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Inflation Targeting and Inflation Persistence in Asia-Pacific

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Abstract

Following the Asian financial crisis in 1997-98, a number of Asian central banks adopted inflation targeting. While it is possible for the average inflation rate to be close to target, deviations of inflation could nevertheless be large and protracted. We therefore explore how successful this framework has been by looking at the persistence of inflation, as measured by the sum of the coefficients in an autoregressive model for inflation, using a median unbiased estimator and bootstrapped confidence bands. We find a significant reduction in inflation persistence following the adoption of inflation targeting. The speed by which persistence falls varies across countries. Interestingly, the economies not adopting inflation targeting do not show a decline in persistence. Measuring the performance of monetary policy strategies in terms of inflation persistence rather than the level of inflation shows that inflation targeting performs better than alternative strategies.

Keywords: Inflation Targeting, Asia, Inflation Persistence, Monetary Policy Strategy

JEL Classification: C22, E31, E5

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1. Introduction

Asian economies have historically experienced relatively low and stable inflation rates (Gerlach et al. 2009). Nevertheless, in recent years a number of Asian central banks have adopted monetary policy frameworks involving explicit inflation targeting (IT) (Filardo and Genberg 2009). This policy choice reflects the same consideration that led to the introduction of IT in many advanced economies, including Sweden and the United Kingdom: the need to introduce a new anchor for monetary policy following the abandonment of a fixed exchange rate regime. Thus, after the Asian financial crisis in 1997-98, Korea introduced IT in 1998, Indonesia and Thailand in 2000, and the Philippines in 2002 (Ito and Hayashi 2004).[1]

In this paper we explore how successful these policy choices have been, looking at data from economies with and without IT in a sample of economies in Asia-Pacific. The literature is ambiguous about the effects of IT in emerging economies. While Goncalves and Salles (2008) and Lin and Ye (2009) find a significant decline in inflation after the adoption of IT, Brito and Bystedt (2010) do not. To better understand this controversy, we study an alternative measure of performance. While it seems natural to judge success by computing the average inflation and its variance since the adoption of the inflation target, it is possible for the average inflation rate to be close to target, but deviations of inflation may nevertheless be large and protracted. Thus, the persistence of shocks to inflation matters also at low levels of inflation. We therefore use an alternative metric of success and study how persistent shocks to inflation are. The intuition is straightforward: deviations of inflation from target will be temporary if the central bank is effective in stablising inflation. In fact, a number of authors have argued that the persistence of inflation has fallen in many industrial countries in recent years, and have suggested that this is due to the greater focus on inflation stabilisation by central banks (Pagan 2003, Levin and Piger 2006 and Benati 2008).

Before proceeding, we emphasise that while IT typically has involved an increase in the weight attached to stabilising inflation in the countries that have adopted it, *any* monetary policy strategy that attaches primary importance to price stability is likely to lead to a low level of inflation persistence.[2] Monetary policy makers in both Japan and Singapore (and, outside Asia, in the euro area and in Switzerland) have established long track records of tight inflation control and might therefore not have felt it necessary to adopt IT, yet conduct policy in much the same way as policy makers using explicit IT.[3] The formal adoption of IT is neither a necessary condition for a drop in inflation persistence nor does it guarantee a drop in persistence. For example, one could view Singapore as an inflation targeter that uses the

[1] See Mishkin (2000) for an early contribution on the advantages and disadvantages of IT as a monetary policy strategies in emerging market economies.

[2] See Walsh (2009) for a similar point.

[3] Of course, the ECB was established only in 1999, but adopted key parts of the monetary policy framework of the Bundesbank, which had a long history of inflation control.

exchange rate as its instrument to control inflation. Other countries might claim to target inflation but do not appear to have reduced the persistence of inflation. In fact, we will evaluate whether the drop in inflation persistence, if any, is unique to IT regimes.

The paper is organised as follows. Section two briefly reviews the literature on the role of IT for inflation persistence in mature and emerging economies. Section three presents an illustrative model useful for gauging the effect of IT on the inflation process. Our preferred measure of inflation persistence is introduced in section four, while section five discusses the results from full-sample as well as rolling-window estimation. Finally, section six offers some tentative conclusions and suggestions for future research.

2. Inflation Targeting and Inflation Persistence

The fall in inflation persistence over the last two decades in major industrial countries is now well documented. Levin and Piger (2006) find that, conditional on a change in the mean (potentially reflecting a change in monetary policy makers' objectives), inflation is much less persistent than previously thought. To understand why, suppose that the central bank controls inflation closely, but that the average inflation rate, as captured by the constant in an autoregressive model for inflation, falls in the sample.[4] If the econometrician does not allow for this change when estimating the degree of persistence, it will appear that inflation was above the mean in the first part and below the mean in the rest of the sample. Thus, inflation will be seen as deviating persistently from the mean.

Less supportive evidence for a reduction in inflation persistence is provided by Cecchetti and Debelle (2006) who conclude that the principal change in the inflation process in the past two decades is a decline in the mean of inflation. Levin, Natalucci, and Piger (2004) argue that the adoption of IT lowered the degree of inflation persistence in major industrial countries. For the aggregate euro area, however, the results are ambiguous. The widely cited study of O`Reilly and Whelan (2005a) finds no change in inflation persistence over the sample period, while Tillmann (2008) provides evidence in favor of a decline in persistence since 1999.

The empirical impact of regime changes on inflation persistence is studied in Benati (2008). He estimates a small-scale New-Keynesian model for major industrial countries over various subperiods using Bayesian methods. His main result is that the degree of intrinsic inflation persistence, i.e. the coefficient of lagged inflation within a hybrid Phillips curve, drops significantly towards zero once a credible new monetary regime is in place.

[4] See the theoretical analysis in Svensson (1997) who finds that under IT, inflation equals the targeted rate plus random shocks that occur between the time the interest rate is set and the impact on inflation. This implies that shocks to inflation are transient.

For emerging market economies, however, the effects of IT are mixed. Goncalves and Salles (2008) find that developing countries adopting IT experience a significant decline of inflation and in growth volatility.[5] Using a variety of propensity score matching methods, Lin and Ye (2009) and Lin (2010) support these findings. According to their result, both the level of inflation and its volatility fall after the adoption of IT. Recently, however, Brito (2010) and Brito and Bystedt (2010) extend this line of research by taking account of common time effects. These authors find that IT has no effect on the level and the variance of inflation in emerging countries.

In this paper we revisit the effects of IT in emerging economies and shed light on this controversy by addressing one important and hitherto neglected aspect, the evolution of inflation persistence. Only two recent papers analyse the effect of IT on the persistence of inflation for developing economies. Siklos (2008) estimates a first-order autoregressive (AR(1)) process for inflation for a set of emerging market countries and includes a dummy variable indicating the adoption of IT. He finds that IT has reduced inflation persistence only in a handful of emerging economies.[6] Filardo and Genberg (2009) survey the experience with IT in Asia and the Pacific. They also analyse the development of inflation persistence, measured again as the AR(1) coefficient for inflation, and find a drop in persistence only for Korea, New Zealand, and Australia. In other countries, most notably Thailand, the Philippines, and Indonesia, persistence increases although IT is used.

Beyond studying data for a set of economies that have previously received little attention, this paper is of interest for three reasons. First, it measures inflation persistence by the sum of the coefficients in an autoregressive representation of inflation using the median unbiased estimator developed by Hansen (1999). Thus far the literature on inflation persistence in emerging market countries mostly relies on OLS estimates of the AR(1) coefficient. The least squares estimate, however, suffers from a bias as the sum of the autoregressive coefficients approaches unity. Moreover, confidence bands based on a normally distributed estimator do not have correct coverage.[7] To check whether persistence falls over time, however, reliable confidence bands are of crucial importance. Using Hansen's (1999) grid-bootstrap estimator solves these issues.

Second, it provides a time-varying measure of persistence obtained from rolling-window estimates. This allows us to assess how inflation persistence has varied over time, which has not been studied previously for emerging market countries. We also allow for structural breaks in the mean of the inflation series. Neglecting these breaks is known to bias the estimates of the AR parameters.

[5] See also Amato and Gerlach (2002) and Vega and Winkelried (2005).

[6] In a case study of Korea, Kim and Park (2006) also find inconclusive evidence on the change in inflation persistence.

[7] See Hansen (1999) and the references therein.

Third, we explicitly test for structural stability of the autoregressive inflation process using a bootstrap approach to calculate critical values.

3. A Simple Interpretive Model

To interpret the results from the econometric analysis below, it is useful to first consider a simple model for inflation. We assume that inflation, π_t, consists of a permanent part, $\overline{\pi}_t$, which obeys a random walk, and a temporary inflation shock, $\upsilon_t \sim N\left(0, \sigma_\upsilon^2\right)$. Formally, we have:

$$\pi_t = \overline{\pi}_t + \upsilon_t \tag{1}$$

with

$$\overline{\pi}_t = \overline{\pi}_{t-1} + \eta_t \tag{2}$$

and $\eta_t \sim N\left(0, \sigma_\eta^2\right)$.

This is a reduced form model in the sense that σ_η^2 is not independent of policy. Indeed, one may think of σ_η^2 as being inversely related to the central bank's control of inflation. Thus, a central bank that responds strongly to economic disturbances in order to prevent long-lasting movements in π_t from occurring can be thought of as reducing the variance of the innovations to the permanent shock, σ_η^2. Perfect inflation control could be thought of as a case in which $\sigma_\eta^2 = 0$.

To proceed, suppose we estimate a first-order autoregressive model for inflation:

$$\pi_t = \rho\pi_{t-1} + \varepsilon_t \tag{3}$$

We can then show that the estimate of the autoregressive parameter, $\hat{\rho}$, is given by:

$$\hat{\rho} = \frac{(T-1)\sigma_\eta^2}{(T-1)\sigma_\eta^2 + \sigma_\upsilon^2} \tag{4}$$

where T denotes the sample length. Note that $\hat{\rho}$ is bounded by zero and unity. In any finite sample, $\hat{\rho}$ can be thought of as a measure of the relative importance of permanent, η_t, to temporary, υ_t, shocks to inflation. Thus, in economies in which permanent shocks dominate, $\hat{\rho}$ will be close to unity. As argued above, under IT (or any other monetary policy strategy in which the central bank moves interest rates aggressively to offset shocks to inflation), σ_η^2 and therefore $\hat{\rho}$ should both be close to zero. In the remainder of the paper we estimate ρ and use it in order to assess the central bank's inflation control.

Of course the choice to adopt IT is not random, but might be driven by both current macroeconomic conditions and the experience under previous monetary regimes. Our empirical framework, however, does not allow us to recognise these determinants explicitly.

4. Measuring Inflation Persistence

While the model above is helpful for understanding how successful inflation targeting might reduce the persistence of shocks to inflation, it is highly stylised and too simple to take to the data. Following O'Reilly and Whelan (2005a) and Levin and Piger (2006), among others, our preferred measure of persistence is the sum of the autoregressive coefficients in a univariate process of inflation. Let α be an intercept term and ε_t a serially uncorrelated shock. We can then generalise (3) to an AR(q) process for inflation

$$\pi_t = \alpha + \sum_{k=1}^{q} \beta_k \pi_{t-k} + \varepsilon_t \tag{5}$$

The sum of autoregressive coefficients is $\rho = \sum_{k=1}^{q} \beta_k$. According to Andrews and Chen (1994), ρ is the best scalar measure of persistence in π_t, since a monotonic relationship exists between ρ and the cumulative impulse response function of π_{t+j} to ε_t. Rewrite expression (5) as

$$\pi_t = \alpha + \rho \pi_{t-1} + \sum_{k=1}^{q-1} \gamma_k \Delta \pi_{t-k} + \varepsilon_t \tag{6}$$

where $\Delta \pi_t = \pi_t - \pi_{t-1}$. If $\rho = 1$, the inflation process contains a unit root. In terms of the stylised model above, this can be thought of as a situation in which inflation control is poor and the variance of the permanent shocks is much greater than the variance of the transitory shocks. If, by contrast, $|\rho| < 1$, the process is stationary and there is at least some inflation control. In the empirical application below, the

appropriate lag length $q \leq q^{\max}$ is chosen according to the Akaike information criterion (AIC) with a maximum lag length of $q^{\max} = 6$ (quarters).

Estimates of ρ obtained from least squares estimation suffer from a downward bias as ρ approaches unity. Furthermore, confidence bands based on a normally distributed ρ do not have the correct coverage. Therefore, we follow the literature and use Hansen's (1999) median unbiased estimator of ρ. His grid bootstrap approach is used to construct confidence bands for ρ with correct coverage. The bootstrap calculations are based on 999 draws and 101 grid points over a range spanned by the sample persistence surrounded by four OLS standard errors.

The presence of structural breaks in the mean of the inflation process can bias the estimates of persistence upwards. To account for this bias we include an appropriate dummy variable d_t in the regression equation, which is unity in $t \geq s$, where s is the break date, and zero elsewhere

$$\pi_t = \alpha + \delta d_t + \rho \pi_{t-1} + \sum_{k=1}^{q-1} \gamma_k \Delta \pi_{t-k} + \varepsilon_t. \quad (7)$$

5. Results

In this paper we use quarterly inflation rates, measures as the annualised change of the Consumer Price Index (CPI) in percentage points. The data spans the period 1985:1 to 2010:1 and is taken from the IMF's International Financial Statistics database.[8] We study Indonesia, Korea, the Philippines and Thailand, which all conduct monetary policy using IT.[9] We also present estimates for China, Taiwan POC, Japan, Malaysia and Singapore that gear monetary policy to price stability without relying on IT. Japan and Singapore have operated with a managed float and have maintained low and stable inflation since the early 1980s. With strong low-inflation credentials, neither economy has felt a need to adopt IT. Malaysia fixed the ringgit to the US dollar during the Asian financial crisis and only abandoned the peg in 2005 following the Chinese authorities' introduction of increased exchange rate flexibility for the renminbi. Monetary policy in Malaysia is now best described as following an eclectic strategy, but with considerable weight attached to inflation outcomes.

[8] Data for Taiwan is taken from Taiwan's Statistical Office.

[9] The Bank of Thailand targets core inflation, defined as inflation excluding fresh food and energy prices. However, to the extend that the deviation between core and headline inflation is temporary, this distinction would seem to be of little importance for the question at hand.

We also study data from Hong Kong SAR, which has operated monetary policy with a currency board since 1983. While this arrangement was intended to provide Hong Kong with a firm monetary anchor following a decade of high and volatile inflation after the introduction of floating exchange rates in the early 1970s, such arrangements generate pronounced swings in inflation in response to shocks to equilibrium real exchange rates.[10] Given the exchange rate regime, it thus seems likely that shocks to inflation are more persistent in Hong Kong than elsewhere.

The set of countries in the Asia-Pacific region is completed by Australia and New Zealand. New Zealand was the first country to adopt IT in 1990 and Australia followed in 1993. We also present estimates for a number of non-Asian economies that conduct monetary policy with IT. This group includes both emerging (Chile, Israel and South Africa) and advanced economies (Norway, Canada, Sweden and the UK).

The inflation series are depicted in Figures 1 to 3. As a consequence of the Asian financial crisis in 1997-98, inflation rates rose sharply in Indonesia, Korea and Thailand, which introduced IT in response, and in Malaysia, which fixed the exchange rate. The figures also show that in many countries inflation rose sharply in 2007 in response to rising oil and food prices.

Table 1 offers some descriptive statistics for inflation in these countries and warrants two comments. First, inflation was typically lower and less volatile in the last decade than before, suggesting that central banks have attached greater importance to price stability in setting monetary policy. Second, the importance of this shift seems independent of whether monetary policy is conducted using IT. This finding reflects the difficulty of finding an effect of IT if performance is measured by the inflation rate.[11]

5.1 Before and After the Asian Financial Crisis

In this section we contrast inflation persistence in Asia-Pacific economies before and after the Asian Financial Crisis in 1997-98 which led several Asian economies to adopt IT. This comparison is made difficult by the fact that the crisis in many cases led to a sharp but temporary increase in inflation. In order to account for this turbulent period we follow Genberg and Filardo (2009) and compare persistence in a pre-1997:2 sample with persistence in a post-2000:1 sample. However, this latter period is also disturbed by a sharp run-up in inflation in 2007, following large shocks to oil and food prices, which were more important for the economies studied here. We therefore report results both for the time period 2000:1-2007:2 and for a longer period ending in 2010:1.

The baseline findings for IT economies in Asia-Pacific are reported in Table 2. The estimates of ρ point to a significant reduction in inflation persistence in all countries with the exception of Indonesia. For

[10] See this discussion in Gerlach and Gerlach-Kristen (2006).

[11] See the debate between Goncalves and Salles (2008), Lin and Ye (2009) Brito and Bystedt (2010).

instance, persistence in Korea is estimated to be 0.97 prior to the Asian financial crisis. In the post-2000 subsample, persistence drops to 0.59, which lies outside the confidence band surrounding the pre-1997 estimate. Moreover, we can exclude the unit-root case for all countries in the 2000-2010 subsample, again with the exception of Indonesia. In the 1990s, the sum of the autoregressive coefficient is statistically indistinguishable from unity. In most cases persistence is somewhat higher if the last two years of the sample period are not included in the estimation. The table also reports the results from estimating (6) by OLS. As expected, ρ_{OLS} understates the degree of inflation persistence relative to the Hansen (1999) estimates.

Turning to the Asian comparison group in Table 3, we note that persistence in the 2000-2010 subsample increases for China, Hong Kong and Japan. Indeed, China and Hong Kong display the greatest levels of persistence, which is perhaps not surprising given their monetary policy regimes. Malaysia and Taiwan experience a fall in persistence, which is, however, small compared to the group of IT economies. Interestingly, we cannot exclude the unit-root case for any of these non-IT economies.

While the level of inflation falls unanimously across countries, the degree of inflation persistence does not. The average degree of inflation persistence of the six IT economies in Asia and the Pacific falls from 1.02 to 0.44 in the 2000-2009 subsample (see the bottom rows of Table 2). In the control group of Asian non-IT economies, however, average inflation persistence increases from 0.79 to 1.06 (see Table 3). Comparing the persistence (rather than the level of inflation) thus reveals that IT has indeed had an effect on the inflation process of the Asian economies we study.

In the non-Asian reference countries, inflation persistence broadly falls as shown in Table 4. Again, the unit-root case cannot be ruled out for most advanced economies in either period. Thus, average persistence in Asia declines more strongly in the 2000-2009 subsample than among IT economies elsewhere in the world. Asian IT regimes have, in this sense been, successful in anchoring inflation dynamics. However, when the most recent years are excluded, persistence increased marginally in Asian IT economies, but remains unchanged in IT regimes outside Asia.

Overall, the work presented in this subsection indicates that inflation became significantly less persistent after the Asian financial crisis. This drop in persistence is particularly large in those economies that formally adopted IT as a monetary policy strategy, where inflation no longer has a unit root. In our diverse sample, some economies are more susceptible to large shocks than others. However, the issue is how quickly inflation falls back after a shock. It is unclear that this property of inflation depends crucially on the nature, apart from the persistence, of the shock. The next session sheds light on the timing of these changes in inflation dynamics.

5.2 Rolling Window Evidence

To illustrate the behavior over time of the persistence measure, we next estimate the model using a moving 40-quarter window. For each window, we also compute confidence intervals as explained above. We also allow the lag length of the AR models to vary across samples as determined by the AIC since the adoption of IT could lead to fewer lags being sufficient to describe the inflation process. As mentioned before, neglecting a structural break in the mean inflation rate can lead to spuriously high estimates of inflation persistence. Thus far the literature on the performance of IT in Asian emerging market countries does not take account of this problem. As the estimation window moves over the sample period, the impact of structural breaks is reduced. Nevertheless, most estimation windows include the Asian crisis in 1997-98. Therefore, we control for a structural break in 1998:3 when the fallout from the Asian financial crisis was most readily apparent, without explicitly testing whether such a break occurred at this time.

The resulting series of persistence estimates together with bootstrapped 90% confidence bands are reported in Figures 4 to 6. Before interpreting these results, a note of caution is warranted. The rolling-window confidence intervals are generated for many overlapping samples. If the samples are not independent of each other, the confidence bands are indicative only. For Indonesia, the Philippines, Korea and Thailand inflation persistence falls after the adoption of IT. This is consistent with the estimates considered above. While a reduction can be observed for all IT economies, the rolling window evidence reveals interesting differences with respect to the timing of this reduction. The fall in persistence is not synchronised across countries. Inflation persistence in Korea and Thailand falls immediately after the new monetary regime became effective. Thus, persistence in Korea drops from about unity to 0.5 in the first two years of IT. The Philippines witness a small drop in persistence immediately after the adoption of IT. A substantial reduction occurs only at the very end of the sample period. Likewise, persistence in Indonesia falls much later than in the other countries. The evidence also points to an increase in persistence as the financial crisis unfolds in 2008.

A note of caution is warranted here. While one is tempted to conclude that this decline is due to the adoption of IT, an alternative interpretation is that the sharp change of inflation following the onset of the Asian financial crisis constitutes a temporary shock, which reduces the estimated persistence of innovations to inflation. Once that episode drops out of the window used to compute the graphs, the measured persistence rises back to some “normal,” and relatively high, level.

The results for the Asian non-IT economies, which are presented in Figure 5, are remarkably different. For most economies, persistence fluctuates around unity throughout the last decade without a tendency to decline.[12] In the control group of non-Asian IT countries in Figure 6, we observe a drop in persistence

[12] While Zhang (2010) and Zhang and Clovis (2010) recently argue that inflation persistence in China has decreased since the mid-1990s, our estimates do not support this claim.

following the adoption of IT in South Africa and Norway. This reduction, however, is only temporary and is reversed four or five years later.

Overall, the results in this subsection point to significant differences between economies with a formal inflation target and those without: while inflation persistence falls in the first group, it remains roughly unchanged in the latter. Nevertheless, the behavior of inflation persistence remains heterogenous even across IT economies.

5.3 Structural Breaks in Inflation Persistence

In this subsection we test for stability of the autoregressive inflation process. For this purpose, we use a sequential F -test over an admissible range that includes the central 70% of the available observations. Andrews and Chen (1996) and O'Reilly and Whelan (2005b) show that the size distortion of this statistic is substantial at high levels of persistence. Therefore, we cannot rely on the asymptotic critical values provided by Andrews (1993). Here we perform a bootstrap and estimate an AR(q) model by OLS over the sample size T, draw residuals and generate, based on the estimated coefficients, a set of N artificial series for $t = 1,...,T$ consistent with the no-break model. For each of these generated series, we perform the break test. The α -th percentile of the resulting distribution is used as the $1-\alpha$ percent critical value.

Figure 7 plots the sequential test statistic together with the 10% critical value based on 2000 bootstrap replications. The Andrews-Quandt sub-F test statistic is then given by the maximum Wald test statistic, that is.

$$\sup - F = \sup W_T(\tau_i) \mid \tau_i \in [\tau_{\min}, \tau_{\max}], \tag{8}$$

where $W_T(\tau_i)$ is the Wald statistic for the null hypothesis of no structural change at time τ_i. Stability of the sum of the autoregressive coefficients can be rejected when the maximum test statistic exceeds the critical value. The results corroborate our earlier findings. We find evidence for a structural break in Korea and the Philippines. For Thailand and Indonesia we identify signs of instability that, however, lack statistical significance. In all other Asian economies we cannot support the notion of a drop in inflation persistence.

The (potential) break dates for the complete set of economies are listed in Table 5. While in Australia, Sweden and Canada the identified break date corresponds to the date of the formal adoption of IT, in the Asian IT economies the break in persistence occurs around the Asian financial crisis. We also report the Andrews-Ploberger exp-F test statistic,

$$\exp - F = \ln\left\{\int_{\tau_{\min}}^{\tau_{\max}} \exp\left[0.5 W_T(\tau_i)\right] d\tau\right\}, \quad (9)$$

for which critical values are derived from bootstrapping. The exp-F test is more suitable than the sub-F test to discriminate the maximum Wald test statistic from local alternatives. The results, however, remain unchanged.

In sum, the time-series evidence presented in this subsection suggests that persistence changed in those economies that adopted IT but did not do so in the economies using other monetary policy strategies.

6. Conclusions

It is widely noted that the introduction of monetary policy strategies focused on achieving low and stable inflation has been associated in many countries with a sharp decline in the persistence of inflation shocks. Formally, this literature proceeds by estimating a low-order autoregression for the annual percentage change in consumer prices and studies the estimated sum of the autoregressive parameters. Applying this approach to a sample of Asia-Pacific countries which operate monetary policy with a range of strategies -- including IT, exchange rate pegs and "eclectic" strategies -- we find evidence that inflation persistence has declined in the economies using inflation targeting but not elsewhere. These findings support the notion of Goncalves and Salles (2008), Lin and Ye (2009) and others that IT is a monetary policy that could successfully be adopted by emerging market economies.

The results of this paper also shed light on how to measure the success of alternative monetary policy strategies. While a comparison of the level of inflation reveals no differences across economies, a comparison of inflation persistence does. Measuring the performance of monetary policy strategies in terms of inflation persistence rather than the level of inflation shows that inflation targeting outperforms alternative strategies.

Despite this overall tendency of IT economies to have a lower degree of persistence, some cross-country differences remain. One potential reason for these differences between, say, Korea and Indonesia, is that some Asian central banks continue to attach great weight to the exchange rate in the formulation of monetary policy despite the adoption of IT. While this may be surprising from the perspective of central banks operating with IT elsewhere, policy makers in Asia may be particularly concerned about the exchange rate in light of the inherent risk of currency mismatches in the financial sector, as suggested by their experiences during the Asian financial crisis. Moreover, policy makers who are well aware of the high export dependence of Asian economies, may be concerned that exchange rate changes may impact on inflation and economic activity, which are both goal variables for central banks with IT. In future research we will investigate this cross-country heterogeneity in detail.

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Table 1. Descriptive Statistics

	Year of IT adoption	Mean inflation pre-1997:2	Mean inflation post-2000:1	Variance of inflation pre-1997:2	Variance of inflation post-2000:1
		Asian inflation targeters			
Australia	1993	4.96	3.16	8.97	1.43
Indonesia	2000	7.77	8.36	4.00	17.29
Korea	1999	5.44	3.11	4.98	0.86
New Zealand	1990	6.09	2.64	30.84	0.69
Philippines	2002	9.88	4.83	54.52	8.91
Thailand	2000	4.31	2.49	2.43	4.70
		Non-Asian inflation targeters			
Canada	1990	3.21	2.10	2.87	0.91
Chile	1991	16.67	3.49	53.39	5.65
Israel	1991	14.67	2.05	18.32	5.21
Norway	2001	4.12	2.11	5.70	1.54
South Africa	2000	12.93	6.12	13.07	10.23
Sweden	1992	4.79	1.50	9.68	1.37
UK	1992	4.53	2.63	5.61	2.00
		Asian non-inflation targeters			
China	-	11.80	1.85	65.16	5.93
Hong Kong	-	7.83	-0.10	6.42	6.76
Japan	-	1.31	-0.23	1.43	0.67
Malaysia	-	2.73	2.17	2.14	2.91
Singapore	-	1.76	1.42	1.96	3.86
Taiwan	-	2.47	0.59	2.88	0.99

Table 2. Inflation Persistence in Asian IT Countries

Economy	Sample	Lag order	ρ_{OLS}	ρ	90% Confidence band
Australia	1985:1 - 1997:2	6	0.95	1.01	$[0.91,1.05]$
	2000:1 - 2010:1	5	0.51	0.58	$[0.30,0.93]$
	2000:1 - 2007:2	4	0.42	0.46	$[0.19,0.78]$
Indonesia	1985:1 - 1997:2	6	0.41	0.45	$[0.19,0.74]$
	2000:1 - 2010:1	6	0.61	0.66	$[0.45,0.89]$
	2000:1 - 2007:2	6	0.59	0.66	$[0.42,1.04]$
Korea	1985:1 - 1997:2	5	0.89	0.97	$[0.83,1.06]$
	2000:1 - 2010:1	4	0.55	0.59	$[0.39,0.80]$
	2000:1 - 2007:2	1	0.66	0.73	$[0.51,1.05]$
New Zealand	1985:1 - 1997:2	5	0.94	1.02	$[0.89,1.08]$
	2000:1 - 2010:1	5	0.63	0.67	$[0.48,0.92]$
	2000:1 - 2007:2	5	0.64	0.71	$[0.50,1.00]$
Philippines	1985:1 - 1997:2	2	0.84	0.86	$[0.77,1.01]$
	2000:1 - 2010:1	6	0.49	0.52	$[0.28,0.81]$
	2000:1 - 2007:2	6	0.53	0.58	$[0.28,1.03]$
Thailand	1985:1 - 1997:2	6	0.82	0.87	$[0.73,1.04]$
	2000:1 - 2010:1	2	0.63	0.66	$[0.52,0.82]$
	2000:1 - 2007:2	2	0.83	0.91	$[0.74,1.07]$
Average	1988:3 - 1997:2	5	0.94	1.02	$[0.88,1.07]$
	2000:1 - 2009:4	6	0.28	0.30	$[0.08,0.52]$
	2000:1 - 2007:2	5	0.53	0.60	$[0.34,0.89]$

Notes: The table reports Hansen's (1999) mean unbiased estimator of the sum of autoregressive coefficients ρ and the bootstrapped 90% confidence bands based on 101 grid points and 999 replications. The OLS estimator is denoted by ρ_{OLS}. The lag order is chosen according to the AIC. Average persistence is based on to the weighted (GDP weights in U.S. dollar taken from the April 2010 World Economic Outlook) inflation rate.

Table 3. Inflation Persistence in Asian Non-IT Countries

Economy	Sample	Lag order	ρ_{OLS}	ρ	90% Confidence band
China	1987:1 - 1997:2	6	0.82	0.85	$[0.73,1.02]$
	2000:1 - 2009:4	5	0.88	0.98	$[0.81,1.08]$
	2000:1 - 2007:2	5	0.86	1.02	$[0.76,1.12]$
Hong Kong	1985:1 - 1997:2	6	0.92	0.94	$[0.87,1.02]$
	2000:1 - 2010:1	5	0.95	1.03	$[0.91,1.09]$
	2000:1 - 2007:2	1	0.93	1.03	$[0.88,1.12]$
Japan	1985:1 - 1997:2	4	0.82	0.88	$[0.73,1.04]$
	2000:1 - 2010:1	5	0.78	0.92	$[0.64,1.12]$
	2000:1 - 2007:2	1	0.76	0.85	$[0.62,1.10]$
Malaysia	1985:1 - 1997:2	5	0.87	0.94	$[0.79,1.08]$
	2000:1 - 2010:1	5	0.68	0.78	$[0.45,1.10]$
	2000:1 - 2007:2	4	0.76	0.79	$[0.65,1.10]$
Singapore	1985:1 - 1997:2	5	0.87	0.90	$[0.81,1.02]$
	2000:1 - 2010:1	6	0.83	0.89	$[0.74,1.06]$
	2000:1 - 2007:2	2	0.61	0.65	$[0.43,0.90]$
Taiwan	1985:1 - 1997:2	2	0.89	0.92	$[0.83,1.03]$
	2000:1 - 2010:1	6	0.72	0.81	$[0.56,1.08]$
	2000:1 - 2007:2	6	0.81	0.91	$[0.67,1.09]$
Average	1988:3 - 1997:2	6	0.76	0.81	$[0.64,1.04]$
	2000:1 - 2009:4	5	0.91	1.01	$[0.85,1.08]$
	2000:1 - 2007: 2	2	0.87	0.95	$[0.80,1.07]$

Notes: The table reports Hansen's (1999) mean unbiased estimator of the sum of autoregressive coefficients ρ and the bootstrapped 90% confidence bands based on 101 grid points and 999 replications. The OLS estimator is denoted by ρ_{OLS}. The lag order is chosen according to the AIC. Average persistence is based on to the weighted (GDP weights in U.S. dollar taken from the April 2010 World Economic Outlook) inflation rate.

Table 4. Inflation Persistence in Other IT Countries

Economy	Sample	Lag order	ρ_{OLS}	ρ	90% Confidence band
Canada	1985:1 - 1997:2	5	0.96	1.05	$[0.94,1.11]$
	2000:1 - 2010:1	5	0.50	0.61	$[0.25,1.09]$
	2000:1 - 2007:2	4	-0.12	-0.09	$[-0.43,0.26]$
Chile	1985:1 - 1997:2	5	0.98	1.04	$[0.96,1.08]$
	2000:1 - 2009:4	2	0.77	0.79	$[0.69,0.91]$
	2000:1 - 2007:2	2	0.69	0.73	$[0.56,0.93]$
Israel	1987:1 - 1997:2	6	0.85	0.90	$[0.78,1.03]$
	2000:1 - 2010:1	2	0.74	0.77	$[0.65,0.90]$
	2000:1 - 2007:2	2	0.74	0.78	$[0.64,1.02]$
Norway	1985:1 - 1997:2	6	0.96	1.02	$[0.93,1.06]$
	2000:1 - 2010:1	5	0.57	0.70	$[0.39,1.13]$
	2000:1 - 2007:2	1	0.62	0.72	$[0.43,1.08]$
South Africa	1985:1 - 1997:2	5	0.96	1.04	$[0.93,1.10]$
	2000:1 - 2010:1	6	0.83	0.87	$[0.74,1.04]$
	2000:1 - 2007:2	6	0.81	0.90	$[0.69,1.08]$
Sweden	1985:1 - 1997:2	5	0.94	1.04	$[0.90,1.09]$
	2000:1 - 2010:1	5	0.74	0.80	$[0.60,1.06]$
	2000:1 - 2007:2	1	0.83	0.97	$[0.73,1.13]$
UK	1985:1 - 1997:2	6	0.92	0.96	$[0.87,1.04]$
	2000:1 - 2010:1	6	0.71	0.76	$[0.55,1.04]$
	2000:1 - 2007:2	5	0.96	1.09	$[0.92,1.21]$
Average	1988:3 - 1997:2	6	0.96	1.00	$[0.93,1.03]$
	2000:1 - 2009:4	5	0.61	0.71	$[0.41,1.10]$
	2000:1 - 2007:2	4	0.11	0.14	$[-0.20,0.48]$

Notes: The table reports Hansen's (1999) mean unbiased estimator of the sum of autoregressive coefficients ρ and the bootstrapped 90% confidence bands based on 101 grid points and 999 replications. The OLS estimator is denoted by ρ_{OLS}. The lag order is chosen according to the AIC. Average persistence is based on to the weighted (GDP weights in U.S. dollar taken from the April 2010 World Economic Outlook) inflation rate.

Table 5. Structural Break Tests

Economy	Lag order	sub-F (Andrews-Quandt)		exp-F (Andrews- Ploberger)		date
		statistic	10% cv	statistic	10% cv	
			Asian inflation targeters			
Australia	6	8.40	7.98	1.70	2.05	1990:4
Indonesia	6	5.31	6.46	1.61	1.69	1998:3
Korea	5	9.65	8.11	2.56	2.03	1998:2
New Zealand	5	1.12	6.31	0.09	1.56	1990:2
Philippines	6	10.23	7.30	3.64	1.84	1998:4
Thailand	5	7.04	7.73	1.08	1.95	1998:2
			Non-Asian inflation targeters			
Canada	5	12.70	7.80	2.72	1.96	1991:1
Chile	5	5.56	7.38	1.30	1.80	1992:1
Israel	6	7.23	7.84	1.78	2.01	1996:2
Norway	5	7.19	7.82	1.52	1.94	1990:4
South Africa	6	7.57	8.57	1.81	2.23	1993:2
Sweden	5	8.79	7.13	2.02	1.80	1993:1
UK	6	9.56	7.78	2.85	1.99	1990:2
			Asian non-inflation targeters			
China	6	4.15	6.82	1.09	1.68	1992:1
Hong Kong	5	9.81	7.66	2.54	1.83	1991:1
Japan	5	6.14	7.04	1.15	1.65	1991:1
Malaysia	5	2.38	7.60	0.39	1.87	1992:3
Singapore	6	2.27	7.25	0.38	1.81	1994:3
Taiwan	6	5.27	7.71	1.27	1.94	1990:4

Notes: Results from tests for the hypothesis of no structural break in persistence for the full sample. The critical values are derived from bootstrapping with 2000 replications.

Figure 1. Inflation in Asian Inflation Targeting Economies. The Shaded Area Denotes the Inflation Targeting Regime

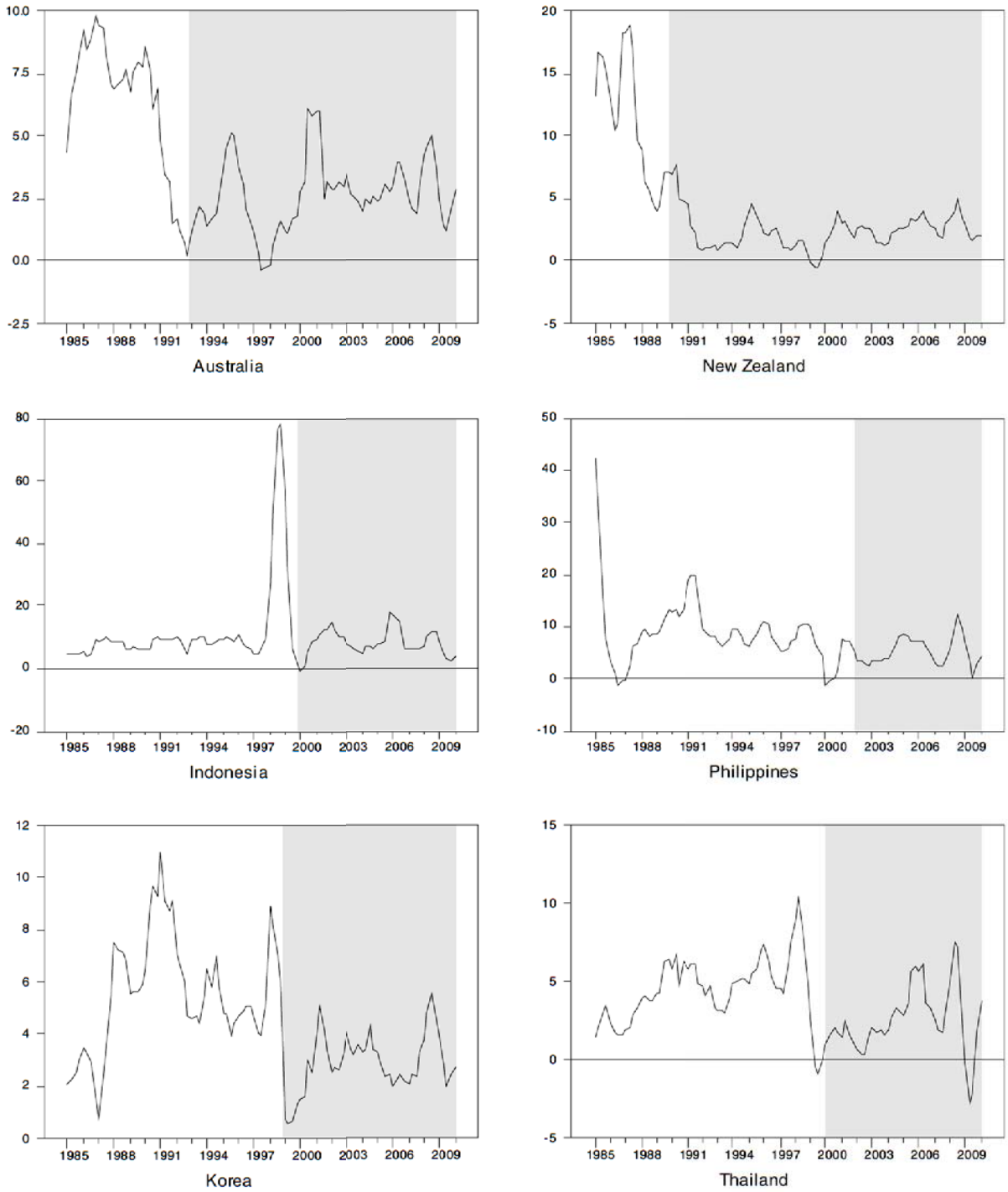

Figure 2. Inflation in Asian Non-Inflation Targeting Economies

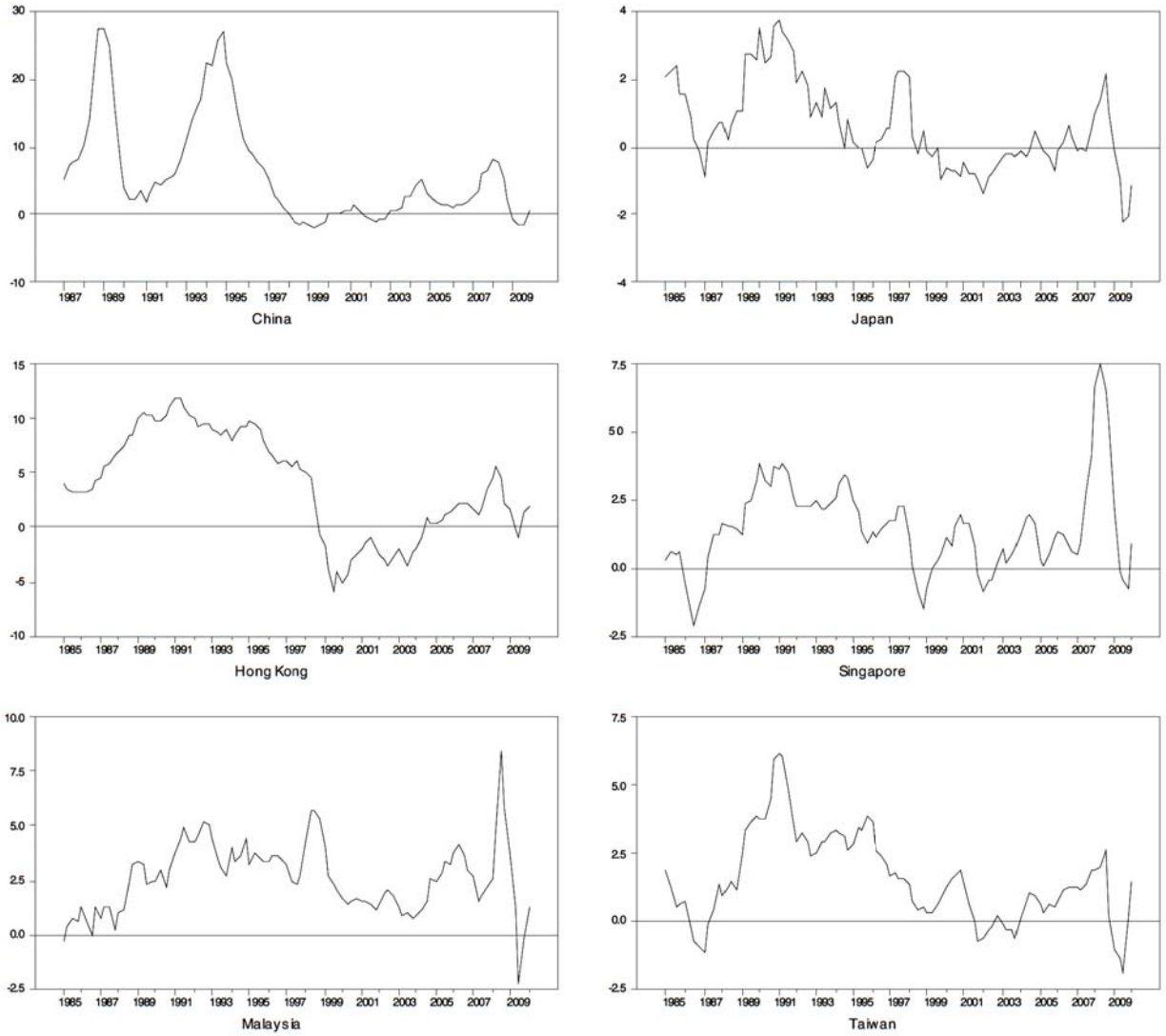

Figure 3. Inflation in Other Inflation Targeting Economies. The Shaded Area Denotes the Inflation Targeting Regime

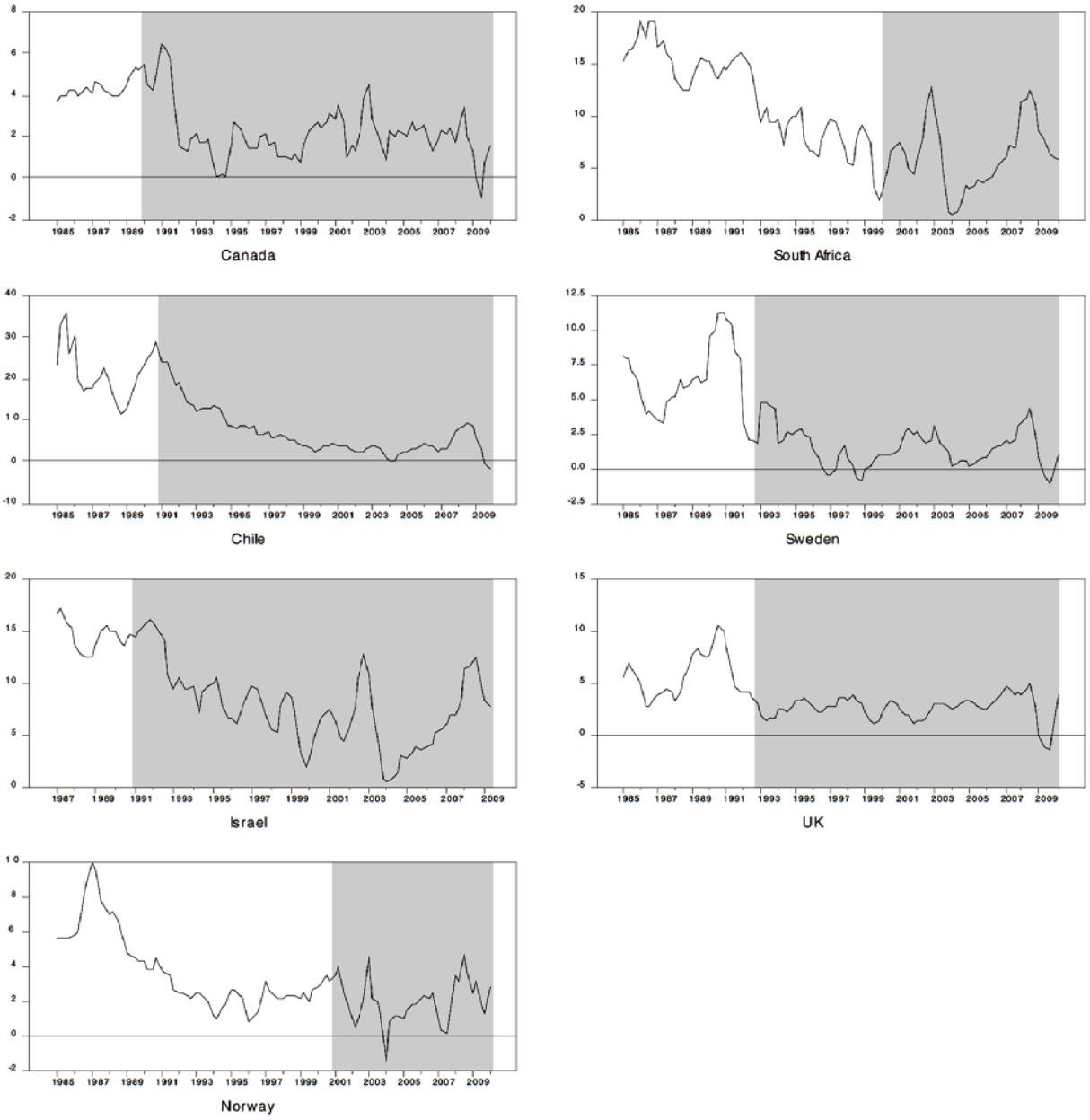

Figure 4. Median Unbiased Estimate of the Sum of Autoregressive Coefficients with a 90% Confidence Band based on a 10-Year Rolling Window for Asian IT Economies

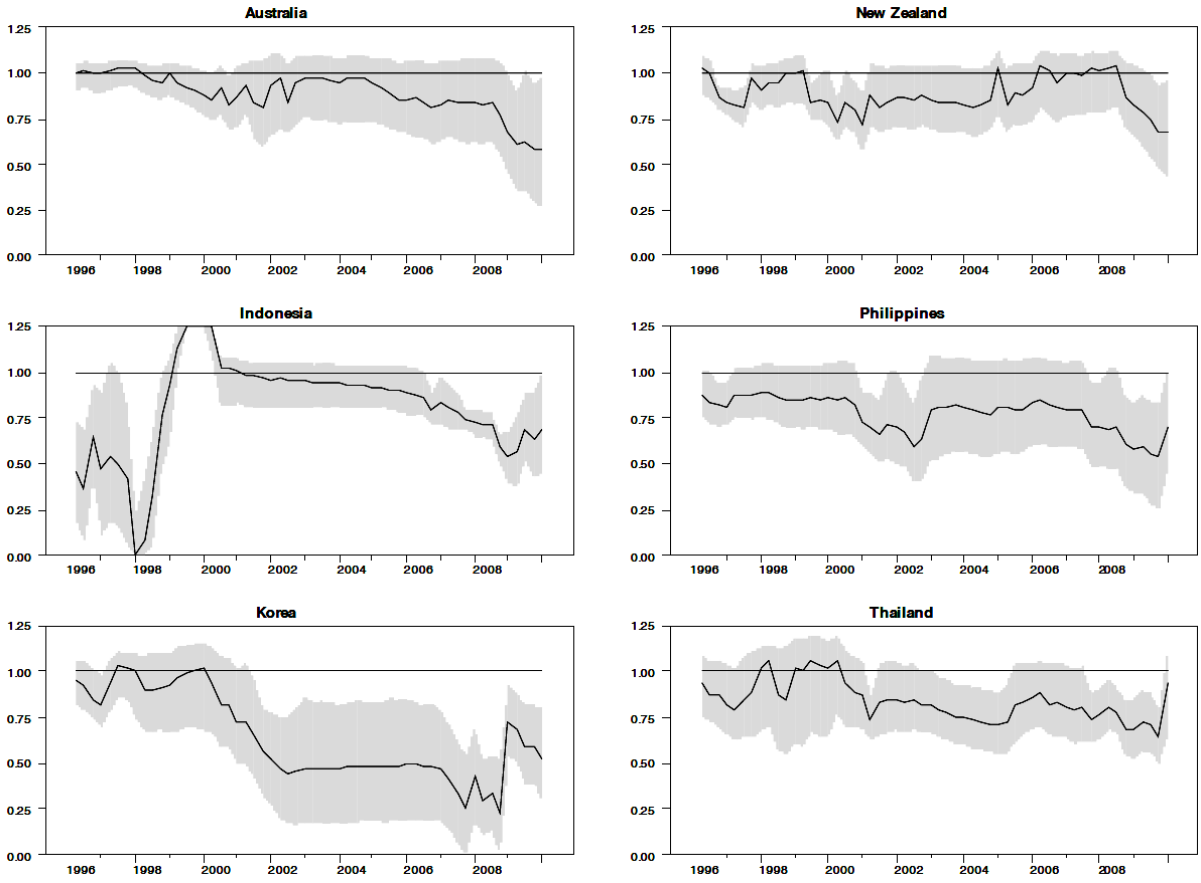

Figure 5. Median Unbiased Estimate of the Sum of Autoregressive Coefficients with a 90% Confidence Band Based on a 10-Year Rolling Window for Asian Non-IT Economies

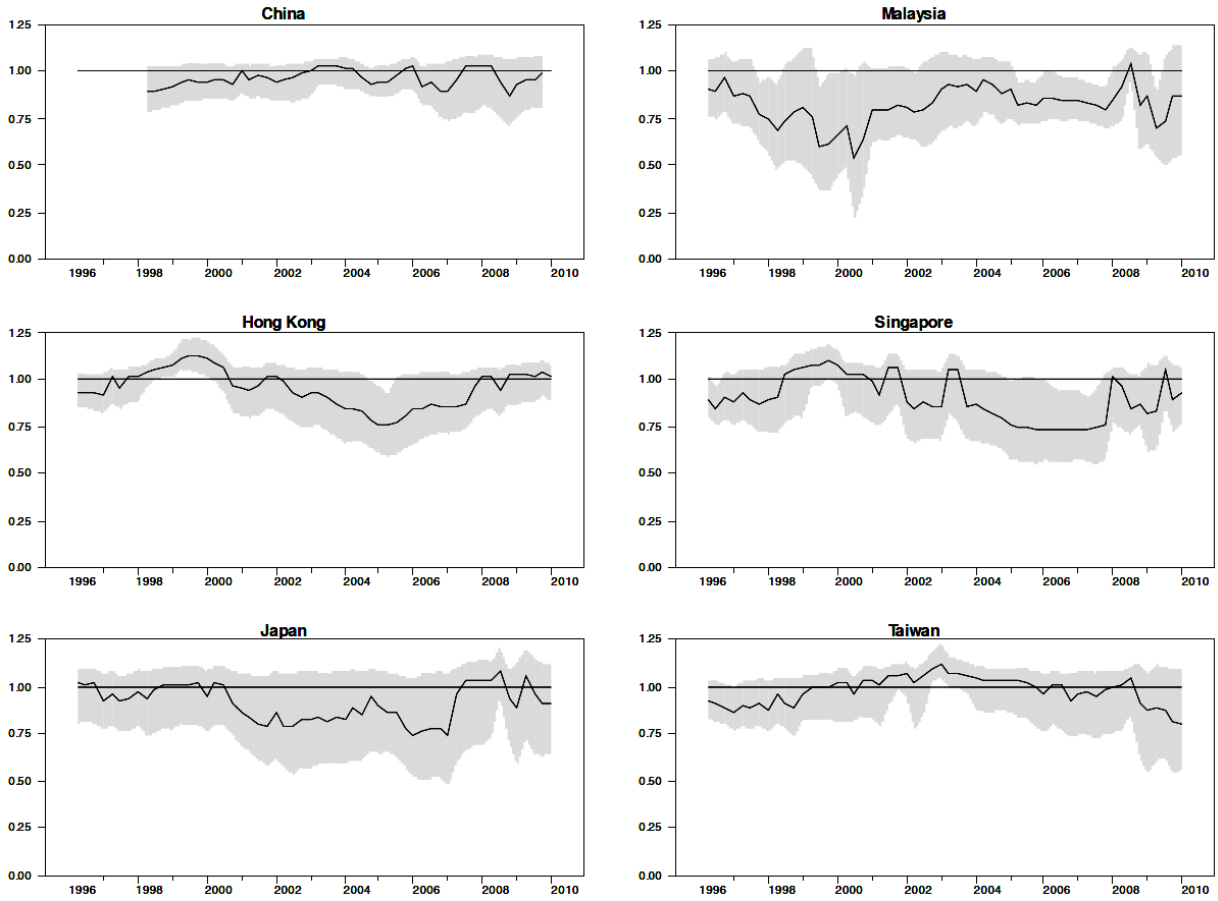

Figure 6. Median Unbiased Estimate of the Sum of Autoregressive Coefficients with a 90% Confidence Band based on a 10-Year Rolling Window for Non-Asian IT Economies

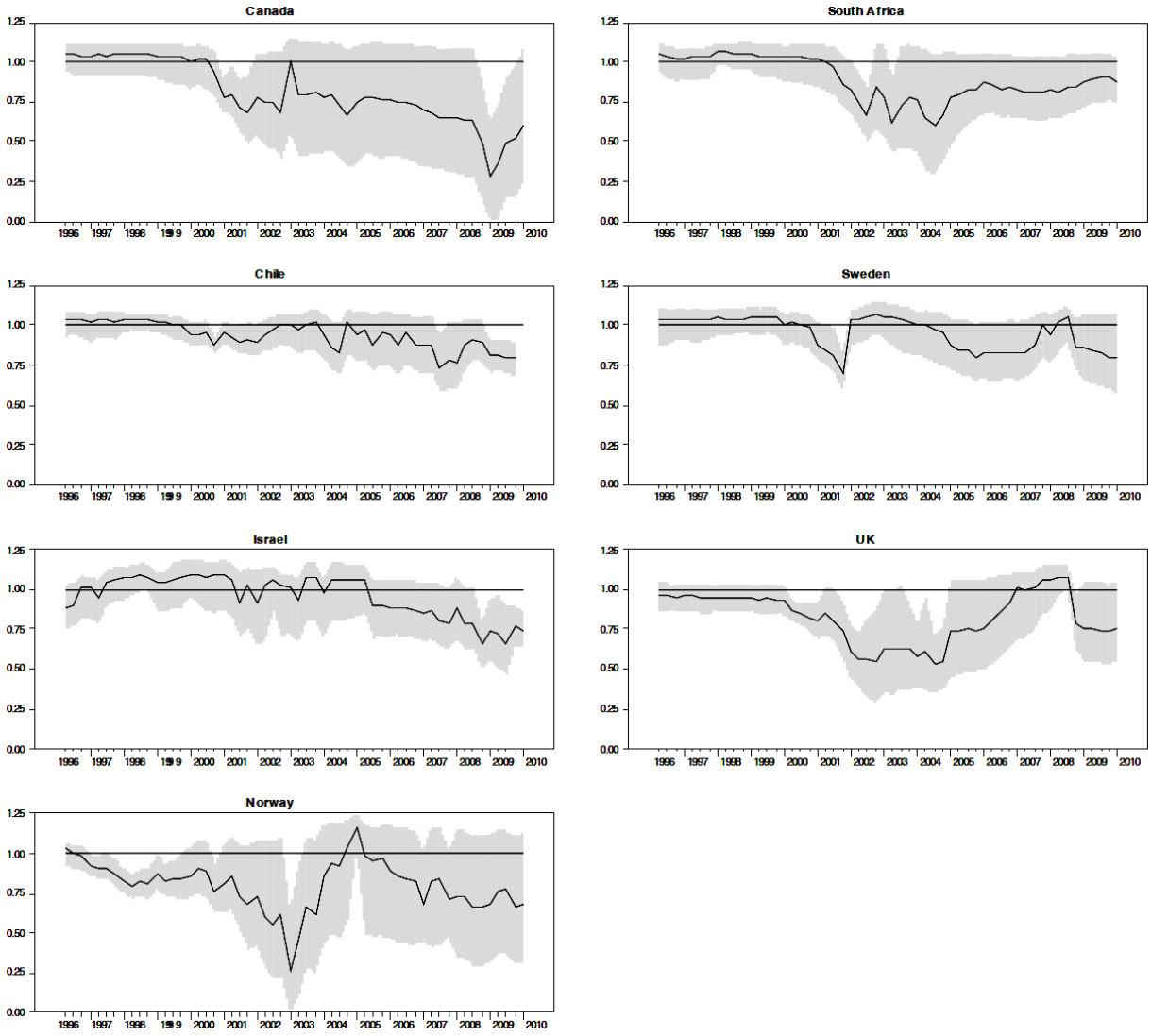

Figure 7. Sequence of *F*-test Statistics for a Break in the Sum of the Autoregressive Coefficients and Bootstrapped 10% Critical Value