International Journal of Applied Business and Economic Research, Vol. 8, No. 1, (2010): 15-30

INFLATION AND ECONOMIC GROWTH IN ASEAN-5, JAPAN AND SOUTH KOREA

Eu Chye Tan
UNIVERSITY OF MALAYA, KUALA LUMPUR, MALAYSIA

The objective of this paper is to ascertain whether any trade-off exists between inflation and economic growth in the founding members of the Association of South East Asian Nations (ASEAN-5) namely Malaysia, Singapore, Thailand, the Philippines and Indonesia and in Japan and South Korea. This in turn could form a basis for addressing the question of whether these countries or a subset of them could sustainably engage in some monetary cooperation with one another, from a macroeconomic vantage point. It is a concern that countries with a predilection for economic growth may sacrifice the objective of price stability. High rates of inflation could in turn disrupt the debt and foreign exchange markets with region-wide effects. Thus, the robustness or sustainability of any regional monetary cooperation such as the liquidity enhancement or reserve pooling mechanism may also hinge on the ability of subscribing nations to contain their domestic rates of inflation.

The purpose of this paper is met by integrating the Philips curve framework with Okun's theory. Quarterly data of these countries spanning generally from 1991 through 2006/7 are mobilized for the purpose. The empirical results suggest that only a nominal trade-off exists between economic growth and inflation in Singapore, South Korea and Thailand after the 1997/98 Asian financial crisis years while none in the other countries. In the wake of these findings, one might infer that monetary cooperation is sustainable amongst these East Asian economies.

Keywords: Growth, Inflation, Tradeoff, Monetary Cooperation
JEL Categories: E31 E24 E60

I. OVERVIEW

The purpose of this paper is to assess the possible trade-off between inflation and economic growth a la Phillips curve in the original Association of South East Asian Nations (ASEAN-5) countries, namely Malaysia, Singapore, Thailand, the Philippines and Indonesia and in Japan and South Korea.[1] Specifically, maintaining economic growth above the trend output level could have inflationary consequences for an economy. Inflation could undermine the external competitiveness of a nation and could affect its debt market and the exchange rate of its currency. Thus any policy undertaken by one of these countries that fuels inflation potentially triggers a currency crisis that could become region-wide via contagion. Generally, crisis prevention to ensure orderly capital flows in the East Asian region demands the pursuit of macroeconomic policies amongst governments in the region that could inspire market confidence. This would ensure the sustainability of any form of regional monetary cooperation such as the international liquidity enhancement or reserve pooling mechanism.

This paper is mooted by the fact that following the 1997 East Asian financial crisis, regional initiatives have been undertaken to intensify monetary cooperation to ward off a recurrence of the crisis. It was to such extent that even the formation of monetary union along the lines of the European monetary union was contemplated. The crisis has at first prompted regional economies to initiate action towards boosting regional financial stability that would shield them from external shocks and liquidity crises under the Chiang Mai Initiative (CMI) (Rajan 2003). The CMI involves all ASEAN countries, China, Japan and South Korea, dubbed the ASEAN plus 3. It concerns the development of a network of bilateral currency swaps and repurchase agreements as a 'firewall' against future financial crises. The CMI is intended to provide countries faced with the prospect of a liquidity shortage with supplementary short term hard currencies. However, capital market confidence in the CMI could be undermined if its swaps and repurchase facilities are abused by defending misaligned real exchange rates that could be brought about via inflationary macroeconomic policies.

Macroeconomic policy that is non inflationary is needed even much more if a full-fledged regional reserve pooling mechanism were to be established. This would involve the pooling of foreign exchange reserves of participating central banks that can be drawn from by any one of them in times of distress (Henning 2002). Currently reserves-rich countries with strong currencies in the region include Japan, South Korea, China and Singapore (Rajan 2003). These countries would naturally disallow their reserves to be drained by other weaker countries. Thus they may insist that the latter undertake the necessary macroeconomic and structural reforms for their entitlement to the common pool when the need arises.

At present, the East Asian economies are at varied stages of economic development. Within the ASEAN region, while Singapore and Malaysia are high and middle-income economies respectively, the others namely, Thailand, Indonesia and the Philippines are lower middle income ones. As rapid economic growth is of paramount importance particularly to the non high-income economies with large populations, their macroeconomic policies would naturally be biased towards economic growth. Given that the push for economic growth could entail price inflation, this paper thus attempts to quantify it.

Such an exercise may be of relevance to the question of which of the countries are more amenable to some form of monetary cooperation with the others from the macroeconomic standpoint. Specifically, cooperation between a pair of countries may be more sustainable if an aggressive pursuit of economic growth by any one country does not have highly inflationary consequences that could destabilize its own financial market and the other country's via contagion. Sustainability may also not be an issue if a country's preoccupation with growth is backed by adequate international reserves to defend its currency from the destabilizing force of higher domestic inflation.

The rest of this paper is configured as follows. Section II presents the theoretical framework of the empirical enquiry while the empirical results and discussion are presented in Section III. Concluding remarks are made in Section IV.

II. THE THEORETICAL FRAMEWORK

The theoretical framework of this exercize departs from the expectations-augmented Phillips curve equation with the natural rate of unemployment (u^*)[2] incorporated as follows:

$$\pi_t = \alpha_0 + \alpha_1(u_t - u^*) + \alpha_2\pi_t^e \quad (1)$$

where π refers to the rate of inflation, u the unemployment rate and π^e the expected rate of inflation with α_1 and α_2 expected to be negative and positive respectively. It is generally believed that wage settlements and hence prices would at least to some extent be responsive to expected inflation. Hence, α_2 could lie in between the extreme values of zero and unity as posited by the Phillips and Friedman-Phelps hypotheses respectively.

The use of this theoretical underpinning is highly appropriate as the inflation-unemployment nexus is still viewed as critical in policy-making. Hence it remains very much on the agenda of researchers (Kustepeli 2005; Atkeson and Ohanion 2001; Niskaken 2002). The relationship between inflation and unemployment is central to the conduct of monetary policy (Gordon 1977). Blinder (1987) contends that the empirical Phillips curve has worked amazingly well for decades and deserves a prominent postion in the core model. The Phillips curve has generally been able to yield more accurate inflation forecasts than forecasts based on other macroeconomic variables such as interest rates, money and commodity prices (Stock and Watson 1999; Kustepeli 2005).

Nevertheless, empirical evidence on the existence of a Phillips curve with trade-offs between inflation and unemployment is mixed. Casual observations by Stanley (2002) suggest that six successive years of unemployment rates below estimated non accelerating inflation rates of unemployment (NAIRUs) yield declining rather than accelerating inflation in the U. S. Generally, the U. S. was then experiencing low and falling unemployment amid low and declining rates of inflation. Similarly, neither were high unemployment rates in Western Europe witnessed since the 1980s accompanied by deflations.

To further pave the way towards meeting the objective of the paper, it is assumed that a close relationship exists between unemployment rate and aggregate output measures. Hence the Okun's theory is invoked.[3] Specifically, since output is high and unemployment is low during periods of high employment, an inverse relationship between unemployment rates and detrended output levels can be expected (McCallum 1989). High (low) unemployment rates would correspond with low (high) values of output measured relative to trend or "normal" values.

Generally, Okun's notable theory postulates a simple relationship between unemployment and economic growth. Like the Phillips curve, Okun's theory has remained useful for capturing the relationship between output and unemployment (Weber and West 1996).

The Okun's notion of the relationship between unemployment and output may be mathematically represented as follows:

$$y - y^* = -\beta(u - u^*) \tag{2}$$

where y refers to the natural logarithm of output and u to the unemployment rate. The terms y^* and u^* are their corresponding equilibrium values defined as potential output and the natural unemployment rate respectively. The left-hand side of the equation defines the output gap while the right captures the unemployment gap with β being the Okun's coefficient. In the absence of unemployment gap, actual output approaches potential output.

Re-arranging and then substituting (2) in (1) yields the inflation-output relationship as follows:

$$\pi_t = \alpha_0 + \alpha_1^{'}(y - y^*) + \alpha_2 \pi_t^e \tag{3}$$

where $\alpha_1^{'} = -\alpha_1 / \beta$ and thus expected to be positive.

To account for the possible influence of supply shocks on the inflation generation process that may possibly give rise to omitted variable bias, the price of crude oil (p_{oil}) and the exchange rate of the domestic currency against the U.S.$ (s) are also introduced into the analysis. The US dollar is the major reserve and transaction currency of these countries. Though it is customary for researchers to account for oil price shocks such as those of 1973 and 1979 via the introduction of a dummy variable, it is felt more appropriate to rely on the actual oil price series given its availability.

III. EMPIRICAL RESULTS AND ANALYSES

The quarterly data used herein span generally from 1991 through 2006/7 and are drawn from the International Financial Statistics of the International Monetary Fund. However, the oil price series which is incorporated into the estimation of equation (3) for the purpose of checking the omitted variable bias is sourced from Bank Negara Malaysia's Monthly Economic Bulletin.

The Hodrick-Prescott filtering (Hodrick and Prescott 1997) and the quadratic trend-fitting techniques are relied upon for the determination of the equilibrium or trend value of output, y* and thus its gap, y-y^*. Since the results based upon Hodrick-Prescott detrended series parallel those based upon fitting of quadratic trends in terms of the statistical significance of the output gap coefficient, only the results based upon the former are reported for economy of space.

Prior to estimation of equation (3) for each individual country, a preliminary check is made on the time series properties of all the data series utilized to steer clear from the possible problem of spurious regression. Table 1 presents the Dickey-Fuller/Augmented Dickey-Fuller (DF/ADF) unit root test statistics. The optimal order of lag augmentation is determined based upon the Akaike Information and Schwarz-Bayesian criteria. It can be discerned from the table that for all the countries in question, inflation and output gap are integrated of order zero, I(0) while the exchange rate and the crude oil price series are integrated of order one, I(1). In the light of such findings, both series are incorporated into the estimation process in first logarithmic differences (Δs, Δp_{oil}) so that they are I(0) to be consistent with inflation and the output gap. The Vector Error Correction Modeling (VECM) technique along the lines of Johansen and Juselius (1990) is not adopted herein particularly because the variables of interest namely inflation and output gap are integrated of order zero. Hence it is appropriate to apply the Ordinary Least Squares (OLS), which is a technique also applied by Malinov and Sommers (1997) and Kustepeli (2005) in their Phillips curve-related studies.

Tables 2 through 8 present the country estimates of equation (3). Since full sample estimates may produce misleading results if structural changes in the economy do matter, sub-sample estimations are also attempted as a cross-check to maintain greater accuracy of the policy implications drawn. As the sole concern of the paper is with the inflation-output relation rather than to identify the determinants of inflation, the roles of the other variables are not discussed. Their inclusion is merely to minimize any omitted variable bias. Serial correlation tests from 1st order to 5th order are conducted and they all invariably rule out the presence of serially correlated errors. When non normality of residuals is detected, estimates are augmented with a dummy variable (D) for outliers. Two alternative proxies for expected inflation are relied upon. One refers to the one-period lead rate of inflation along the lines of McCallum (1976) and the other the lagged rate of inflation following Gordon (1985), Blackley (1989) and Payne (1995). The McCallum's approach refers to next period's inflation, whereas the Lucas's supply curve incorporates expectations of current inflation.

Estimates of equation (3) with respect to Singapore are furnished in Table 2. All the estimates therein except regression (4) could withstand all the diagnostic tests against serial correlation, functional form misspecification, non-normality of residuals and heteroskedasticity. It is interesting to note that though the full sample estimates, i.e. from 1991Q3 through 2006Q4 (regressions [1] & [2]) suggest output gap to be a statistically significant determinant of inflation with an estimated coefficient of about 0.04-0.05, it is only in the latter sub-sample period of 1999Q1-2006Q4 (regressions [5] and [6]) that it is indeed so. The coefficient estimated over this period is around 0.05.Output gap does not seem to matter in the earlier period of 1991Q3-1998Q4 (regression [3]).

Table 1
Augmented Dickey-Fuller Unit Root Tests

	Levels	*1st Difference*	*2nd Difference*
Malaysia			
Π	-2.346 [a]	-10.706*	-9.379*
	-6.224* [b]		
(y-y*)	-5.772*	-4.364*	-4.965*
S	-1.687	-5.003*	-6.510* [a]
			-9.684* [b]
Philippines			
Π	-4.004*[a]	-13.578*	-7.095*
	-5.955*[b]		
(y-y*)	-4.238*	-3.143*	-94.070*
S	-1.397	-4.655*	-10.307*
Indonesia			
Π	-4.404* [a]	-5.776*[a]	-7.610*
	-3.839* [b]	-8.991*[b]	
(y-y*)	-4.558*	-5.877*	-4.313* [a]
			-9.010* [b]
s	-1.255	-5.134*	-6.271* [a]
			-6.712* [b]
Singapore			
Π	-3.945*	-6.164*[a]	-6.189*[a]
(y-y*)	-3.936*	-9.710*[b]	-9.225*[b]
S	-1.243 [a]	-4.992*	-12.265*
	-0.721 [b]	-3.783*	-8.856*
Thailand			
Π	-4.314* [a]	-7.365*	-11.680*
	-5.150* [b]		
(y-y*)	-3.688*	-3.055*	-16.289*
S	-1.477 [a]	-5.379*[a]	-7.668*
	-1.658 [b]	-5.490*[b]	
South Korea			
Π	-7.596*	-9.465*	-8.923*
(y-y*)	-5.730*	-4.264*	-5.070*
S	-1.642 [a]	-5.837* [a]	-6.446* [a]
	-1.880 [b]	-5.915* [b]	-9.720* [b]
Japan			
Π	-3.168*	-10.586*	-9.028*
(y-y*)	-4.466*	-4.262* [a]	-11.180*
s	-2.107	-6.959* [b]	-6.532* [a]
		-3.524*	-11.786* [b]
Crude oil price	-1.655 [a]	-3.936* [a]	-10.422*
p_{oil}	-1.792 [b]	-5.629* [b]	

Notes: [a]Based on Akaike Information Criterion for lag augmentation
[b]Based on Schwarz-Bayesian Criterion for lag augmentation
* Significant at the 5% level

Table 2
Singapore

	1991Q3-2006Q4		*1991Q3-1998Q4*		*1999Q1-2006Q4*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
C	0.003	0.003	0.002	0.0007	0.004	0.004
	(2.991*)	(2.980*)	(0.844)	(0.421)	(2.959*)	(3.077*)
$(y-y^*)_t$	0.043	0.051	0.021	0.034	0.051	0.054
	(2.738*)	(3.310*)	(0.715)	(1.288)	(2.984*)	(3.162*)
Δst	-0.015	-0.009	-0.017	0.033	0.045	0.045
	(-0.722)	(-0.422)	(-0.608)	(1.054)	(1.350)	(1.310)
Δp_{oilt}	0.003	-0.0009	0.002	0.005	0.009	0.009
	(0.711)	(-0.227)	(0.195)	(0.636)	(1.776)	(1.700)
Π_{t-1}	0.353		0.599		0.127	
	(3.016*)		(3.210*)		(0.804)	
Π_{t+1}		0.357		0.711		-0.043
		(3.081*)		(3.866*)		(-0.261)
s2	-0.001	-0.001	0.001	0.002	-0.003	-0.003
	(-0.839)	(-0.773)	(0.598)	(1.252)	(-2.078*)	(-1.942)
s3	-0.001	-0.0008	-0.0009	0.0001	-0.001	-0.001
	(-0.834)	(-0.568)	(-0.462)	(0.064)	(-0.658)	(-0.673)
s4	-0.003	-0.003	-0.0007	0.0002	-0.004	-0.004
	(-1.998*)	(-1.749)	(-0.340)	(0.116)	(-2.107*)	(-1.990)
Adj-R^2	0.242	0.247	0.275	0.370	0.297	0.280
Std error of regression	0.003	0.003	0.003	0.003	0.003	0.003
LM (Chi-square) test for serial correlation	3.760 [0.439]	3.703 [0.448]	0.595 [0.964]	0.415 [0.981]	1.431 [0.839]	2.611 [0.625]
Functional Form (F)	1.349 [0.251]	1.973 [0.166]	0.001 [0.971]	5.190 [0.033]	0.014 [0.907]	0.052 [0.822]
Normality (Chi-sqare)	0.737 [0.692]	0.415 [0.813]	2.359 [0.307]	0.899 [0.638]	0.231 [0.891]	0.170 [0.918]
Heteroskedasticity (F)	0.397 [0.531]	1.051 [0.309]	2.565 [0.120]	0.123 [0.728]	0.296 [0.591]	0.362 [0.552]

Note: * Significant at the 5% level

Table 3 relates to the estimates for Thailand. As its overall sample period only begins in 1993Q1, no attempt is made to break the sample period into two as the resulting sub-sample period of 1993Q1-1998Q4 would then be too short to yield meaningful estimates. Only full and post East Asian crisis sample period estimations are attempted. Based upon the diagnostic tests, all the regressions are reliable for inference-making purposes. Though full sample estimates (regressions [1] and [2]) would rule out the output gap as an explanatory factor for inflation, it is featured

distinctly as bearing a statistically significant relation with inflation with a magnitude to the order of 0.2 over the sample period, 1999Q1-2007Q3 (regressions [5] and [6]).

The econometric estimates of South Korea are presented in Table 4. Given their diagnostic test outcomes, all the regressions are valid for interpretation. As in the case of Singapore, the trade-off between inflation and output growth can only be witnessed in the post East Asian crisis period. This is in view of the fact that the

Table 3
Thailand

	1993Q1-2007Q3		*1999Q1-2007Q3*	
	(1)	*(2)*	*(3)*	*(4)*
c	0.005 (2.543*)	0.003 (1.262)	0.001 (0.480)	0.002 (0.780)
$(y-y^*)_t$	0.029 (1.209)	0.010 (0.343)	0.225 (2.924*)	0.257 (3.410*)
Δs_t	0.051 (3.133*)	0.044 (2.427*)	0.067 (1.563)	0.071 (1.676)
Δp_{oilt}	0.100 (0.159)	-0.002 (-0.237)	0.009 (0.853)	0.010 (0.987)
Π_{t-1}	0.420 (3.740*)		0.024 (0.136)	
Π_{t+1}		0.330 (2.387*)		-0.142 (-0.833)
s2	0.006 (2.101*)	0.007 (2.314*)	0.015 (2.805*)	0.016 (3.365*)
s3	-0.0004 (-0.136)	0.004 (1.418)	0.010 (1.792)	0.011 (2.392*)
s4	-0.005 (-1.854)	-0.0003 (-0.115)	-0.007 (-2.114*)	-0.009 (-2.289*)
Adj-R^2	0.377	0.285	0.294	0.312
Std error of regression	0.007	0.007	0.006	0.006
LM (Chi-square) test for serial correlation	4.262 [0.372]	1.861 [0.761]	5.598 [0.231]	2.409 [0.661]
Functional Form (F)	0.346 [0.559]	0.026 [0.872]	1.528 [0.227]	1.123 [0.299]
Normality (Chi-sqare)	0.030 [0.985]	1.671 [0.434]	5.293 [0.071]	5.481 [0.065]
Heteroskedasticity (F)	0.227 [0.636]	0.043 [0.837]	2.275 [0.141]	3.511 [0.070]

Note: * Significant at the 5% level

Table 4
South Korea

	1991Q1-2007Q3		*1991Q1-1998Q4*		*1999Q1-2007Q3*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
c	0.013	0.016	0.015	0.019	0.019	0.023
	(5.856*)	(5.269*)	(5.534*)	(4.542*)	(4.959*)	(3.945*)
$(y-y^*)_t$	-0.010	-0.0003	-0.032	-0.012	0.116	0.143
	(-0.410)	(-0.013)	(-1.286)	(-0.385)	(2.225*)	(2.529*)
Δst	0.085	0.091	0.082	0.086	0.052	0.064
	(7.894*)	(7.521*)	(-7.285*)	(6.774*)	(2.056*)	(2.767*)
Δp_{oilt}	0.012	0.005	0.021	0.004	0.011	0.011
	(1.846)	(0.811)	(1.988)	(0.380)	(1.383)	(1.549)
Π_{t-1}	0.233		0.059		0.051	
	(2.507*)		(0.515)		(0.301)	
Π_{t+1}		-0.123		-0.146		-0.299
		(-1.066)		(-1.038)		(-1.437)
D_t		0.012				
		(2.743*)				
s2	-0.006	-0.004	-0.0009	-0.001	-0.013	-0.015
	(-2.092*)	(-1.289)	(-0.224)	(-0.253)	(-3.129*)	(-2.821*)
s3	-0.008	-0.007	-0.007	-0.009	-0.012	-0.014
	(-3.128*)	(-2.613*)	(-2.109*)	(-2.289*)	(-3.359*)	(-2.830*)
s4	-0.011	-0.011	-0.009	-0.012	-0.026	-0.028
	(-2.453*)	(-2.451*)	(-1.762)	(-2.045*)	(-3.249*)	(-3.187*)
Adj-R^2	0.623	0.606	0.784	0.752	0.353	0.411
Std error of regression	0.005	0.005	0.005	0.005	0.004	0.004
LM (Chi-square) test for serial correlation	7.706 [0.103]	7.514 [0.111]	4.963 [0.291]	7.178 [0.127]	7.375 [0.117]	1.668 [0.797]
Functional form (F)	3.094 [0.084]	3.298 [0.075]	1.141 [0.298]	0.438 [0.515]	1.098 [0.304]	1.136 [0.296]
Normality (Chi-square)	0.647 [0.723]	0.318 [0.853]	0.828 [0.661]	1.043 [0.594]	0.241 [0.887]	2.201 [0.333]
Heteroskedasticity (F)	0.095 [0.759]	0.100 [0.753]	0.094 [0.762]	0.232 [0.634]	1.819 [0.187]	5.066 [0.031]

*Note:** Significant at the 5% level

estimated output gap coefficient is only statistically significant based upon the sample period, 1999Q1-2007Q3 (regressions [5] and [6]). The magnitude of the coefficient is about 0.1. Estimates based upon other sample periods would dismiss output gap as an explanatory factor for inflation.

Results pertaining to Japan are reported in Table 5. All the estimated coefficients may be examined for their statistical significance by virtue of the diagnostic test

results. Though regression [3] suffers from heteroskedasticity, the t-statistics presented are White's heteroskedasticity-adjusted. Interestingly, contrary to the cases of Singapore and South Korea, the estimated output gap coefficient is only statistically significant based upon the 1991Q1-1998Q4 sample period (regression [3]). This is notwithstanding the fact that it is indicated to be so by a full sample estimate (regression [1], 1991Q1-2007Q4). However, even this inference would

Table 5
Japan

	1991Q1-2007Q4		1991Q1-1998Q4		1999Q1-2007Q4	
	(1)	(2)	(3)	(4)	(5)	(6)
c	-0.003	-0.004	-0.001	-0.0002	-0.005	-0.005
	(-4.411*)	(-3.644*)	(-1.167)	(-0.094)	(-6.132*)	(-5.447*)
$(y-y^*)_t$	0.082	0.068	0.141	0.096	0.068	0.057
	(2.281*)	(1.775)	(2.605*)	(1.743)	(1.296)	(1.084)
Δst	-0.026	-0.021	-0.037	-0.024	-0.012	-0.007
	(-2.931*)	(-2.372*)	(-2.445*)	(-1.898)	(-0.833)	(-0.532)
Δp_{oilt}	-0.007	-0.007	-0.017	-0.007	0.004	0.004
	(-1.684)	(-1.883)	(-1.712)	(-0.945)	(0.970)	(0.908)
Π_{t-1}	-0.168		-0.312		-0.094	
	(-1.628)		(-2.080)		(-0.573)	
Π_{t+1}		-0.036		-0.231		0.079
		(-0.341)		(-1.415)		(0.407)
D_t	0.012	0.012		0.012		
	(5.399*)	(5.261*)		(2.927*)		
s2	0.008	0.009	0.008	0.007	0.007	0.008
	(6.374*)	(6.762*)	(4.384*)	(2.659*)	(5.109*)	(5.601*)
s3	0.003	0.003	0.002	-0.0005	0.004	0.004
	(2.929*)	(2.237*)	(1.736)	(-0.258)	(3.263*)	(3.125*)
s4	0.004	0.004	0.004	0.003	0.005	0.005
	(3.641*)	(2.731*)	(1.757)	(1.099)	(3.782*)	(2.637*)
Adj-R^2	0.681	0.675	0.581	0.694	0.594	0.600
Std error of regression	0.003	0.003	0.004	0.004	0.002	0.002
LM (Chi-square) test for serial correlation	4.103 [0.392]	6.041 [0.196]	2.251 [0.690]	2.331 [0.675]	2.332 [0.675]	0.421 [0.981]
Functional Form (F)	0.559 [0.458]	1.323 [0.255]	0.898 [0.354]	0.671 [0.422]	3.557 [0.070]	2.482 [0.127]
Normality (Chi-square)	1.031 [0.597]	0.587 [0.746]	1.725 [0.422]	0.401 [0.818]	2.025 [0.363]	1.127 [0.569]
Heteroskedasticity (F)	0.003 [0.954]	0.060 [0.807]	12.261 [0.002]	0.041 [0.841]	0.301 [0.587]	0.098 [0.757]

*Note:** Significant at the 5% level

appear to be rather tenuous as the output gap is revealed to be statistically significant only when expected inflation is proxied by the lagged rate of inflation. This is unlike the cases of Thailand, Singapore and South Korea where the statistical significance of output gap is invariant to the specification for the expected rate of inflation.

The results of the other countries namely the Philippines, Indonesia and Malaysia fail to indicate any possible tradeoff between economic growth and inflation throughout the period from 1991 through 2006/7. Table 6 is related to the Philippines. All the regressions appear valid for interpretation except regression

Table 6
Philippines

	1991Q3-2006Q3		*1991Q3-1998Q4*		*1999Q1-2006Q3*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
c	0.015	0.016	0.017	0.018	0.024	0.023
	(4.948*)	(5.104*)	(3.773*)	(4.043*)	(3.474*)	(2.978*)
$(y-y^*)_t$	-0.039	-0.029	-0.103	-0.040	0.206	0.172
	(-0.676)	(-0.507)	(-1.447)	(-0.518)	(1.520)	(1.175)
Δs_t	0.019	-0.010	0.012	-0.020	0.038	0.003
	(0.902)	(-0.452)	(0.450)	(-0.678)	(0.792)	(0.062)
Δp_{oilt}	-0.011	-0.015	-0.011	-0.014	-0.003	-0.003
	(-1.205)	(-1.772)	(-0.704)	(-0.904)	(-0.235)	(-0.235)
Π_{t-1}	0.294		0.362		0.169	
	(3.240*)		(1.948)		(1.486)	
Π_{t+1}		0.290		0.350		0.153
		(3.086*)		(1.459)		(1.256)
D_t	-0.054	-0.054			-0.052	-0.052
	(-7.538*)	(-7.374*)			(-7.635*)	(-7.473*)
s2	-0.008	-0.008	-0.013	-0.011	-0.014	-0.014
	(-2.965*)	(-2.983*)	(-2.897*)	(-2.466*)	(-2.407*)	(-2.307*)
s3	-0.001	-0.0002	-0.004	-0.001	-0.005	-0.004
	(-0.433)	(-0.075)	(-0.938)	(-0.253)	(-1.135)	(-0.832)
s4	-0.005	-0.005	-0.0008	-0.009	-0.034	-0.028
	(-0.624)	(-0.637)	(-0.076)	(0.744)	(-1.857)	(-1.382)
Adj-R^2	0.569	0.559	0.290	0.225	0.674	0.665
Std error of regression	0.007	0.007	0.007	0.007	0.006	0.006
LM (Chi-square) test for serial correlation	5.794 [0.215]	7.148 [0.128]	6.437 [0.169]	6.001 [0.199]	2.775 [0.596]	6.266 [0.180]
Functional Form (F)	3.221 [0.079]	8.367 [0.006]	0.664 [0.424]	0.027 [0.871]	2.466 [0.131]	1.558 [0.226]
Normality (Chi-square)	1.818 [0.403]	1.276 [0.528]	0.330 [0.848]	0.267 [0.875]	1.801 [0.406]	1.925 [0.382]
Heteroskedasticity (F)	0.0004 [0.984]	0.028 [0.869]	1.984 [0.170]	0.464 [0.501]	0.544 [0.467]	0.461 [0.503]

Note: * Significant at the 5% level

[2] that could not withstand the functional form misspecification test. The other full and sub-sample regressions invariably suggest the absence of any statistically significant link between output gap and inflation given the low t-statistics concerned.

With regard to Indonesia as in Table 7, regression [4] warrants inference-making about explanatory variables while the others are plagued with the problem of functional form misspecification.[4] However, the low t-statistic of 0.705 of the estimated output gap coefficient would dismiss it as an inflationary factor in Indonesia.

Table 7
Indonesia

	1997Q1-2007Q3		*1999Q1-2007Q3*	
	(1)	*(2)*	*(3)*	*(4)*
c	0.010	0.026	0.024	0.029
	(1.827)	(4.900*)	(5.021*)	(7.382*)
$(y-y^*)_t$	-0.253	-0.468	0.140	0.090
	(-2.613*)	(-5.589*)	(1.267)	(0.705)
Δst	0.172	0.069	0.057	0.037
	(10.696*)	(2.995*)	(1.899)	(1.115)
Δp_{oilt}	-0.034	-0.065	-0.029	-0.037
	(-1.317)	(-2.571*)	(-1.565)	(-1.929)
Π_{t-1}	0.605		0.185	
	(7.757*)		(1.779)	
Π_{t+1}		0.471		0.084
		(5.451*)		(0.639)
D_t	0.083	0.097	0.077	0.079
	(4.936*)	(7.295*)	(7.235*)	(6.987*)
s2	-0.014	-0.017	-0.016	-0.016
	(-2.033*)	(-2.205*)	(-3.156*)	(-2.996*)
s3	0.007	-0.009	-0.012	-0.016
	(1.021)	(-1.142)	(-1.983)	(-2.623*)
s4	-0.010	-0.033	-0.004	-0.010
	(-1.331)	(-4.038*)	(-0.775)	(-1.577)
Adj-R^2	0.870	0.857	0.730	0.702
Std error of regression	0.016	0.017	0.010	0.011
LM (Chi-square) test for serial correlation	1.814 [0.770]	3.867 [0.424]	1.846 [0.764]	2.802 [0.592]
Functional Form (F)	40.158 [0.000]	38.710 [0.000]	5.996 [0.022]	2.161 [0.154]
Normality (Chi-square)	0.583 [0.747]	1.357 [0.507]	2.718 [0.257]	1.041 [0.594]
Heteroskedasticity (F)	0.526 [0.472]	0.782 [0.382]	0.219 [0.643]	0.349 [0.559]

Note: * Significant at the 5% level

Finally in the case of Malaysia as highlighted in Table 8, post East Asian crisis period estimates (regressions [5] and [6]) could pass all the diagnostic tests that permit interpretation of estimated coefficients. However by virtue of low t-statistics, output gap has no bearing on inflation.

Table 8
Malaysia

	1991Q2-2007Q3		*1991Q2-1998Q4*		*1999Q1-2007Q3*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
C	0.008	0.008	0.013	0.013	0.006	0.005
	(5.403*)	(5.330*)	(5.175*)	(5.306*)	(2.935*)	(2.797*)
$(y-y^*)_t$	-0.023	-0.036	-0.049	-0.047	-0.008	-0.027
	(-1.051)	(-1.699)	(-1.518)	(-1.413)	(-0.224)	(-0.773)
Δst	0.033	0.020	0.032	0.033	-0.029	-0.026
	(1.708)	(0.997)	(1.622)	(1.558)	(-0.415)	(-0.372)
Δp_{oilt}	-0.004	-0.005	0.0008	0.0005	0.001	0.0008
	(-0.800)	(-1.063)	(0.080)	(0.050)	(0.247)	(0.154)
Π_{t-1}	0.338		-0.045		0.370	
	(2.526*)		(-0.213)		(2.039*)	
Π_{t+1}		0.325		-0.049		0.401
		(2.050*)		(-0.246)		(2.153*)
s2	-0.005	-0.003	-0.003	-0.004	-0.005	-0.003
	(-3.135*)	(-1.760)	(-1.077)	(-1.126)	(-2.542)	(-1.669)
s3	-0.005	-0.005	-0.006	-0.006	-0.004	-0.004
	(-2.854*)	(-2.718*)	(-1.697)	(-1.689)	(-1.572)	(-1.647)
s4	-0.003	-0.005	-0.005	-0.005	-0.001	-0.003
	(-2.003*)	(-3.081*)	(-1.940)	(-1.665)	(-0.591)	(-1.192)
Adj-R^2	0.335	0.317	0.361	0.361	0.187	0.199
Std error of regression	0.004	0.004	0.005	0.005	0.003	0.003
LM (Chi-square) test for serial correlation	3.107 [0.540]	2.254 [0.689]	3.316 [0.506]	3.307 [0.508]	1.241 [0.871]	0.804 [0.938]
Functional Form (F)	8.850 [0.004]	4.027 [0.050]	4.873 [0.038]	4.732 [0.041]	0.198 [0.660]	0.297 [0.591]
Normality (Chi-sqare)	1.843 [0.398]	1.666 [0.435]	0.810 [0.667]	0.724 [0.696]	1.808 [0.405]	1.445 [0.486]
Heteroskedasticity (F)	10.008 [0.020]	9.681 [0.003]	5.039 [0.033]	5.048 [0.032]	0.287 [0.596]	0.156 [0.696]

Note: * Significant at the 5% level

IV. CONCLUDING REMARKS

The aim of this paper is to explore the possibility of a trade-off between economic growth and inflation in the five original ASEAN countries, Japan and South Korea.

This could form the basis for addressing the question of which of the countries could sustainably engage in monetary cooperation with one another, from the macroeconomic standpoint. It is a concern that countries that relentlessly pursue the economic growth objective may sacrifice the objective of price stability with highly inflationary consequences. A highly inflationary condition could in turn undermine the debt and foreign exchange markets, prompting disorderly capital flows and causing upheavals in the region's financial markets. The robustness of any regional reserve pooling or liquidity enhancement mechanism as a form of monetary cooperation may rest on the ability to maintain domestic price stability amongst member nations.

Rigorous analysis of the relationship between economic growth, specifically output gap and inflation is maintained in this paper by carrying out sub-sample apart from full sample estimations in order to draw more accurate and contemporaneously relevant policy implications. Full sample estimations may inadvertently disregard structural changes that an economy could have undergone over the length of the sample period. Indeed, this study highlights the weakness of relying upon too long a sample series for drawing meaningful implications as reflected by differences between full sample and sub-sample estimates. Moreover two de-trending techniques are resorted to in order to de-trend output, approximated by the real gross domestic product.

The regression analysis reveals that a trade-off possibly exists between economic growth and inflation in Singapore, South Korea and Thailand generally after the East Asian financial crisis years. However the output gap coefficient is rather small ranging from 0.05 in the case of Singapore to 0.2 in the case of Thailand. No trade-off appears in the estimates for the Philippines, Indonesia and Malaysia. In the case of Japan, the trade-off possibly existed only prior to the East Asian financial crisis years. In the light of these findings, one could infer that monetary cooperation is sustainable amongst these countries. Countries like Singapore and South Korea are reserves-rich economies. Even if they are overambitious in their growth pursuits with inflationary tendencies, they may have the means to counter any threat to their currency stability. Anyhow, the magnitude of the trade-off is found to be rather small. Hence, the other countries need not worry about the sustainability of macroeconomic policies pursued by Singapore and South Korea. As there is no evidence of trade-off in the other countries, their macroeconomic policies especially to pursue the growth objective need not be viewed with anxiety by their regional neighbors.

A logical extension to this study would then be to seek explanations for the low or zero trade-off between inflation and economic growth in these countries. Presumably, the explanations would lie in their structural characteristics or peculiarities. Thus this study could constitute a prelude.

Notes

1. The other ASEAN countries namely, Cambodia, Laos, Myanmar, Vietnam and Brunei and the rapidly growing China are excluded due to non access to their data. All the ASEAN countries, Japan, South Korea and China are generally referred to as East Asian economies.
2. u* may also be referred to as the non-accelerating inflation rate of unemployment (NAIRU). It need not be constant but time-varying instead (Stiglitz 1997 and Ferri, *et al.* 2001).
3. The theory has often been deployed in conjunction with the Phillips curve to understand the labor and commodity market implications of economic policy measures (Knoester 1986 and Apergis and Rezitis 2003).
4. The Indonesian quarterly data series are only available from 1997.

References

Apergis, N., and A. Rezitis (2003), "An Examination of Okun's Law: Evidence from Regional Areas In Greece." *Applied Economics* 35 **:** 1147-51.

Atkeson, A., and L. E. Ohanion (2001), "Are Phillips Curve Useful for Forecasting Inflation?" *Federal Reserve Bank of Minneapolis Quarterly Review* 25(1): 2-11.

Blackley, P. R. (1989), "The Measurement and Determination of State Equilibrium Unemployment Rates," *Southern Economic Journal* 56 : 440-56.

Blinder, A. S. (1987), "Keynes, Lucas and Scientific Progress," *American Economic Review* 77: 130-6.

Ferri, P.; E. Greenberg: R. H. Day. (2001), "The Phillips Curve, Regime Switching and the NAIRU," *Journal of Economic Behavior and Organization* 46(1): 23-37.

Gordon, R. J. (1985), "Understanding Inflation in The 1980s," *Brookings Papers on Economic Activity*, 1: 263-99.

Henning, R. *East Asian Financial Cooperation After the Chiang Mai Initiative.* Washington, D.C.: Institute for International Economics, 2002.

Hodrick, R. J., and E. C. Prescott (1997), "Postwar US Business Cycles: An Empirical Investigation," *Journal of Money, Credit and Banking* 29 : 1-16.

Johansen, S., and K. Juselius (1990), "Maximum Likelihood Estimation and Inference on Cointegration – With Application to The Demand for Money," *Oxford Bulletin of Economics and Statistics* 52 : 169-210.

Knoester, A. (1986), "Okun's Law Revisited," *Weltwirtschaftliches Archiv* 122: 657-65.

Kustepeli, Y. (2005), "A Comprehensive Short-run Analysis of a (Possible) Turkish Phillips Curve," *Applied Economics* 37 : 581-91.

Malinov, M. J. and P. M. Sommers (1997), "A New Line on the Phillips Curve," *Social Science Quarterly* 78(3) : 740-46.

McCallum, B. T. (1976), "Rational Expectations and the Natural Rate: Some Consistent Estimates," *Econometrica* 44 : 43-52.

McCallum, B. T. (1989), *Monetary Economics: Theory and Policy*. Singapore: Macmillan.

Niskaken, W. A. (2002), "On the Death of The Phillips Curve," *Cato Journal* 22(2) : 193-8.

Okun, A. M. (1962), "Potential GNP: Its Measurement and Significance," *American Statistical Association's Proceedings of the Business and Economics Statistics Section*.

Payne, J. E. (1995), "Expectations-augmented Phillips Curve: Further Evidence From State Economies," *Applied Economics Letters* 2 : 248-54.

Rajan, R. S. (2003), *Economic Globalization and Asia: Essays on Finance, Trade and Taxation.* Singapore: World Scientific, Institute of Policy Studies.

Stanley, T. D. (2002), "When All are NAIRU: Hysteresis and Behavioral Inertia," *Applied Economics Letters* 9: 753-57.

Stiglitz, J. E. (1997), "Reflections of the Natural Rate Hypothesis," *Journal of Economic Perspectives* 11 : 3-10.

Stock, J. H. and M. W. Watson (1999), "Forecasting Inflation," *Journal of Monetary Economics* 44(2): 293-335.

Weber, C. E. and J. E. West (1996), "Functional forms in Regression Models of Okun's Law," *Applied Economics Letters* 3 : 607-9.