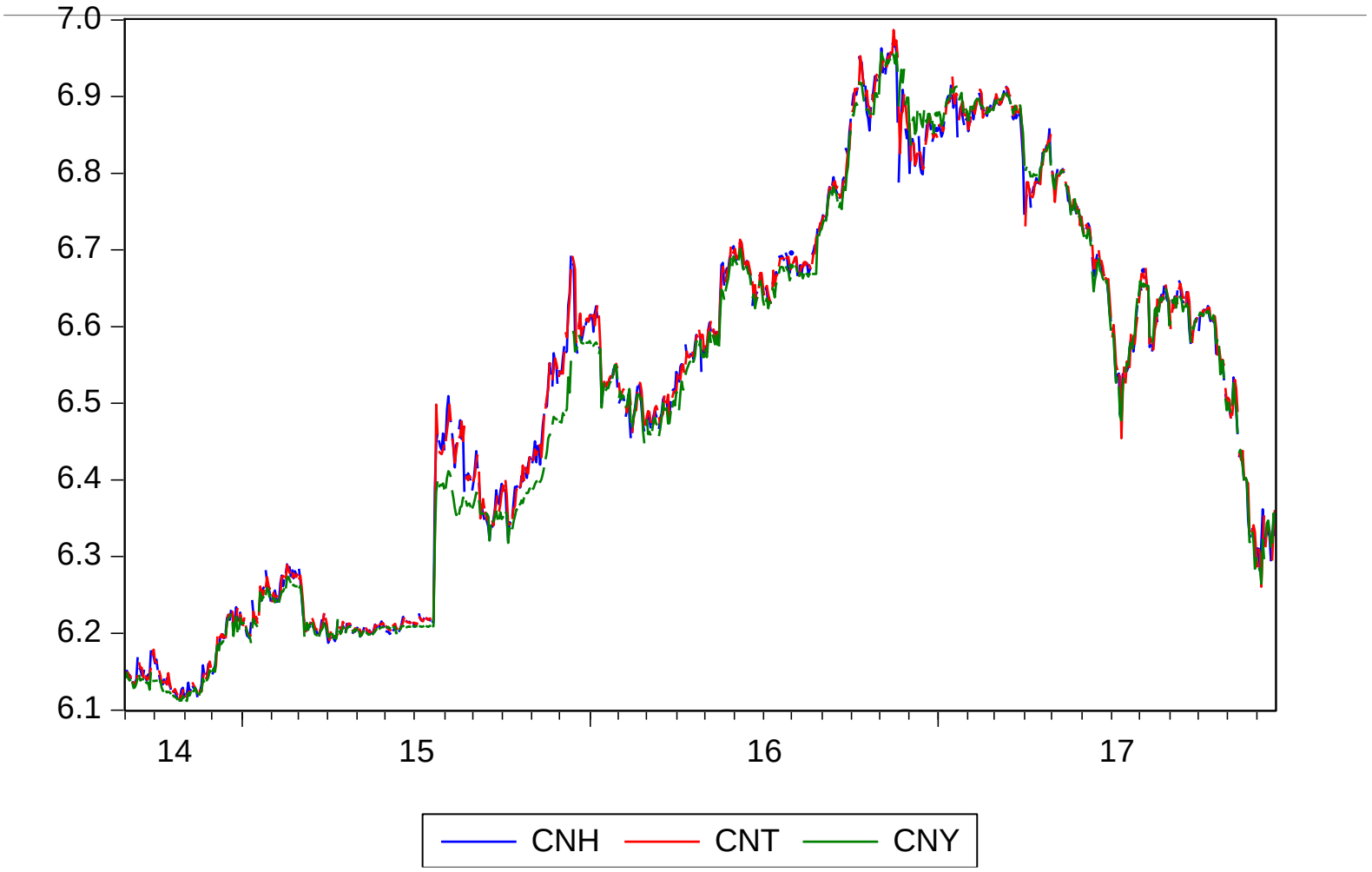


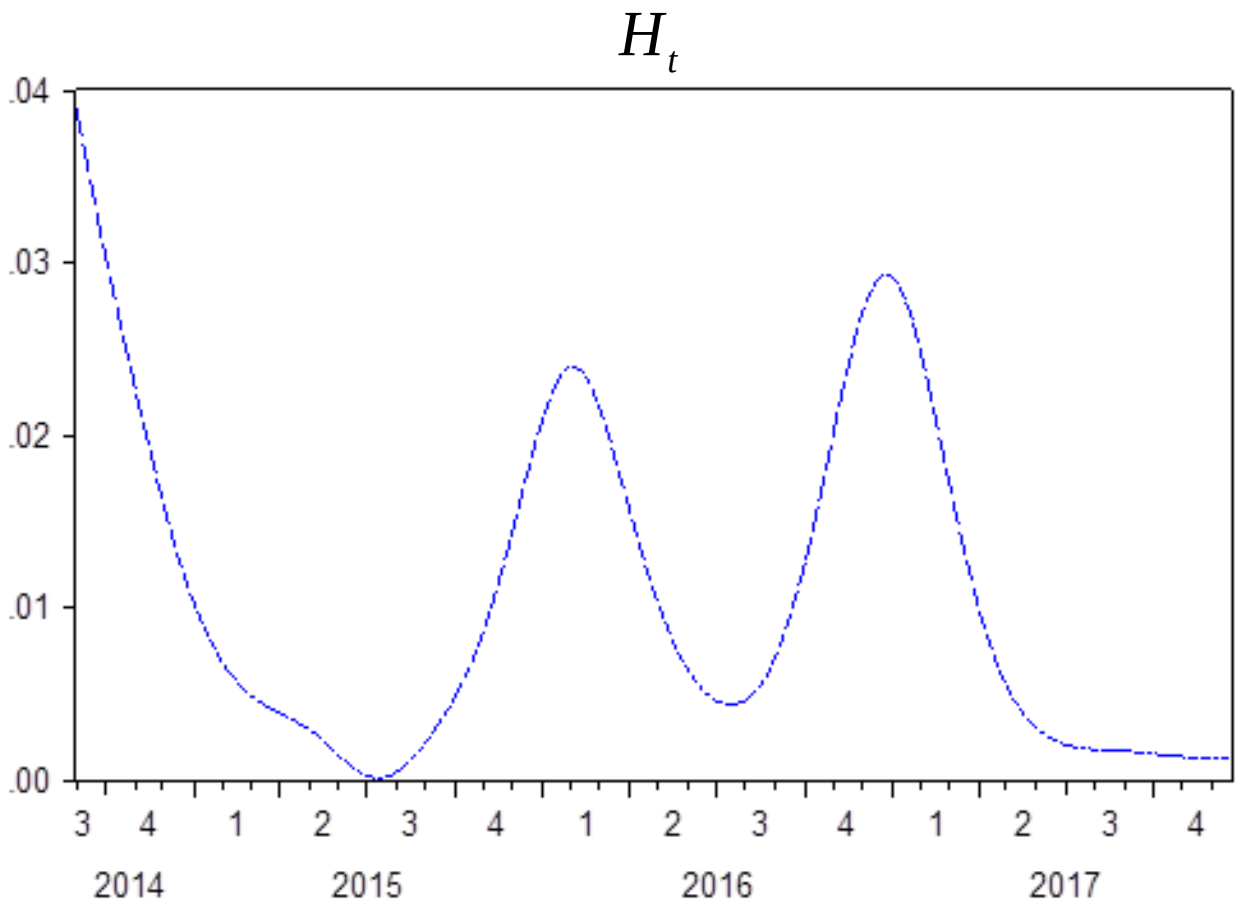
IMF Working Papers (Arslanalp, 2016): China's influence on regional markets is not yet to the level of the United States.

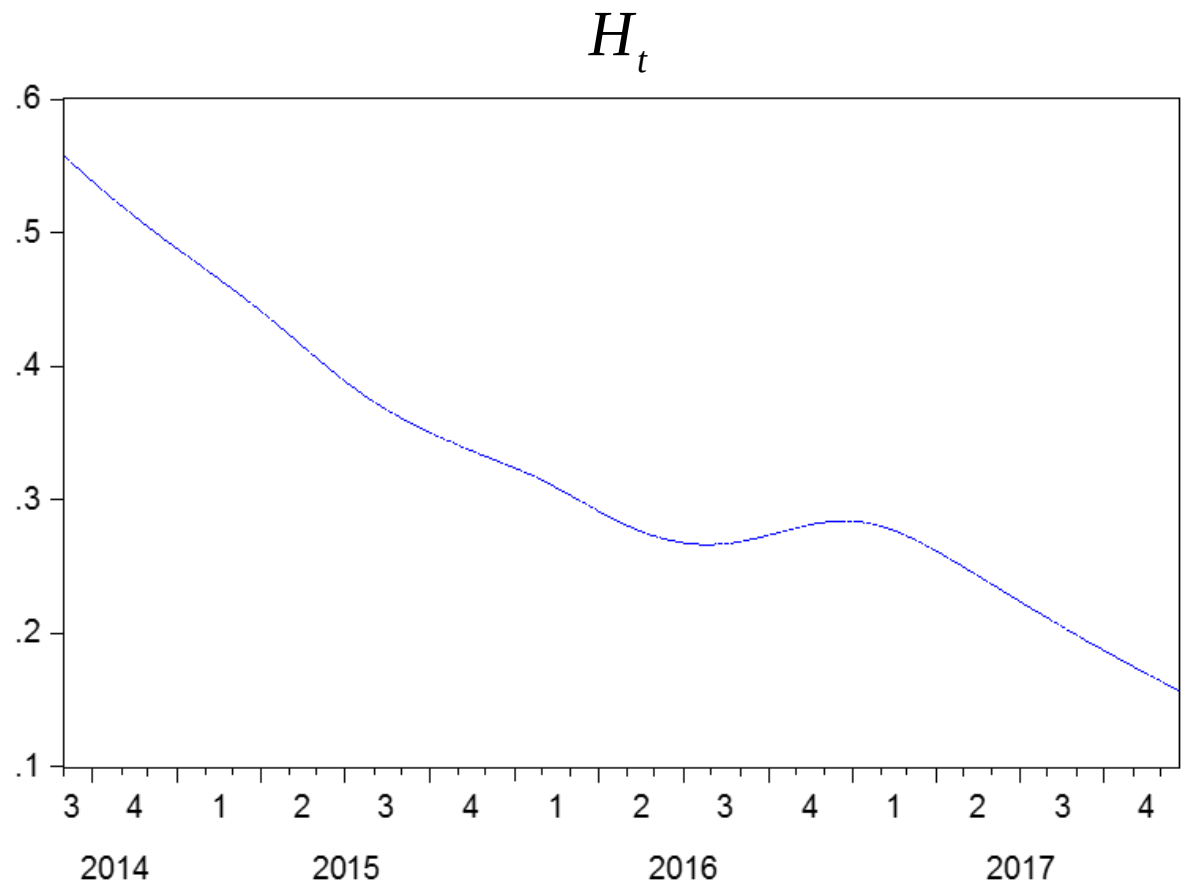
5. Conclusion

- Since there is unit root in r_{CNY}, r_{CNH} and r_{CNT} , the sigma convergence test is more suitable than conventional unit root test.
- Before China's stock market crash in 2015, RMB return converge in the three RMB markets. After then, mainland China's impacts on the Great Chinese Economic Area weakened.
- After the global financial risk, US recover it's impact on the RMB markets.

Thank You for Your Attention.


7.0
6.9
6.8
6.7
6.6
6.5
6.4
6.3
6.2
6.1
14
15
16
17
CNH
CNT
CNY


H_t
.04
.03
.02
.01
.00
3 4 1 2 3 4 1 2 3 4 1 2 3 4
2014
2015
2016
2017


H_t
.6
.5
.4
.3
.2
.1
3 4 1 2 3 4 1 2 3 4 1 2 3 4
2014
2015
2016
2017