Investigating real interest parity using Wavelet analysis

Paper presented at the ESSA conference, 7-9 September 2009, Port Elizabeth

by

Quinton Morris &
Andrea Saayman

School ECONOMICS

Agenda

- Introduction
- Real interest parity
- Empirical investigation
  - Data
  - Method = Wavelet analysis
  - Results
- Concluding remarks

School ECONOMICS

Introduction

- Link between exchange rate, inflation rate and the interest rate
  - Adaptive expectations
  - Fisher closed condition
  - International Fisher effect
- Arbitrage should equalise real interest rates worldwide = real interest parity (RIP) condition
  - If not – monetary policy and portfolio diversification = more effective
  - If – high degree of market integration

School ECONOMICS

Does real interest parity hold?

- First OLS estimates failed to proof RIP – Chumby & Obstfeld (1984), Mishkin (1984), Mark (1985)
- Recent research investigate the unit root properties of the real interest differential
  - Random walk or mean reverting (convergence)?
  - Moosa & Bhatti (1996) show mean reversion (industrialised countries)
  - Singh & Banerjee (2006) find no mean reversion (emerging economies)
- We investigate the properties of the real interest rates and RIP for SA and the USA

School ECONOMICS

Real Interest Parity

- Real interest parity is derived from PPP, UIP and the Fisher parity relationship.
- Purchasing Power Parity: $\Delta s_t^e = \pi_t^e - \pi_t^{*e}$
- Uncovered interest parity: $\Delta s_t^e = i_t - i_t^*$
- Fisher parity: $i_t = r_t^e + \pi_t^e$

$$i_t - i_t^* = \pi_t^e - \pi_t^{*e}$$

$$r_t^e = r_t^{*e}$$

$$RIRD_t = r_t^e - r_t^{*e}$$

School ECONOMICS

Empirical investigation

- Moosa & Bhatti (1996) criticized against previous research techniques
- Various new techniques followed:
  - Fractional integration
  - Grid bootstrap
  - Median unbiased estimation
- We use Wavelet analysis
- Assume static expectations for *ex ante* analysis
- Realised inflation used in *ex post* analysis

Variable	Description	Source
st i	TB rate	IFS
lt i	G-bond yield	SARB
π	Inflation rate	SARB
st i*	3month c paper	IFS
lt i*	G-bond yield	IFS
π*	Inflation rate	US Bureau Labor Stats

School ECONOMICS

Wavelet Analysis

- Fourier analysis – trigonometric functions
- Wavelet analysis – "small wave"
- "zooming" function – local behaviour
- Father Wavelet - smooth low frequency behaviour.
- Mother Wavelet - high frequency behaviour.

Wavelet Analysis

- HAAR - Alfred Haar (1909), discontinuity property
- DAUBLETS – smooth Wavelet, vanishing moments
- SYMMLETS & COIFLETS - least asymmetrical

Wavelet Analysis

Estimating **d** (difference parameter):

- Hosking (1981) - fractional value
- Jensen (1999) - Wavelet Ordinary Least Squared (WOLS):
  - ➢ Wavelet coefficients ~ $N\left(0, \sigma^2 \cdot 2^{-2jd}\right)$

$$R(j) = \sigma^2 2^{-2jd}$$

$$\ln R(j) = \ln \sigma^2 - d \ln 2^{2j}$$

- ➢ Ordinary least squares method

Wavelet Analysis

d	Mean (trend) & variance	Shock duration
d=0	Short-run mean-reversion Finite variance	Short-lived
0<d<1/2	Long-run mean-reversion Finite variance	Long-lived
1/2<d<1	Long-run mean-reversion Infinite variance	Long-lived
d=1	No mean-reversion Infinite variance	Infinite
d>1	No mean-reversion Infinite variance	Infinite: effect increases with time

Results

Variable	Haar	Daubechies 4	Daubechies 12	Daubechies 20
kt *ex post* r	0.564	0.605	0.719	0.674
kt *ex ante* r	0.531	0.571	0.665	0.611
kt *ex post* r*	0.97	0.957	1	1.038
kt *ex ante* r*	0.985	0.94	1.028	1.037
kt *ex post* diff	0.687	0.595	0.583	0.637
kt *ex ante* diff	0.672	0.564	0.525	0.565
lt *ex post* r	0.601	0.398#	0.592	0.568
lt *ex ante* r	0.6	0.394	0.587	0.557
lt *ex post* r*	0.732	0.782	0.797	0.76
lt *ex ante* r*	0.71	0.756	0.783	0.733
lt *ex post* diff	0.69	0.454	0.042#	0.492#
lt *ex ante* diff	0.69	0.446#	0.109#	0.475#

#Do not reject H_0: d = 0.

Results

Variable	Haar	Daubechies 4	Daubechies 12	Daubechies 20
kt *ex post* r	0.719	0.677	0.751	0.756
kt *ex ante* r	0.606	0.604	0.698	0.712
kt *ex post* r*	0.835	0.374#	-0.217#	0.632
kt *ex ante* r*	0.813	0.444#	0.235#	0.673
kt *ex post* diff	0.432#	0.644	0.711	0.7
kt *ex ante* diff	0.350#	0.567	0.658	0.653
lt *ex post* r	0.77	0.829	0.881	0.87
lt *ex ante* r	0.687	0.797	0.863	0.874
lt *ex post* r*	0.711	0.641	0.636	0.628
lt *ex ante* r*	0.705	0.646	0.654	0.664
lt *ex post* diff	0.636	0.73	0.811	0.803
lt *ex ante* diff	0.553	0.68	0.775	0.785

#Do not reject H_0: d = 0.

Results

- Therefore:
  - Similar to Singh & Banerjee (2006) – limited support for convergence using short-term interest rates
  - Market integration between USA and SA during 1994-2004 caused convergence in long-term interest rates
  - Support Sekioua (2008) that convergence more likely for long-term interest rate differential
  - Including 2008 and 2007 leads to rejection of market integration – might be atypical period?
  - Not much difference between *ex ante* and *ex post* analyses

Conclusion

- This paper expands on the existing real interest parity literature between an emerging economy and a developed economy.
- We found support for real interest convergence between long run real interest rates of the US and RSA (1994 – 2004).
- The Haar Wavelet provided support for short term real interest rates convergence between 1997 - 2008.
- Short and long term real interest rates in South Africa tend to be mean reverting in the long run, but with long memory.

School ECONOMICS

Thank You

School ECONOMICS