



GROWTH-INFLATION LINKAGES IN EMERGING ASIAN ECONOMIES

Key points

- *Despite the tight labour market and the largely closed output gap, inflation has remained subdued in most emerging Asian economies over the past few years. This has cast doubt on whether there is a change in the growth-inflation relationship in the emerging Asian economies which will have implications for the current monetary policy stance.*
- *Our analysis on the Phillips curve suggests that the relationship between core inflation and economic slack in the emerging Asian economies generally remains unchanged after the Global Financial Crisis (GFC). The sluggish reaction of inflation to growth could be due to the lagged response of inflation to the economic cycles, with an average lag of four quarters. Nevertheless, we do observe a lower level of inflation given the same degree of economic slack and inflation expectation through a parallel downward shift of the Phillips curve in a number of economies, suggesting inflation in these economies could be structurally lower.*
- *Further investigation using sub-categories of core inflation reveals that education and health are the two major items contributing to lower levels of inflation in these economies, probably due to considerable increase in public spending after the GFC.*

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I. INTRODUCTION

Over the past few years, along with the tightening labour market, most emerging Asian economies have started growing above and close to their potentials. However, inflation has remained subdued, with headline CPI inflation staying either below historical averages or in the lower part of their official target ranges. As a result of this slow moving inflation, central banks will need to keep the accommodative monetary policy stance for a longer period to stimulate greater economic activity until noticeable inflationary pressure is present. This could result in excessive risk taking and leverage build-up. In addition, given ongoing monetary policy normalisation in advanced economies, a divergent monetary policy stance could encourage capital outflows from emerging Asian economies, thus adding more uncertainties to economic prospects and increasing the dilemma facing central banks.

This special analysis attempts to examine whether the Phillips curve, in its relationship between core inflation and output gap, has significantly changed in emerging Asian economies after the GFC. Our analysis points to no change in the Phillips curve relationship between core inflation and economic slack for a range of economies¹ after the GFC,² but there is a structural downward shift of inflation in some economies. This pattern is particularly evident in consumer categories like education and health service. Meanwhile, we find that the sluggish reaction of inflation to growth could be due to the lagged response of inflation to economic cycles, and the lags were on average four quarters.

II. DEFINITION OF CORE INFLATION AND ITS RECENT DEVELOPMENTS

One challenge of cross-economy studies on core inflation is the consistency of the definition of inflation. Definitions can vary both within and across economies. To overcome this challenge, we construct a new core inflation series for each emerging Asian economy in the sample based on similar CPI inflation compositions. We define core inflation as the headline CPI inflation that excludes food, non-alcoholic beverages, alcoholic beverages, tobacco, household energy, and transportation energy. As suggested in Table 1, the newly constructed core inflation accounts for a large part of the consumer baskets, and weighs at least half of the overall headline CPI inflation.

¹ China is not included since its consumer basket weights are not available.

² This is consistent with Blanchard, Cerutti, and Summers (2015), who found the slope of the Phillips curve decreased until early 1990 and stayed roughly stable since then for 20 advanced economies.

Table 1. Consumer basket weights³

	KR	ID	PH	HK	SG	TH	MY
Non-core	23.9	42.0	50.6	31.1	28.6	49.3	47.6
Food*	12.9	29.9	36.3	27.3	21.7	34.5	29.0
All beverages and tobacco	2.4	6.2	4.7	0.5	1.0	4.4	4.1
Household energy	4.2	5.9	8.1	2.7	3.4	5.1	3.2
Transport energy	4.4	N.A.	1.5	0.6	2.5	5.3	11.3
Core	76.1	58.0	49.4	69.0	71.5	50.7	52.4

Notes: *Both raw food and prepared food are included.

Source: CEIC.

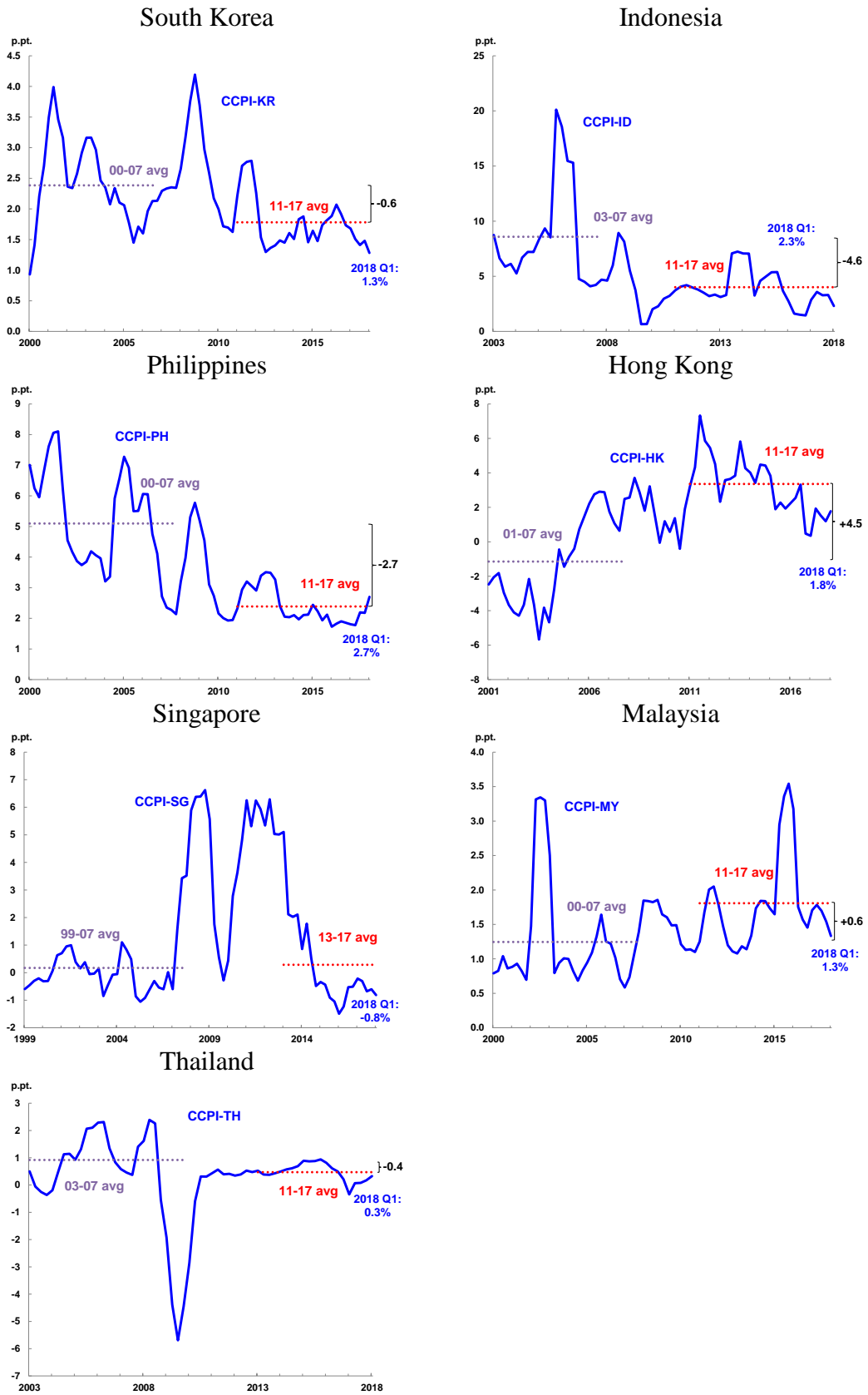
In recent years, core inflation of all seven emerging Asian economies in the sample has generally stayed at the lower range of the post GFC sample period (Chart 1). The low inflation persists until the beginning of 2018, when this note was written, even though growth has gradually picked up since early 2017.

However, if we look at inflation over a longer-time horizon, divergence emerges. When compared with the average pre-GFC inflation level, the post-GFC core inflation has become significantly lower in South Korea, Indonesia, and the Philippines. For the remaining economies, the post-GFC levels of core inflation are, on average, either higher (Hong Kong and Malaysia) or have barely changed (Singapore and Thailand). Interestingly, South Korea, Indonesia, and the Philippines are three inflation targeting economies which adopted the inflation targeting framework in 1998, 2001, and 2002, respectively and, with the exception of Thailand, all the remaining economies do not set inflation targets.

At this stage, we are missing a key explanatory factor for inflation dynamics, the slack in the economy or the output gap. Lower inflation could be solely due to sluggish underlying economic activities, rather than structural change in inflation itself. In the next section, we test the relationship between inflation and output gap, i.e. the Phillips curve, to shed light on the following questions. Has inflation become less reactive to the output gap, or in other words, has the Phillips curve become flatter? Or, has the inflation level become structurally lower while the relationship between inflation and output gap remains unchanged? And, what has contributed to the recent changes?

³ To focus on price change of consumer basket items and exclude the impact of weight changes on inflation dynamics, we use the pre-GFC weights of consumer goods in the basket as the benchmark weights for each economy.

Chart 1: Core inflation in emerging Asian economies



Sources: CEIC and HKMA staff calculation.

III. THE PHILLIPS CURVE

To test growth-inflation linkages, we estimate a New Keynesian Phillips curve (NKPC) for each economy separately. The NKPC depicts the relationship between inflation and economic activities, which also incorporates inflation expectation. According to the NKPC, during economic booms, excessive demand relative to the supply capacity tends to induce higher inflationary pressure, while during economic downturns, excess supply tends to result in lower inflationary pressure. A standard NKPC equation is as follows:

$$\pi_t = \alpha + \theta\pi_t^e + \gamma\tilde{y}_{t-i} + \eta_t \quad (1)$$

where π_t , π_t^e denotes core inflation and five-year forward inflation expectation rates at quarter t respectively.⁴

We conduct our estimations in two steps. First, we estimate equation (1) for the pre-GFC period to obtain appropriate numbers for output gap lags⁵ that we could use in our later estimation. Secondly, we apply the chosen number of lags and estimate the following equation:

$$\pi_t = \beta_0 + \beta_1 PostGFC_t + \beta_2\tilde{y}_{t-i} + \beta_3 PostGFC_t * \tilde{y}_{t-i} + \beta_4\pi_t^e + \epsilon_t \quad (2)$$

Slightly different from equation (1), we add two more control variables. One is the dummy variable *PostGFC* that equals to one for the sample period since the GFC (i.e. since 2011) and equals to zero for the sample period before the GFC (i.e. until 2007). Another is the interaction of *PostGFC* dummy with the lagged output gap. According to the regression results (see Table A2 in Annex for detailed estimation results), several observations can be made:

- i. Consistent with the estimates for equation (1), in the pre-GFC period core inflation positively responds to output gap with certain lags in most emerging Asian economies, except Malaysia.

⁴ The headline five-year forward inflation expectation rates are used because expectation of headline inflation in the longer term reflects expectation of underlying trend of price development without the impact of short-term price fluctuations, and thus are more comparable with current core inflation rates. Asia Pacific Consensus Forecast (APCF) publishes surveyed five-year forward inflation expectation twice a year (every April and October). To avoid reverse causality issue, for the same year, we match core inflation in June and September with April's five-year inflation expectation, and December and March in the next year with October's five-year inflation expectation. APCF does not provide five year inflation expectation for the Philippines until 2009, and thus we do not include inflation expectation for the Philippines when we estimate equations (1) and (2).

⁵ The appropriate numbers of lags are selected mainly based on the goodness-of-fit of equation (1), measured by adjusted R-square. The chosen lags are reported in Table A1 in the Annex, which are highlighted in bold and blue.

- ii. After the GFC, the responsiveness of core inflation to output gap has not significantly changed in most emerging Asian economies (Chart 2.1). Thailand and Malaysia are two exceptions in which the responses have slightly changed.
- iii. Consistent with our observations in Chart 1, the conditional mean of core inflation has significantly reduced in the post-GFC period for South Korea, the Philippines, and Indonesia, but has increased for Hong Kong and Malaysia, and stayed unchanged for Singapore and Thailand (Chart 2.2).

Chart 2.1: Change in the inflation-output gap relation in the estimated Phillips curve

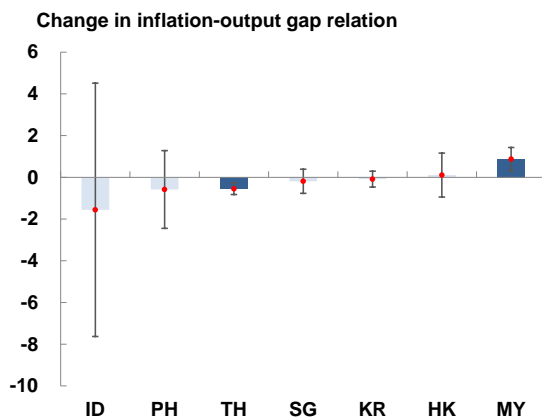
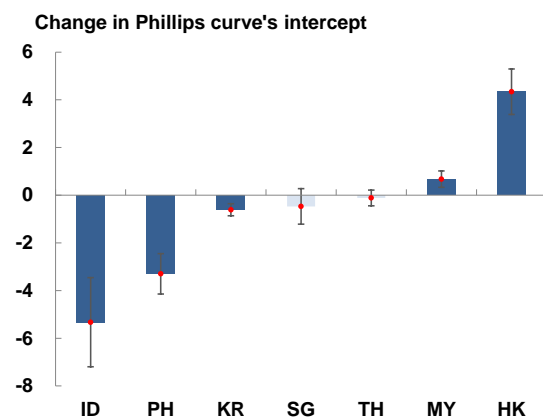


Chart 2.2: Change in the intercept of the estimated Phillips curve

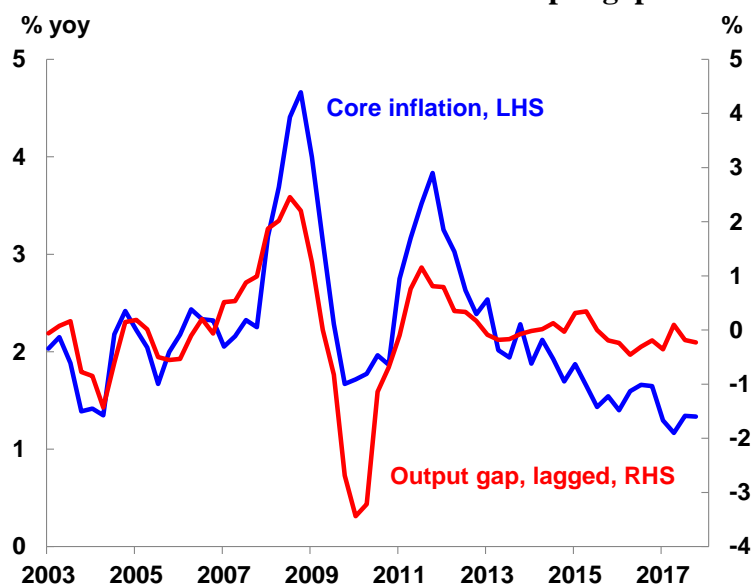


Notes: The chart shows the change from the pre-GFC period (2003-2007) to the post GFC period (2013-2017). Dark blue bars represent significant change, while light blue bars represent insignificant change. The error bars refer to two standard deviations in the confidence interval.

Source: HKMA staff estimates.

The results could provide some insights into the current low-inflation puzzle. In South Korea, the Philippines and Indonesia, the inflation levels might have become structurally lower accompanied by a downward shift of the Phillips curve. However, given that the slope of the Phillips curve has not changed in South Korea, the Philippines, and Indonesia, as growth continues to pick up, inflation is likely to slowly pick up, although to a level lower than historical data suggests. As there is no significant change in the Phillips curve in Hong Kong and Singapore, it is likely that inflation will slowly edge up because growth has been strong. The currently low inflation might be due to the lagged reaction of inflation to growth. In sum, for most emerging Asian economies, despite the structural downward shifts after the GFC, inflation remains responsive to economic slacks (Chart 3).

Chart 3: Core inflation and Output gap



Notes: Both core inflation and output gap are PPP-weighted average of emerging Asian economies that preserve the growth-inflation linkages after the GFC, including KR, PH, HK, and SG. Indonesia is excluded since the weight for transportation energy in the consumer basket is not available.

Source: HKMA staff estimations.

IV. WHAT COULD HAVE CONTRIBUTED TO THE DOWNWARD SHIFT IN INFLATION FOR SOME ECONOMIES AFTER THE GFC?

To better understand the reasons for the structurally lower inflation in Korea, the Philippines, and Singapore, we examine inflation sub-components in these economies. More specifically, we conduct the same regression specification in equation (2) to see which sub-components are more accountable.⁶ Although South Korea, the Philippines, and Indonesia are the only three countries with the downward shift, we also examine inflation in the sub-components and output relation in the remaining economies to see whether there is any common pattern. Based on the regression results (detailed estimation results are available upon request), a couple of observations can be drawn.

- i. Relatively larger weights for service categories, such as health and education, are the common items that show significantly lower conditional means and the magnitudes of downward shifting are also meaningful. This is particularly true for South Korea, the Philippines, and Indonesia.

⁶ Here we use a similar approach in Mahedy and Shapiro (2017), in which they claim that disinflation in health-care services was the major driver for the persistent weakness in US core PCE inflation since the GFC.

- ii. There are not many categories that have significantly lower conditional means in Hong Kong and Malaysia, which is consistent with the aggregate estimates in Chart 2.2.

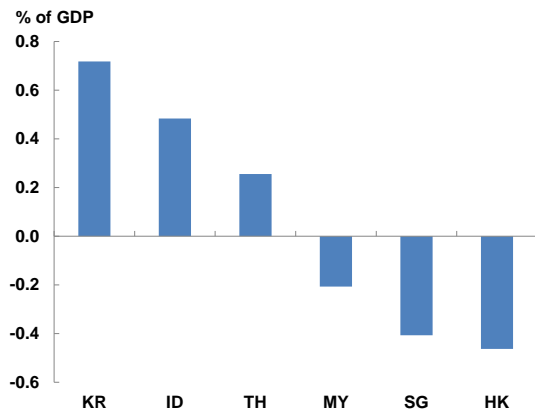
One possible explanation for the disinflationary pressure on education and health might be due to public spending. An increase in public spending, such as a government subsidy, might exert downward pressure on inflation through the channel of shifting out the supply curve. For instance, in Singapore, government health assistance schemes have halved health care inflation down to about 1.2%.⁷

Likewise, as we can see in Chart 4.1, the downward shifts in inflation for education sectors in South Korea, the Philippines, and Indonesia echo the increase in public spending on education in those economies after the GFC. Meanwhile, the public expenditure on health sectors has broadly increased in emerging Asian economies (Chart 4.2), which is also consistent with the findings we see in the downward shifts of inflation for health related categories in the Philippines, Indonesia, South Korea, and Thailand.

Other factors could also contribute to lower inflationary pressures, such as lower commodity prices, government support for the rental market to reduce pressure on housing costs, massive support for infrastructure to lower transportation costs, the expansion of Business-to-consumer (B2C) marketing to bypass traditional agent costs, and advancements in the Information and Communications Technology (ITC) sector to increase price transparency and lower costs.

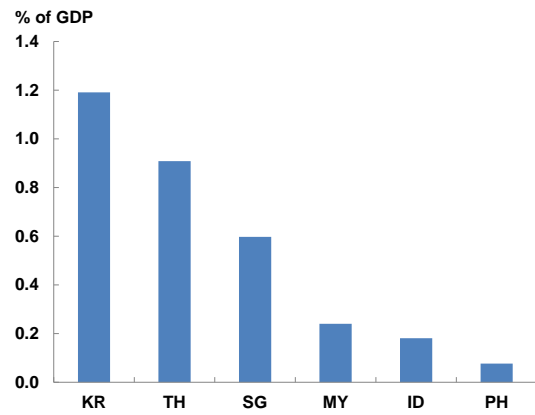
⁷ See "[Govt. assistance schemes helped halve healthcare inflation rates](#)", Chee Hong Tat, Ministry of Health, Singapore.

Chart 4.1: Change in share of public expenditure on education between pre-GFC and post-GFC periods



Notes: Pre-GFC refers to 2000-2007 average, while post-GFC refers to 2011-2014 average.
Source: United Nations.

Chart 4.2: Change in share of public expenditure on health between pre-GFC and post-GFC periods



Notes: Pre-GFC refers to 2000-2007 average, while post-GFC refers to 2011-2014 average.
Source: WDI.

V. CONCLUDING REMARKS

Our analysis on the Phillips curve for a range of emerging Asian economies reveals that the relationship between inflation and growth remains largely unchanged after the GFC. However, in three of the economies (South Korea, the Philippines, and Indonesia), the average level of inflation has become lower regardless of the output gap in the post GFC period. In other words, the Phillips curve has shifted downwards. By looking further into the composition of core inflation, we find that this pattern is particularly evident in consumer spending categories like health and education services. In addition, inflation reacts to the output gap with a lag of up to four quarters.

With the potential lagged reaction of inflation to output gap development, central banks must stand ready to prevent any overshooting of inflation, along with excessive risk taking and leverage build-up. Additionally, in formulating appropriate monetary policies, regional central banks may need to take into account sustained disinflationary factors, such as public spending that is devoted to reduce poverty and improve inequality, technology innovations that lower communications costs, and pro-competitive effects of large-scale infrastructure investments.

Annex:
Table A1. Number of output gap lags used in NKPC
(selected lags are given in bold and blue)

	Lags	γ	P-value	Adj. R-square
South Korea	1	0.2	0.04	0.52
	2	0.3	0.00	0.69
	3	0.4	0.00	0.84
	<u>4</u>	<u>0.4</u>	<u>0.00</u>	<u>0.85</u>
	5	0.3	0.00	0.69
Philippines	1	-0.3	0.46	-0.01
	2	0.0	0.97	-0.03
	3	0.4	0.31	0.00
	<u>4</u>	<u>0.8</u>	<u>0.06</u>	<u>0.08</u>
	5	0.3	0.52	-0.02
Indonesia	1	-0.1	0.98	0.06
	2	3.2	0.25	0.13
	3	3.5	0.17	0.16
	<u>4</u>	<u>4.7</u>	<u>0.05</u>	<u>0.26</u>
	5	1.8	0.43	0.09
Hong Kong	<u>1</u>	<u>0.9</u>	<u>0.00</u>	<u>0.49</u>
	2	0.7	0.02	0.30
	3	0.3	0.29	0.16
	4	0.1	0.81	0.13
	5	0.0	0.83	0.13
Singapore	1	0.2	0.00	0.21
	<u>2</u>	<u>0.2</u>	<u>0.00</u>	<u>0.23</u>
	3	0.2	0.01	0.17
	4	0.1	0.11	0.02
	5	0.1	0.23	-0.02
Thailand	1	-0.2	0.57	-0.08
	2	-0.1	0.71	-0.09
	3	0.2	0.58	-0.08
	4	0.4	0.13	0.04
	<u>5</u>	<u>0.6</u>	<u>0.01</u>	<u>0.24</u>
Malaysia	1	-0.2	0.04	0.08
	2	-0.3	0.01	0.18
	<u>3</u>	<u>-0.3</u>	<u>0.00</u>	<u>0.26</u>
	4	-0.2	0.03	0.10
	5	0.0	0.61	-0.06

Table A2. Core inflation and output gap

	KR	PH	ID	HK	SG	TH	MY
<i>Post-GFC</i>	-0.6***	-3.3***	-5.3***	4.3***	-0.5	-0.1	0.7***
<i>Output gap</i>	0.4***	0.8**	4.6***	0.7***	0.2***	0.5***	-0.3***
<i>Post-GFC * output gap</i>	-0.1	-0.6	-1.6	0.1	-0.2	-0.6***	0.9***
<i>Inflation expectation</i>	0.1	n.a.	-1.7***	0.4	1.3**	0.0	0.0
<i>Constant</i>	2.2***	5.3***	17.5***	-2.2	-2.1**	0.6	1.1***
<i>Observations</i>	64	48	48	57	56	48	60
<i>R-squared</i>	0.8	0.6	0.5	0.7	0.2	0.3	0.3

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

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