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Monetary Policy and Inflation Dynamics in ASEAN Economies

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Abstract

This paper investigates the evolution of inflation dynamics in the five largest ASEAN countries between 1997 and 2017. To account for changes in the monetary policy frameworks since the Asian Financial Crisis (AFC), the analysis is based on country-specific Phillips Curves allowing for time-varying parameters. The paper finds evidence of a higher degree of forward-looking dynamics and a better anchoring of inflation expectations, consistent with the improvements in monetary policy frameworks in the region. In contrast, the quantitative impact of cyclical fluctuations and import prices has gradually diminished over time.

JEL Classification Numbers: C22, E31, E5

Keywords: Phillips curve, monetary policy, inflation expectations, ASEAN countries

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Contents

Figures

Tables

I. INTRODUCTION

Inflation dynamics in the five founding members (Indonesia, Malaysia, the Philippines, Singapore and Thailand) of the Association of Southeast Asian Nations (ASEAN) has experienced substantial changes over the last 20 years (see IMF, 2018a). In line with the experience of many emerging economies adopting inflation targeting regimes, headline inflation and inflation volatility in ASEAN-5 economies have declined significantly since the early 2000s. But inflation challenges have not disappeared. Asian economies weathered well disinflationary pressures in the aftermath of Global Financial Crisis (GFC), but the decline in oil prices since 2014 has proven more challenging. From a monetary policy perspective, whether this disinflation stems from high sensitivity of inflation to oil price changes or a weakening of forward-looking dynamics and the anchoring of inflation expectations yields very distinct implications.

Against this background the aim of this paper is twofold. First, to provide evidence on how inflation dynamics has evolved in ASEAN-5 economies over the last three decades. Second, to explore the extent to which changes in inflation dynamics can be attributed to the improvement of monetary policy frameworks.

To get quantitative evidence on inflation dynamics in ASEAN-5 economies we employ a hybrid New Keynesian Phillips Curve specification (e.g. Galí and Gertler, 1999) extended to an open-economy context[1] and allowing for time variation in the parameters along the lines of recent contributions like Ball and Mazumder (2011) and Blanchard (2016) among others. More specifically, this paper documents the changes in the contribution of long-term expectations (i.e. forward-looking dynamics), economic slack, oil price inflation and non-oil-import price inflation across countries over the last three decades.

Using our novel evidence on the main inflation drivers in the region, we then explore the link between monetary policy transparency and inflation dynamics. The five largest ASEAN countries may offer very interesting lessons of how the improvement of monetary policy frameworks can change inflation dynamics and the challenges that remain looking forward. Our results can therefore prove very useful for many other Emerging Economies currently involved in the improvement of their monetary policy regimes while facing the challenges of increased globalization.

Our main findings are as follows. The adoption of price stability as a major monetary policy objective, higher central bank transparency and enhanced communication have improved the anchoring of inflation expectations and led to stronger forward-looking dynamics (or lower persistence) in inflation over the last two decades. In contrast, the quantitative impact of cyclical fluctuations has gradually diminished over time. Interestingly, we find evidence of a significant flattening of the Phillips curve in ASEAN economies since the GFC. Since these economies were relatively less affected by the crisis than many other advanced economies our

[1] We abstract from theoretical derivations of the hybrid NKPC and do not include terms of trade in our Phillips curve specification. Instead we follow the specification of Blanchard (2016).

findings suggest the Phillips curve flattening may be a global phenomenon (e.g. Ball and Mazumder, 2011, Blanchard et al, 2015), with potentially far reaching implications for monetary policy worldwide.

Our results support the fact that exchange rate liberalization, economic development and technological progress have contributed to reduce the effect of non-oil and oil import inflation on headline inflation. However, strong disinflation and, in some cases, outright deflation in oil-importing economies (Singapore, Thailand) since 2014 indicate that supply-side shocks have not been fully counterbalanced by the forward-looking component of the inflation process in ASEAN-5 yet.

This paper contributes to the growing interest on inflation analysis for the ASEAN countries (e.g. Direkudomsak, 2016, Guinigundo, 2016, Hendar, 2016, Khemangkorn et al., 2008, Meng, 2016, Singh, 2016). The existing literature on inflation dynamics in the ASEAN region nonetheless remains still limited, and mainly focuses on country-specific analyses using different model specifications, data samples and estimation techniques. We provide a common framework that allows for better international comparison not only among ASEAN countries but also as example to many other emerging economies. Our analysis expands to ASEAN economies existing literature findings that inflation targeting lowers inflation persistence (e.g. Benati, 2008, for advanced economies, Gerlach and Tillmann, 2012, for some Asian countries) and the positive correlation between central bank transparency and the anchoring of inflation expectations (e.g. Van der Cruijsen and Demertzis, 2007). Our paper also provides additional quantitative evidence to support recent exhaustive reviews of the evolution of monetary policy frameworks in Asia and the ASEAN region (e.g. Morgan, 2013, IMF, 2016).

The remainder of the paper is organized as follows. Section II describes our benchmark model specification and the data used in our empirical work. Section III discusses our main findings for the region as a whole, focusing on the potential impact of enhanced monetary policy transparency and communication on inflation dynamics. In addition, we document a flattening of the Phillips curve in the ASEAN-5 countries since the GFC. A detailed discussion of country-specific results is provided in Section IV. Section V discusses robustness checks regarding data and our benchmark Phillips curve specification. Section VI finally concludes.

II. EMPIRICAL METHODOLOGY AND DATA

Modeling Inflation Dynamics

A key goal of this paper is to unveil the main drivers of inflation dynamics in ASEAN-5 economies. Our empirical approach relies on the estimation of Phillips Curves at a country level. Our specification builds on the hybrid New Keynesian Phillips Curve (NKPC) specification of Fuhrer and Moore (1995) and Galí and Gertler (1999) among others. To allow for potential changes in the coefficients over time, either from the evolution of monetary policy regimes, or reflecting changes in the global economic environment since the onset of the GFC, we allow for time-varying coefficients in our estimation along the lines of IMF (2016), Blanchard (2016) and Dany-Knedlik and Holtemöller (2017) among others.

Formally, we estimate the following Phillips Curve as a benchmark specification:

$$\pi_t = \beta_t^1 \bar{\pi}_t + (1 - \beta_t^1)\pi_{t-1}^{MA4} + \beta_t^2 \tilde{y}_{t-1} + \beta_t^3 \pi_t^{IM} + \varepsilon_t \quad (1)$$

where π_t is headline consumer price index inflation, $\bar{\pi}_t$ denotes long-run inflation expectations, π_{t-1}^{MA4} is the moving average of inflation over the previous four quarters, $\tilde{y}_{t-1}$ is the economic slack measured as the output gap, π_t^{IM} is inflation of imported goods and services and ε_t is the measurement error and is assumed to be a Gaussian white noise process. In terms of economic interpretation, the coefficient β_t^1 measures how much inflation is driven by long-term expectations, that is, the forward-looking component of inflation in contrast to the influence of lagged inflation, which in turn is captured by (1-β_t^1). β_t^2 measures the impact of cyclical economic activity on inflation, i.e. the slope of the Phillips Curve. Finally, the effect of import price inflation is captured by β_t^3.

Data

We use quarterly data from 1995Q1 until 2016Q4 for ASEAN-5 countries. Due to data limitations, the sample of Indonesia and Malaysia starts in 1998Q1. Our benchmark specification uses headline consumer price indexes and real GDP from the World Economic Outlook (WEO) database and import price indices from the HAVER database. Import price and headline CPI are included in the estimation as year-on-year inflation rates. The output gap is computed using the standard HP-filter. As our measure of long-term inflation expectations, our benchmark specification uses trend estimates from Garcia and Poon (2018, see section III.A for further details). For the computation of contributions (see Section III for details) and for further robustness checks (see section IV for details), we also use crude oil price and nominal exchange rates from the HAVER database, as well as Consensus long-run inflation expectations.

Estimation Approach

We estimate the model using a standard Kalman filter with Gauss-Newton optimization with the Marquardt step method. Starting values for parameters and variances are taken from OLS regressions over a ten-year rolling window. We also introduce country-specific variance ratios across all state equations based on the signal to noise ratios from the rolling window estimation.

To sharpen the discussion, particularly over the disinflationary episode 2014-16, we decompose the contribution of import price inflation into non-oil-import price inflation and oil price inflation using a regression analysis in line with IMF (2013, 2016). As a robustness check, in Section IV we relax that assumption and estimate directly non-oil import and oil price inflation contributions.

III. WHAT DRIVES INFLATION DYNAMICS IN ASEAN-5 COUNTRIES?

We discuss our results in two steps. We first provide an overview of our key findings from a multi-country perspective, highlighting the main characteristics of inflation dynamics in the ASEAN-5 region. In a second stage, we elaborate in greater detail the country-specific findings, in particular over the disinflation period experienced in those countries between 2014-16.

A. Key Findings

To illustrate the contributions of the different inflation drivers across ASEAN-5 countries, we use the country-specific estimations and compute the relative median contribution of long-term expectations (i.e. forward-looking dynamics), economic slack, oil price inflation and non-oil-import price inflation across countries over time (see Figure 1). The main insights are as follows.

We find that inflation expectations have become the most important driver of inflation dynamics across ASEAN-5 countries, and explain on average around 60% of median inflation in the region. Compared to the importance of expectations, the contributions of economic slack, non-oil-import and oil price inflation are modest and explain on average only 9%, 12% and 7%, broadly in line with the estimation residual (9%).

ASEAN-5 inflation has become increasingly forward-looking since the AFC, although the contributions of inflation expectations somewhat declined during the GFC and in the recent low inflation period 2014-16. Forward-looking dynamics averaged 43% between 1996 and 2001, and increased to around 66% thereafter, declining temporarily over the GFC (57%) and the recent disinflation period (61%).

Economic slack contributions to inflation have gradually become more limited over the sample as a whole, but showing some higher relevance in recessionary episodes. From 1995 until 2007

economic slack explained around 7% of headline inflation, and although it rose to 15% over the economic expansion prior to the GFC (2002-07), that rise was temporary and thereafter declined to less than 5%. Higher contributions in recessionary periods however point to some non-linearities in the transmission of supply shocks in the region, while the more muted impact of economic activity on inflation dynamics in recent years is consistent with available evidence for advanced economies following the GFC (e.g. Watson, 2014, among others).

Figure 1: Relative Median Contributions to Inflation

Note: We obtain the relative median contributions by estimating equation (1) for each country and simulating the contributions of the four inflation drivers as well as for the residual. We then take the median contribution of driver and of headline inflation rates at each point in time across countries. The relative median contribution is then the median contribution of a specific driver over the median headline inflation.

The quantitative importance of import price inflation for ASEAN-5 inflation dynamics have changed significantly over the last three decades. Non-oil import inflation and, to a less extent, oil price inflation were jointly the major drivers of inflation rates during the AFC (almost 27%). Thereafter, however, their contributions declined (to around 8% and 5% respectively for most of the sample). Only over the most recent disinflationary episode (2014-16), non-oil-import and oil price inflation contributions (15% and 18% of median headline inflation respectively) rebounded again. The removal of subsidies along the years and the potential improvements in the price discovery mechanism in the ASEAN-5 economies may have contributed to attenuate the impact of imported inflation on overall inflation.

Overall, the stylized facts above inflation dynamics discussed above are very much in line with the experience of many other advanced and emerging economies. Indeed, there is evidence of global inflation factors playing an important role in inflation developments in most countries and the ASEAN-5 economies have not been immune to those influences (for a recent discussion see IMF, 2018b).

The Role of Forward-Looking Dynamics

The increase in the forward-looking component of inflation dynamics after the AFC is one of the key findings of our analysis. We will argue such a change is mostly related to most ASEAN-5 countries enhancing their monetary policy frameworks and operational practices since the AFC. We provide additional supporting evidence for that conjuncture below. In terms of our empirical framework, the coefficient on forward-looking dynamics, β_t^1, and the level of (long-term) trend inflation, $\bar{\pi}_t$, play a crucial role in providing stable inflation rates and macroeconomic stability. They are therefore crucial for monetary policy.

Guiding long-term inflation expectations are a crucial element of modern monetary policy making. The consistency of private sector's inflation expectations at medium-to-long horizons with the central bank's target provides a direct assessment of the credibility of monetary policy. Moreover, in an environment of very low inflation, stable long-term inflation expectations are essential to bring inflation back to target.

Surveys of inflation expectations and expectations extracted from financial instruments are nowadays among the standard indicators monitored by many central banks.[2] In addition, the estimation of long-term inflation trends using econometric models has become increasingly common in major central banks since the GFC. The rationale behind those research efforts is twofold. First, given the forward-looking orientation of modern monetary policymaking, policy decisions should be based on reliable indicators of long-term inflation expectations. While survey and financial indicators provide useful information, both have important shortcomings, which may have rendered them less reliable in an environment characterized by persistently low inflation. Second, discrepancies between both types of indicators require a regular assessment of their information content and the estimation of trend inflation measures can be instrumental in that regard.

Among the ASEAN-5 countries, break-even inflation rates (BEIRs) are only available for Thailand, and therefore are not an alternative variable of choice as a measure of $\bar{\pi}_t$ in our econometric exercise. To account for the aforementioned shortcomings of survey-based expectations, we employ trend inflation estimates from Garcia and Poon (2018).[3] Their framework uses survey-based expectations as an additional source of information to estimate trend inflation−the optimal conditional long-term inflation forecasts−while allowing for potential deviations of survey-based expectations from the estimated level of trend inflation.

[2] Surveys are a traditional source of information about long-term expectations, as they have been available several times per year for many countries over several decades. With the issuance of inflation-linked bonds in many advanced but also emerging economies, the so-called "break-even inflation rate" (BEIR) - the yield spread between comparable conventional bonds and ILBs - has also become a crucial indicator of inflation expectations. BEIRs often provide more timely information on investors' inflation expectations than survey-based expectations. Yet, in addition to the expected inflation, BEIRs may incorporate other factors, notably inflation risk and liquidity risk premium, and should better be interpreted as the overall inflation compensation requested by investors to hold nominal assets, rather than a pure measure of expected inflation.

[3] Based on the methodology introduced by Chan et. al (2018).

Figure 2: Long-term Inflation Expectations (trend inflation estimates, percent)

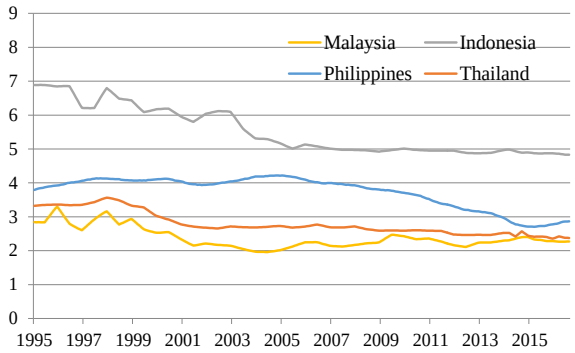
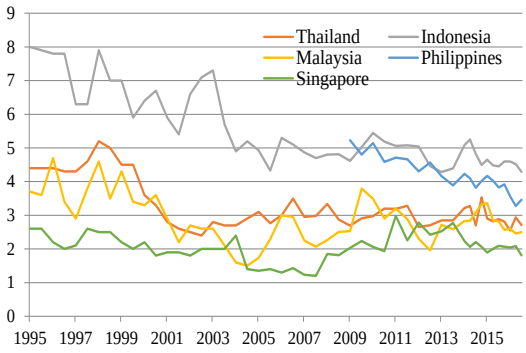


Figure 3: Consensus Long-run Inflation Expectations (percent)



Figures 2 and 3 depict the long-term trend inflation estimates included in our benchmark estimation compared to the Consensus Economics long-term (6-10 years ahead) expectations. Survey expectations are substantially more volatile compared to trend inflation estimates. For Malaysia, Indonesia and Thailand trend estimates lie below the Consensus survey expectations throughout the sample. Within the framework of Garcia and Poon (2018) and Chan et al. (2018), this points towards a systematic deviation of actual trend expectations that can be explained by informational rigidities (see Coibion and Gorodnichenko, 2015, and Mertens and Nason, 2015).

The role of monetary policy to foster forward-looking dynamics is twofold. Aligning private sector's inflation expectations at medium-to-long horizons to the central bank's target is necessary, but not sufficient for stabilizing inflation dynamics. Additionally, long-run inflation expectations should exert a substantial influence on inflation dynamics, e.g. actual inflation should have an important degree of forward-looking dynamics, as opposed to be driven by past inflation only. In other words, the private sector's (long-term) inflation expectations should be aligned to the central bank's inflation target−the public should regard the inflation target as a highly likely outcome for actual inflation in the future−and economic agents should also incorporate the inflation target into their pricing decisions.

In our hybrid Phillips Curve specification (1), the sum of the degree of forward and of backward looking dynamics is set to unity. Thereby, β_t^1 determines the importance of inflation long-term expectations and $(1 - \beta_t^1)$ represents the importance of past inflation, or inflation persistence. Gali and Gertler (1999) provide the theoretical foundation for this specification. They augment the new Keynesian Phillips curve by assuming two groups of price setters; one that sets prices according to the purely forward-looking NKPC and the other that is adjust prices according to price indexation, whereby prices are set equal to the average of the most recent round of price adjustments, i.e. to past inflation (Calvo, 1983).

Forward-looking Inflation Dynamics and Central Bank Transparency

Central bank transparency is essential for managing inflation expectations and their impact on inflation dynamics. As pointed out by Blinder et al. (2008), central bank transparency matters because both the underlying structure of the economies and the monetary policy framework may change over time, and, should such changes occur, the central bank should clearly communicate them to the public to enhance monetary policy effectiveness. Transparency should then be fundamental whenever information on the macroeconomic situation is asymmetrically distributed between the central bank and the public, and, when expectations are not completely rational. Against this general background, effective communication of the central banks objectives and its strategy, its decisions and the rationale behind them, as well as information about the outlook for inflation, real economic activity and the economy in general, are crucial elements of a transparent monetary policy. In our empirical model, a transparent central bank should be capable of aligning public long-run trend expectations ($\bar{\pi}_t$) to the central bank's inflation target, and achieve a certain degree of forward-looking behavior in price setting.

In the last two decades, central bank transparency increased significantly in the ASEAN-5 countries. Before the AFC, pegged exchange rate regimes dominated the monetary policy environment in the ASEAN-5 region. Excessive borrowing and currency mismatch by corporates and banks led to severe exchange rate pressures and depreciations when capital flows reversed. To strengthen monetary policy independence and to gain more open capital accounts, all ASEAN-5 increased their exchange rate flexibility since the AFC. In addition, ASEAN-5 central banks made significant improvements in their operating frameworks and policy objectives, as well as in communication efforts as a response to challenges coming from the global economic environment (see e.g. Morgan, 2013, IMF, 2018).

Table 1 summarizes the current status of the monetary policy frameworks and communication practices in ASEAN-5 countries. Low and stable inflation is included in monetary policy objectives in all ASEAN-5 countries with Thailand, Indonesia and Philippines adopting an explicit (but in some cases flexible) inflation targeting regime. Also, main communication tools like the statement of a primary policy objective, the medium-term inflation target and the publication and explanation of monetary policy decisions are implemented across countries. The heterogeneities across availability and timing of the publications of minutes, as well as inflation rates, point to further potential for improving central bank transparency and communication in the ASEAN-5 region.

Figure 4 depicts a quantitative measure of central bank transparency−the Dincer and Eichengreen (2014) central bank transparency index (DE index) − for ASEAN-5 countries. For reference purposes, a benchmark average index of top 5 scoring countries (Czech Republic, Israel, New Zealand, Hungary and Sweden) is also depicted. Starting with low scores between 2 and 4 index points in 1998, the index illustrates that ASEAN-5 countries have gradually but steadily improved central bank transparency: Indonesia, Philippines and Thailand to scoring between 9 and 10 index points in 2014, and Malaysia and Singapore 6 and 5, respectively. Compared to the top 5 performers, however, there is generally still room for further improvements of central bank transparency in ASEAN-5 countries.

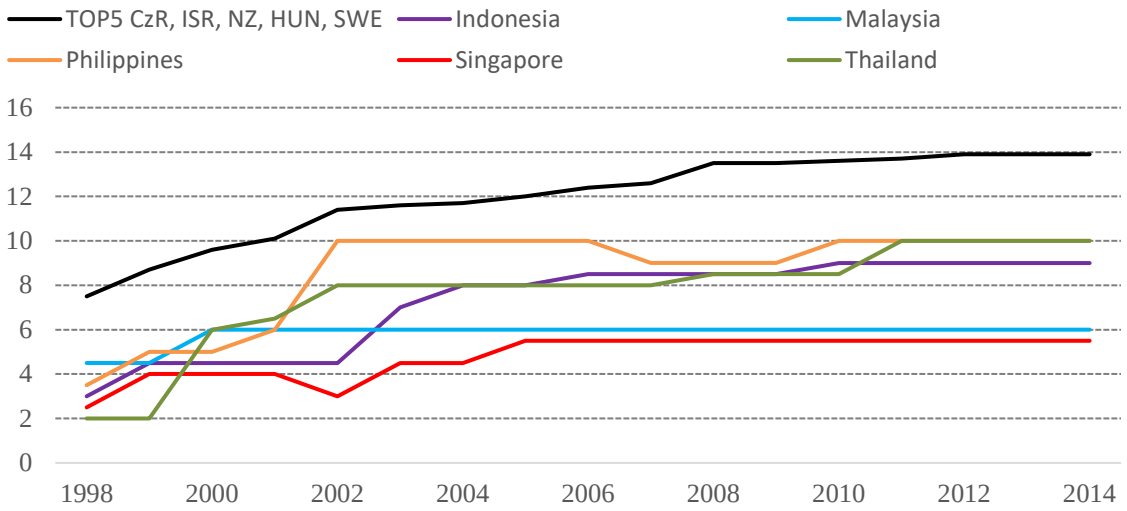
Table 1: Monetary Policy Frameworks and Transparency in ASEAN-5 Countries

	Indonesia	Malaysia	Philippines	Singapore	Thailand
Central bank mandate	Achieve and maintain a stable value of rupiah	Promote monetary and financial stability conductive to sustainable growth of Malaysian economy	Promote and maintain price stability provide proactive leadership in bringing about a strong financial system, conductive to a sustainable growth of the economy	Maintain price stability foster a sound and reputable financial stability ensure prudent and effective management of foreign reserves and grow Singapore's as international competitive financial center	Maintain monetary stability and payment systems
Primary monetary policy objective	Stable price of goods and services and stable exchange rate	Price stability with sustainable growth	Price stability	Price stability	Price stability
Stated monetary policy framework	Inflation targeting (2005)	Flexible inflation targeting without explicit anchor	Inflation targeting (2002)	Implicit inflation targeting	Flexible inflation targeting (2000)
Medium term inflation target	4% ±1% (approved target for 2015-2017))	No explicit target (about 3% over long-term)	3%±1% (approved target for 2015-2018)	Comfort level of about 2%	2.5%±1.5% (approved target for 2018)
Report on macroeconomic outlook					
Inflation report	Monthly	No	Quarterly	Semi-annually*	Quarterly
Decision and rational					
Monetary policy stance	Yes, on the day of decision	Yes, on the day of decision	Yes, on the day of decision	Yes, on the day of decision	Yes, on the day of decision
Minutes policy meetings	Yes	No	Yes, one month after the meeting	No	Yes, two weeks after the meeting
Explanation of decision making process	Yes	Yes	Yes *(also letter to the President if target is missed)*	Yes	Yes *(also letter to Minister of Finance if target is missed)*

Sources: Central Bank webpages and authors' compilation
* Singapore's Monetary Authority also provides its inflation outlook as addition to the monthly inflation data publication.

Supporting evidence on the link between central bank transparency and forward-looking dynamics in inflation can be seen in Figures 5 and 6. Both the of time-varying estimates of the forward-looking coefficient, β_t^1, and the overall contribution of long-term expectations to inflation, $\beta_t^1 \bar{\pi}_t$, are positively correlated with the respective DE transparency score for each country. Our results therefore support the view that the greater transparency in the ASEAN-5 central banks can be associated with a higher degree of forward-looking dynamics in these countries.

Figure 4: ASEAN-5 CBs: Dincer-Eichengreen Central Bank transparency index



Note: Based on Dincer and Eichengreen (2014). Maximum score of 15 based on 5 dimensions of CB transparency including about policy objectives (explicit objectives, quantification, instrument independence), economic information used for monetary policy decisions (data, model and central bank forecasts), decision making process (policy strategy, prompt account of deliberations, voting information), disclosure of policy decisions (prompt announcement, explanations, forward guidance), and policy implementation (evaluation with respect to targets, shocks impairing achieving goals, explain decision to achieve policy objectives). As reference, the scoring of the ASEAN-5 countries is compared to that of the top five countries in the Dincer-Eichengreen sample (Check Republic, Israel, New Zealand, Hungary and Sweden).

Figure 5: Degree of Forward-Looking Dynamics and Dincer-Eichengreen Transparency Index: estimated coefficients

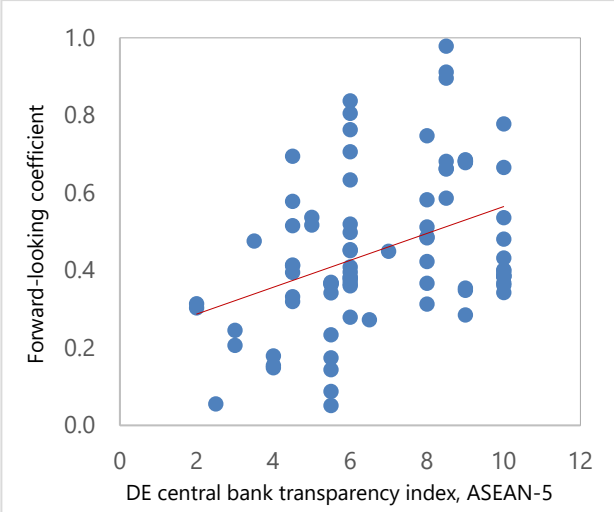
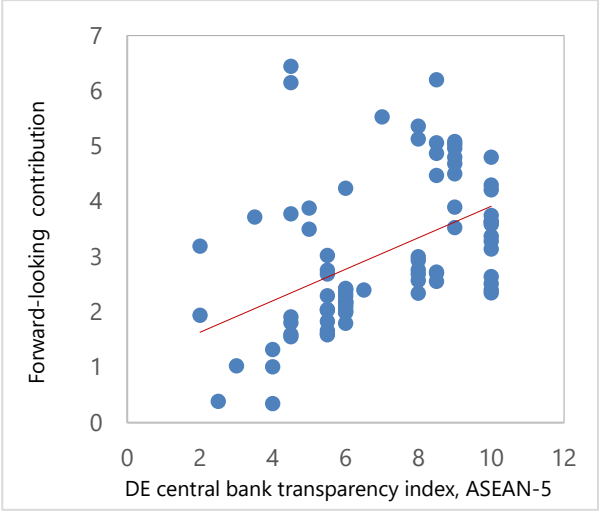


Figure 6: Degree of Forward-Looking Dynamics and Dincer-Eichengreen Transparency Index: estimated contributions



Inflation Dynamics and Cyclical Fluctuations

The slope of the Phillips Curve is a key parameter of interest since the relationship between economic slack (unemployment or overall economic activity) and inflation was postulated, and continues to generate substantial attention nowadays (e.g. Blanchard et al., 2015). In the case of ASEAN-5 countries, it is therefore important to discuss how strong the impact of the cyclical economic position is for inflation dynamics in the region.

The contribution of economic slack to overall inflation has fluctuated significantly across the last three decades (see Figure 7). It has been quantitatively more important ahead of the GFC, but thereafter movements in economic slack have played a very limited role in the inflation process. The higher importance of economic slack in the first half of the 2000s can be related to structural transitions of the ASEAN-5 economies induced by exchange rate liberalization, enhanced economic policy and intrinsic economic transition as adjustment process resulting from the AFC.

Over recent years all ASEAN-5 countries have experienced a flattening of the Phillips curve. Although in some cases that flattening may imply a decline from average, historical levels (e.g. Indonesia). And for other countries from relatively very high levels pre-2008, the bulk of the decline took place by early 2010s, but was followed by a stabilization at a lower level thereafter (see Figure 8). Such a flattening of the Phillips curve is more in line with available evidence from advanced economies that were more severely affected by the GFC (e.g. Blanchard, 2016, IMF, 2013, 2016), despite the fact that ASEAN-5 economies were relatively less affected by the financial turbulences. However, it is not a phenomenon experienced by other advanced Asian economies. For example, South Korea has, in contrast, experienced a mild but nonetheless steepening of the Phillips curve since 2010. Yet, such a steepening has compensated an earlier flattening that took place over the 2000s, but particularly in the second part of that decade. This evidence suggests that ASEAN 5 economies may be experiencing a flattening of the Phillips curve somewhat later than other advanced economies.

The flattening of the Phillips curve in ASEAN-5 economies, we unveil here, has important implications for monetary policy and the understanding of inflation dynamics. For example, it helps explain the relatively low inflation experienced across ASEAN-5 economies in 2017 despite the growth momentum in all the countries in the region. Although the reasons why such a flattening of the Phillips curve may be taking place are beyond the scope of this paper,[4] it deserves close monitoring.

[4] The declining sensitivity of median inflation in ASEAN-5 to output gap could also be linked to the behavior of potential output during period of declining inflation. For example, with a possible strengthening of potential output in ASEAN-5 since the GFC (Anand et al., 2014), fiscal and monetary policy may not have to react strongly and this may affect the estimates of the PC slope.

Figure 7: Median Contribution of Output Gap to Inflation in ASEAN-5 countries

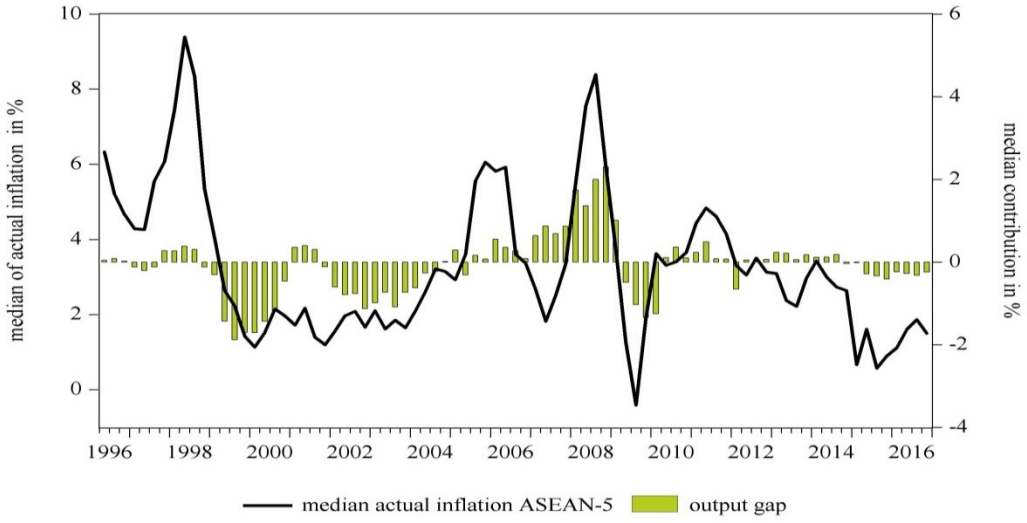
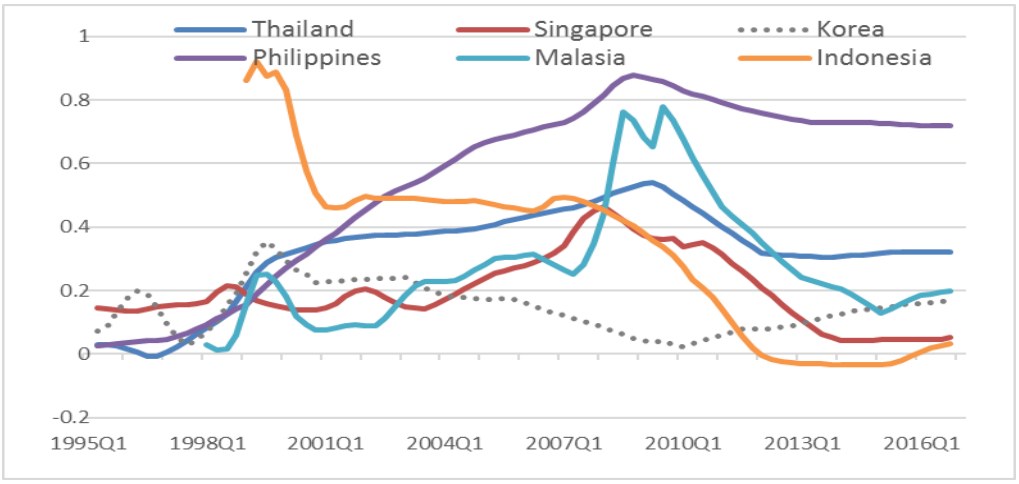


Figure 8: Phillips Curve Slope in the ASEAN-5 and South Korea

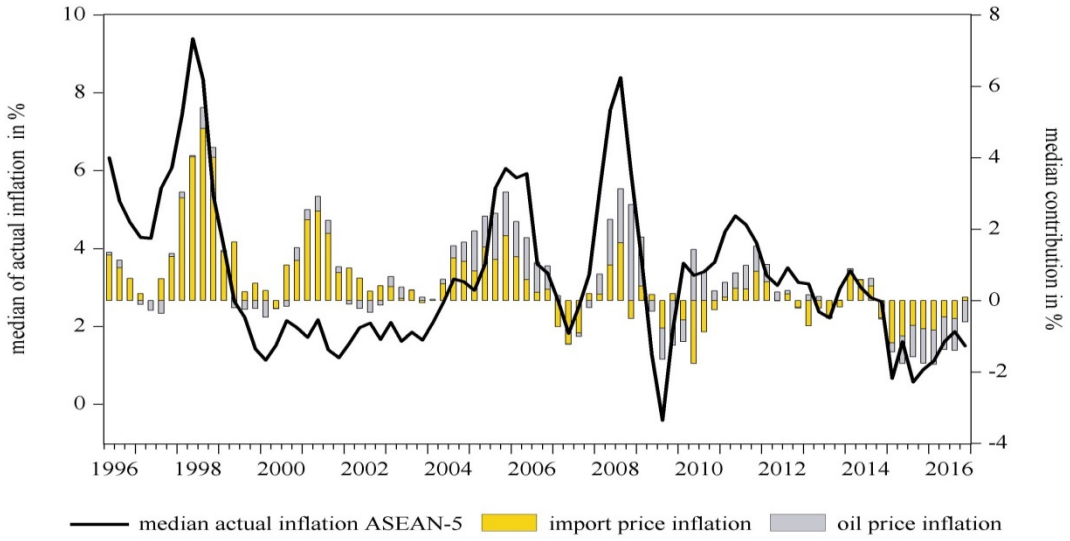


Note: β_t^2 parameter in equation $\pi_t = \beta_t^1 \bar{\pi}_t + (1 - \beta_t^1)\pi_{t-1}^{MA4} + \beta_t^2 \tilde{y}_{t-1} + \beta_t^3 \pi_t^{IM} + \varepsilon_t$ estimated at country level

Inflation Dynamics, Non-oil-import and Oil Price Inflation

The sharp fall in oil prices is a recurrent explanation for the recent low trend in inflation rates since 2014. This raises the question of whether oil price inflation has in general a strong impact on headline inflation, or whether the magnitude of the oil price decline since 2014 was an unusual episode of oil prices driving inflation developments. When looking at the relation between headline inflation and oil price inflation for the ASEAN-5 group as a whole, it is important to bear in mind that Malaysia and Indonesia are oil producing countries, while Thailand, Philippines and Singapore are oil importers.

Figure 9: Median Contribution of Import Price Inflation in ASEAN-5 Countries



As it can be seen in Figure 9, the combined contributions of non-oil-import and oil price inflation declined substantially after AFC. Yet, while the quantitative importance of non-oil import inflation has diminished significantly since the early 2000s, that of oil price inflation rose after the AFC. Oil price contributions lie between 0.30 percentage points and -0.49percentage points from 1996-2001 and the contributions range increases to (1.41 -0.17 percentage points) between 2002-08. In the recent period of disinflation, oil price inflation drove down median inflation by -0.46 percentage points in 2015 and -0.59 percentage points in 2016, which suggests that the contributions were substantial, but not out of range with other historical episodes.

In sum, our analysis suggests that over the last two decades long-run inflation expectations have become the most important driver of ASEAN-5 inflation. This development is highly correlated to the evolution and enhancement of monetary policy frameworks and central bank communication in those countries. Other traditional drivers, for example the output gap movements, have a more limited impact on headline inflation in normal conditions, but much stronger during crisis periods. Import inflation contribution has also become more limited over time, although has been rather stable since the early 2000s. The next Section looks at the individual country experiences in greater detail.

IV. COUNTRY-SPECIFIC EVIDENCE

This section discusses our estimation results at the country level. The purpose is twofold. First, we report our estimation results in greater detail, including the evolution of time-varying parameters and the uncertainty surrounding the estimates, as well as the implied contributions of drivers to headline inflation for each of the countries. Second, we illustrate how the individual country experiences relate to the general patterns discussed in the previous section.

Indonesia

Indonesian inflation rate has declined from an average of 8.5% before the GFC to around 5% after the GFC (see Figure 10). Yet, towards the end of our sample, disinflationary pressures have been limited for Indonesia, possibly reflecting a less direct impact of low commodity prices due to the fuel and electricity subsidies still in place although reduced since 2015.

The main drivers of Indonesian inflation process have changed over time to become less dependent on real economic activity and import inflation. In the early 2000s, economic slack and import inflation accounted for half of inflation developments: for example, in 2002 Indonesian inflation rate was about 12% of which 6.3 percentage points could be explained by economic activity and import inflation (3.5 percentage points by the output gap, 2.1 percentage points by non-oil-import prices and 0.8 percentage points by oil price inflation) and only 3.6 percentage points was determined by expectations of future inflation. In contrast, in 2015 inflation expectations explained 4.9 percentage points of the 6.4% headline inflation rate, while economic slack accounted for 0.05 percentage points, non-oil-import inflation and oil price inflation contribute with 0.8 percentage points and -0.5 percentage points respectively.

Figure 10: Main Inflation Components: Indonesia

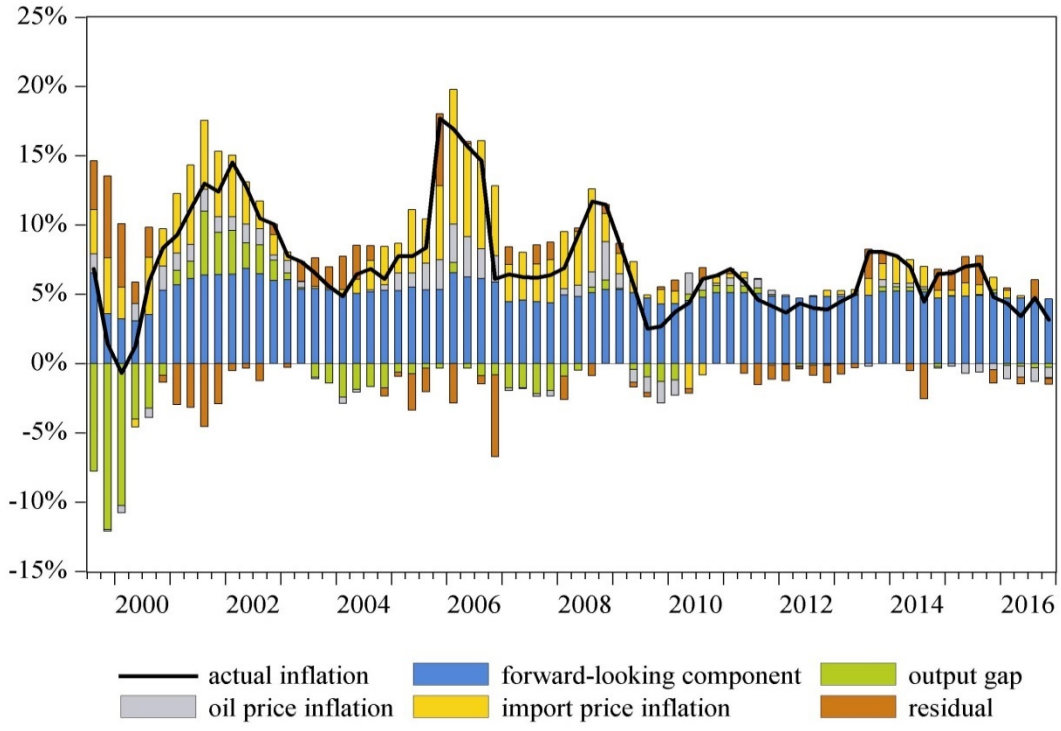
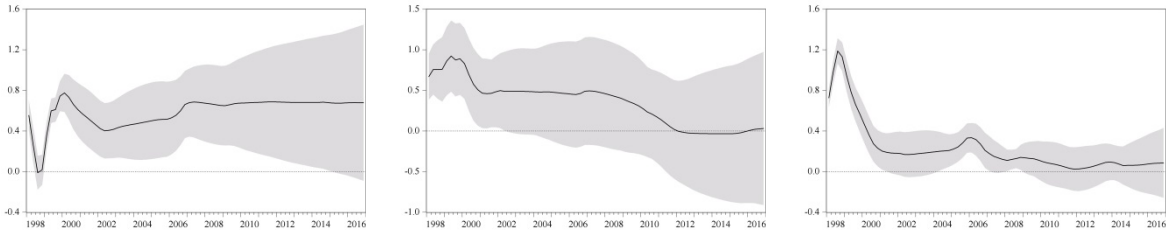


Figure 11: Time-varying Coefficient Estimates: Indonesia

(a) Trend expectation (b) Economic slack (c) Import inflation



Improvements in the monetary policy framework coincide with partially strengthened forward-looking dynamics of Indonesian headline inflation. Contributions of trend inflation expectations in Indonesia rise sharply in the first half of the 2000 and stabilize thereafter. In particular, the contribution of forward-looking dynamics increased by 74% from 2001 (2.67 percentage points) to 2005 (4.7 percentage points) and continue to narrowly fluctuate around 4.7 percentage points since then. The reason for the increase is twofold. First, the coefficient of the forward-looking component (see Figure 11 panel a) rose from 0.32 in 2001 to 0.73 in 2007, stabilizing at around 0.7. Second, the Indonesian trend inflation estimates (see Figure 2) have fallen from 7.9% in 2001 to 5% from 2007 onwards.

The rise in forward-looking dynamics between 2002-07 seemed to be related to the continuous improvement of the Bank Indonesia's (BI) monetary policy framework and communication strategy over that period.[5] In particular, the Central Bank Act of 2004 outlined a clear mechanism for accountability and transparency of monetary policy, including the announcement of the inflation target and a monetary policy plan at the start of each year, the provision of a quarterly report to parliament on the conduct of monetary policy, the Monetary Policy Report, the publication of decisions of Monetary Board meetings, the economic forecasting models and a monetary policy outlook. Moreover, in early 2005 the BI began to use interest rates as the main policy instrument due to difficulties of controlling base money.[6]

Indonesia's headline inflation has been stable at low levels around 5% since the GFC. This stabilization can be related to improvements in monetary policy framework and

[5] In 2000 BI adopted an explicit inflation targeting framework to achieve and price stability, i.e. low and stable inflation, and stable exchange rates. Initially, base money was used as an operational target to achieve inflation targets defined in terms of core CPI inflation rates. As core inflation proved to be a more difficult concept to communicate to the public, the Central Bank Act No 3/2004 induced the government to set annual and medium-term inflation targets based on headline CPI inflation rates, following the BI's recommendations.

[6] Following the central bank reforms in 2004, inflation dynamics became somewhat more forward-looking. However, inflation volatility remained at high levels due to ad hoc adjustments of administered prices in 2005 and 2008, which led to actual CPI inflation higher than short-term targets. This created uncertainty over inflation expectations and affected monetary policy credibility as BI's communication mainly focused on short-term rather than medium-term inflation targets (IMF, 2010, Box 3). In mid-2010 BI re-evaluated its monetary policy framework including the adoption of a policy mix of monetary and macroprudential policies (IMF 2012). BI's communication has improved, focusing more on the medium-term inflation target and de-emphasizing other policy objectives s, like output and credit growth.

communication together with a declining importance of import prices, including oil and non-oil. Further improvements in forward-looking monetary policy communication and coordination between monetary and fiscal policy will ensure stable headline inflation in the future.

Real economic slack has played a very limited role in Indonesia's headline inflation rate since the GFC. The output gap contributions have declined from 2007 onwards, from a range of 4.2 to -1.7 percentage points in 2001-07 to 0.4 to -0.7 percentage points in 2008-16. This can be directly related to a decline in the Phillips Curve slope (from 0.49 in 2001 to 0.03 in 2010, see Figure 12 panel b) but also to a lower volatility of the output gap. In turn, the range of Indonesian output gap simultaneously declined from a range of 4.2% to -1.8% between 2001-08 to a range of 0.4% to 0.7% thereafter.

The quantitative importance of import price inflation has also diminished over time, especially non-oil-import price inflation. After an increase from 0.13 in 2001 to 0.31 in 2006, the coefficient of import prices stabilizes at around 0.08 from 2008-16 (see Figure 12 panel c). Contributions of non-oil-import and oil price inflation declined from an average of 2.4 and 1.5 percentage points between 2001-08 to 0.83 and 0.13 percentage points thereafter. The higher impact of oil price inflation from 2000-07 appears to be associated with pressures from administrated prices arising from energy subsidy reforms (Hendar, 2015). After 2008, however, better coordination between the central bank and the government's policy on administrated prices has helped attenuate the impact of oil price fluctuations on inflation.

Malaysia

Malaysian inflation rates have remained remarkably stable compared to the other ASEAN-5 countries since the GFC. Over our sample, Malaysian headline inflation has averaged 2.5%, out of which 2.08 percentage points are explained by forward-looking inflation expectations and only 0.2 percentage points are related to economic slack and import inflation (output gap 0.02 percentage points, non-oil-import price inflation 0.06 percentage points, oil price inflation 0.11 percentage points). More recently, a relatively high and even increasing forward-looking coefficient and stable long-run expectations (Figure 3) have decisively contributed to limit disinflationary pressures stemming from falling oil and import prices since 2014.

Since the early 2000s Bank Negara Malaysia (BNM) has steadily enhanced its monetary policy framework, transparency and communication strategy regarding its objectives, namely low and stable inflation with sustainable growth. Since mid-2003 monetary policy statements have been released on a quarterly basis, and from 2006 onwards, shortly after Malaysia moved from a U.S. Dollar peg to effective exchange rate stability, statements are released directly after the monetary policy meetings.

Improvements in the monetary policy framework in response to the GFC seemed to strengthen the shift towards forward-looking dynamics in Malaysian inflation. The Central Bank Act in 2009 redefined and expanded the BNM monetary policy framework, and existing communication and transparency in quarterly economic and financial reports, monthly

statistical publications, press conferences and statements as well as annual reports including BNM forecasts for economic growth, inflation and policy outlook strengthened further. Monetary policy statements are now released immediately after the MPC meetings, which since 2010 take place every two months rather than about 8 times per year.

Figure 12: Main Inflation Components: Malaysia

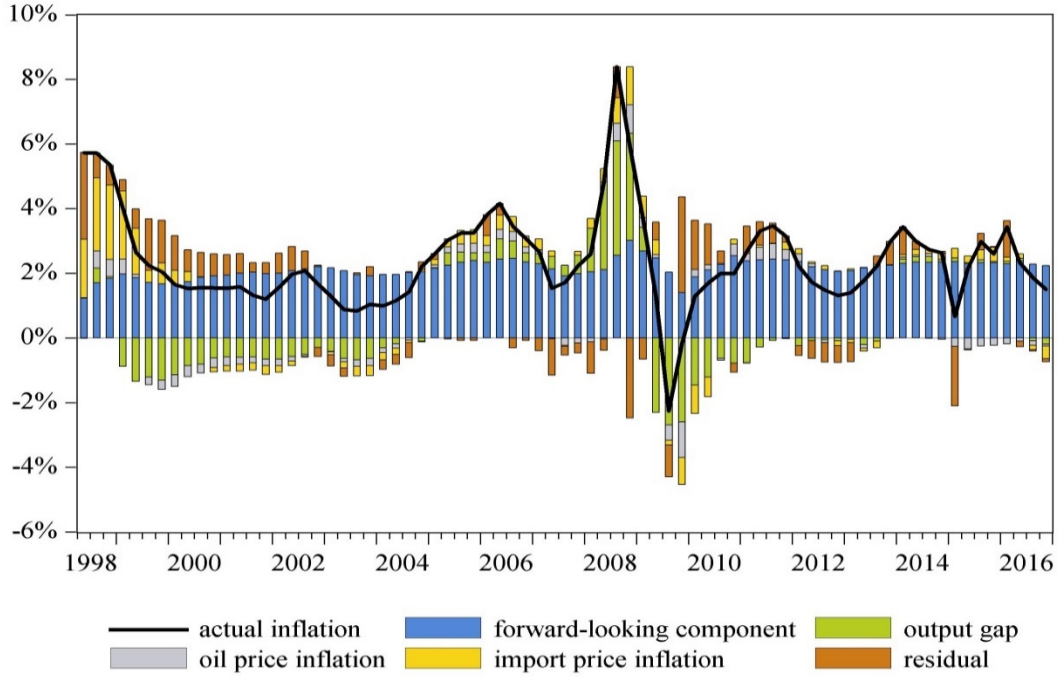
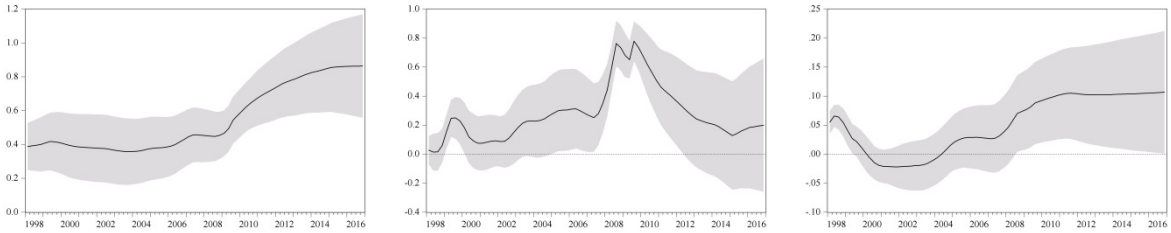


Figure 13: Time-varying Coefficient Estimates: Malaysia

(a) Trend expectation (b) Economic slack (c) Import inflation



Our results suggest those efforts have been reflected in inflation dynamics over recent years. The contribution of inflation expectations increased from an average of 1.8 percentage points between 2002-07 to an average of 2.3 percentage points over the period 2008-16 (see Figure 12). Trend inflation estimates have been rather stable around 2.5% throughout the entire sample (see Figure 3), and the rise in forward-looking dynamics can mainly be attributed to a

rise of the forward-looking coefficient (Figure 13 panel a) doubling from 0.4 over 2002-05 to 0.8 over 2006-16.

Overall, the quantitative importance of economic slack for inflation dynamics has been relatively limited, with the exception being the GFC period. The decline in output had a large negative impact on Malaysian headline inflation during the GFC, with the contribution ranging from 3.2 to -1.6 percentage points over 2008-10. Apart from the crisis period around 2008, economic slack has a rather limited impact on inflation resembling the results for the ASEAN-5 region discussed in the previous section. The altered impact of the output gap on inflation during the GFC can in part be explained by a rise in the coefficient of economic slack (see Figure 13 panel b). The slope parameter is roughly 0.4 across the sample but changes to 0.8 over the period 2008-10.

Non-oil-import and oil prices have a very limited impact on Malaysian headline inflation. As apparent from Figure 13, the contributions of import inflation to Malaysian headline inflation is rather stable but small, ranging from 0.46 to -0.24 percentage points for non-oil-import inflation and 0.37 to -0.26 percentage points for oil price inflation over the entire sample. The coefficient of import inflation in contrast depicts statistically significant time variation (see Figure 13 panel c) and increases from 0.006 over 2002-08 to 0.1 over 2009-16. The stable and limited contribution of oil price movements to inflation movements might be related to the fact that Malaysia is a crude oil exporter, whereby crude oil prices are substantially administered for most of the sample. However, the gradual liberalization of energy prices and the introduction of a Goods and Service Tax via the fiscal act in 2010 might also influence inflation in the future.[7]

[7] As pointed out by Singh (2016), the fiscal act of 2010 might alter inflation volatility due to the removal of subsidies on selected food, fuel and utilities and the introduction of a goods and service tax. After the gradual removal of subsidies, Malaysia implemented a managed-float pricing mechanism for fuel in December 2014, whereby fuel prices are adjusted monthly in response to changes in market prices. This might alter the pass-through of oil price movements to headline inflation in the future, increasing inflation volatility. Also, future tax rate changes of the recently introduced goods and service tax will eventually map into consumer price developments. Indeed, the tax rises in 2015 most likely contributed to offset the declines in oil prices in 2015.

Philippines

Inflation expectations gain importance for Philippines' inflation dynamics, though long-run trend inflation has been on a steady downward trend from around 4% between 1995-2008 to 2.9% in 2016, altering the risk of disinflationary pressures from import price inflation. Over the entire sample, forward-looking dynamics account for 72% of headline inflation (on average 3.6 percentage points of 4.9% headline inflation). In comparison, the contributions of economic slack and import inflation are rather limited.

Over 1996-2007, 64% of the average headline inflation (on average 3.64 percentage points of 5.8% headline inflation) is explained by forward-looking dynamics (see Figure 1). Since GFC this share increased to 87% (on average 3.4 percentage points of 3.9% headline inflation over 2008-16). A possible explanation is that the decline of Philippines' headline inflation reflects the effect of decreasing trend expectations. In contrast, the weight with which trend inflation enters the inflation process has been stable, since the coefficient of the trend expectations (see Figure 15 panel a) does not deviate significantly from around 0.4 across the entire sample and thus cannot explain the rising importance of forward-looking component.

Inflation sensitivity to business cycle conditions has gradually increased over time. Since the onset of the GFC the coefficient of economic slack increased from 0.03 in 1996 to 0.81 in 2008 (see Figure 15 panel b), pointing to a significant steepening of the Philippines' Phillips Curve. The increase of sensitivity to the output gap is not translated to the contribution of economic slack. This is mainly due to reduced volatility of the output gap since the GFC. Standard deviations of the output gap decline from 1.33 over 1996-2009 to 0.74 from 2010 onwards. Over the entire sample contribution of economic slack ranges between 2.71 to -1.29 percentage points.

Non-oil-import and oil price inflation have a limited impact on headline inflation in the Philippines. The contribution of import prices to headline inflation declines substantially (see Figure 14). Over 1996-2002 on average 28% of headline inflation can be associated to non-oil-import inflation (1.7 percentage points of 6% average headline inflation) whereby between 2003-16 the relative contribution declined to 3% (0.1 percentage points of 4.4% average headline inflation). In contrast, oil price contributions are rather stable across the sample ranging from 1 to -0.6 percentage points. The underlying coefficient of import inflation (see Figure 15 panel c) increases from 0.1 in 1996 to 0.41 in 2006 and stabilizes around 0.23 thereafter.

Figure 14: Main Inflation Components: Philippines

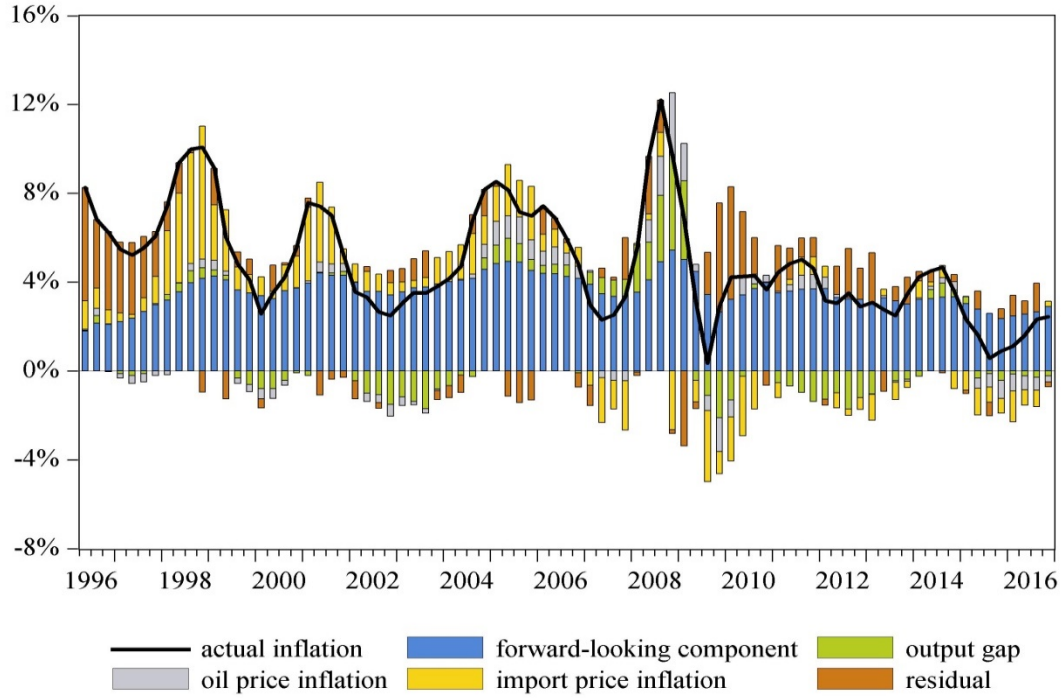
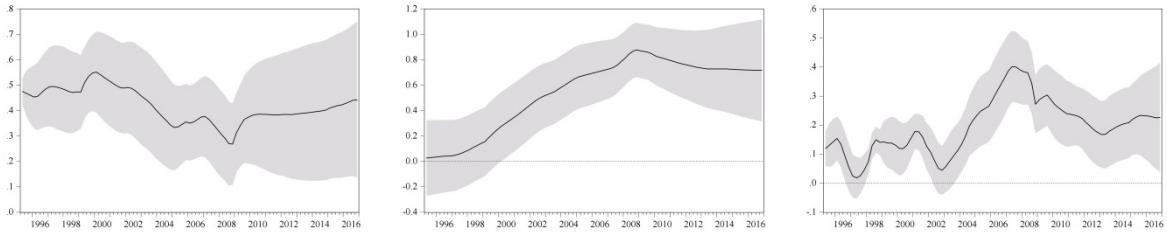


Figure 15: Time-varying Coefficient Estimates: Philippines

(a) Trend expectation (b) Economic slack (c) Import inflation



Overall Philippines' headline inflation stabilizes after the GFC, and remained within the set target range, which may help explain whyforward-looking dynamics play an increasing role during this period. Guinigundo (2016) also studies inflation dynamics in the Philippines and concludes that the anchoring of inflation expectations may have strengthened recently. Our results suggest that the increasing contribution is not due to increasing sensitivity of inflation to forward-looking expectations but rather explained by the fact that both inflation rates and long-term inflation expectations have declined steadily. The long-run trend expectations were somewhat stable, but nonetheless below the BSP official inflation target of 3% over 2014-16. From the perspective of monetary policy and central bank transparency, a continuation of inflation expectations below official inflation target increases the risk of inflation expectations de-anchoring in the future. Against a background of expected lower oil prices, recurrent disinflation episodes may become more likelyin the future.

Singapore

Being a small and very open economy, Singapore's inflation dynamics have been particularly vulnerable to cost-push shocks in times of economic turmoil. Singapore's inflation drivers exhibit significantly higher variation over time than the other large ASEAN economies. Between 1996 and 2016, headline inflation has averaged 1.6% (see Figure 16), out of which forward-looking dynamics explain 1.85 percentage points. Only 0.16, 0.47 and -0.11 percentage points of headline inflation is explained by movements of economic slack, non-oil-import and oil price inflation.

Singapore's headline inflation volatility increased after the GFC and experienced strong disinflationary pressures from 2013 up to 2016, which can be related to the fall in non-oil-import and oil price inflation. This fall in non-oil-import and oil price inflation are relatively strong, outweighing the increasing importance of forward-looking dynamics and pushing inflation rates down from 4.7% in 2012 to 1% in 2014, and into negative territory in 2015 and 2016.

The importance of forward-looking dynamics has increased from the mid-2000s and has helped to mitigate large supply shock effects. The contribution of inflation expectations increases from 0.2 percentage points in 1996 to an average of 2.2 percentage points between 2007 and 2016, explaining 88% of average headline inflation during that period. The rising importance of inflation expectations stems from an increasing coefficient (see Figure 18 panel a) of forward-looking dynamics, which rises from 0.19 in 1996 to 0.34 in 2016 (in line with the results in Meng, 2016). However, the coefficient on inflation expectation drops to 0.05 in 2008 after it increases again to 0.39 in 2010. This sudden decline and subsequent rise of the coefficient is due to an abrupt drop of inflation expectations in 2004 from 2.2% to 1.3% (see Figure 3). Inflation expectations remain at this low level up until 2009 when expectations suddenly rise to 1.9% again. Since we do not have long-run trend estimates and rely on consensus inflation expectations in the Singapore case, it is likely that this sudden movement reflects common drawbacks of survey-based inflation expectations measures (see Section on forward-looking dynamics).

The importance of cyclical conditions as driver of Singapore's inflation has been limited over the last two decades. Average contribution of economic slack is 0.51 percentage points and rather modest except for the GFC. This is also reflected in the dynamics of the coefficient on real economic activity (see Figure 17 panel b), which is 0.14 between 1996 and 2004, rises to 0.46 during the GFC and declines again to 0.05 in 2016.

Figure 16: Main Inflation Components: Singapore

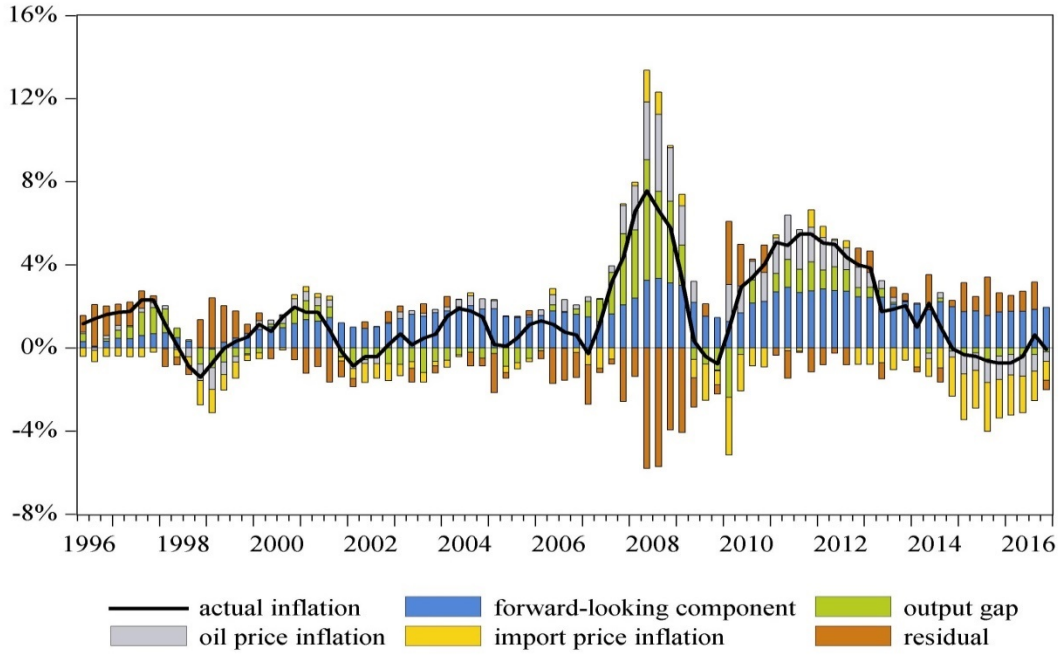
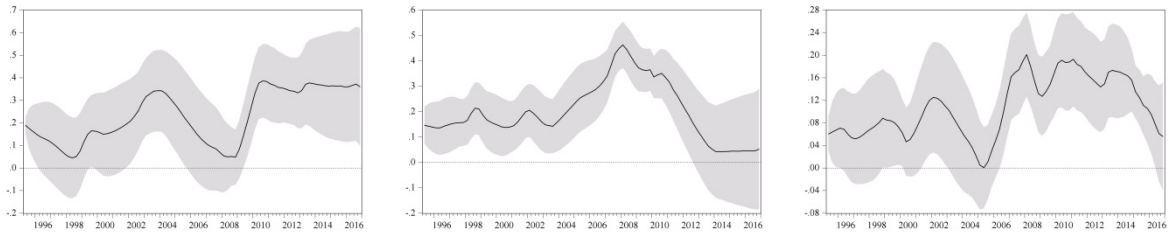


Figure 17: Time-varying Coefficient Estimates: Singapore

(a) Trend expectations (b) Economic slack (c) Import inflation



Non-oil-import and oil price inflation is more important for Singapore's headline inflation compared to other ASEAN-5 countries and increases over time. Singapore has a trade intensive economy and this is reflected in a larger relative contribution of non-oil-import and oil price inflation to headline inflation compared to the ASEAN-5 region. The average contribution of non-oil-import and oil price inflation increased from 0.59 percentage points between 1996 and 2006 to 1.9 percentage points from 2007 onwards, whereby contributions of non-oil-imports price inflation are systematically higher than those of oil price inflation. In line with the rise of contribution to headline inflation the coefficient of import inflation increases from 0.06 in 1996 to 0.15 in 2014 but reveals a decreasing trend thereafter. The steady decline in property prices in recent years may also be another disinflationary factor, as possibly reflected in the negative residual towards the end of the sample.

Thailand

Although the forward-looking component of Thai headline inflation has been substantially strengthened after the AFC, it was not able to offset recent disinflationary pressures stemming from oil price declines. The evolution of Thailand's monetary policy framework after the AFC helped anchor inflation expectations and strengthen forward-looking dynamics in inflation until the GFC. However, Thailand experienced deflation in 2008 and 2015 due to a persistently negative output gap from 2008 and increased pass-through of oil price decline in from 2014 onwards. In those episodes, the expectation-driven component of Thai headline inflation has not been able to offset supply-side shocks, pointing towards further scope for improvement in monetary policy communication.

Thai headline inflation has been on a gradual downward trend over the last two decades. Thailand's headline inflation declined substantially from an average of 6.5% before the AFC to 2.5% thereafter. Thailand has adopted an explicit inflation targeting scheme since 2001, and the implementation of a well-defined monetary policy framework has an important impact on Thailand's inflation dynamics.

After the AFC, forward-looking dynamics explains more than half (53%) of headline inflation, two thirds more than before the AFC (33%). However, disinflation pressures after the GFC and finally deflation since early 2015 raised concerns about the weakening of that expectations channel. From 2001 to 2010 the absolute contribution of forward-looking dynamics is 2.4 percentage points but decreases to 2 percentage points thereafter. Importantly, the lower contribution of forward-looking dynamics reflects both lower coefficient estimates (see Figure 19 panel a), and a decline of long-run trend inflation (see Figure 2).

Contributions of economic slack to Thailand's headline inflation show a similar nonlinear pattern compared to the rest of the ASEAN-5 countries: The contribution of economic slack is rather limited in 'normal times', but peaks during the AFC and GFC. Time-varying contribution of economic slack to Thailand's headline inflation is comparable to the rest of the ASEAN-5 countries. The impact of output gap fluctuations reflects a nonlinear pattern in the sense that the contribution is rather limited but gains importance during the GFC. As shown in Figure 19, the contribution of economic slack to inflation is on average -2.13 and -2.58 percentage points during the AFC and GFC. In contrast, since 2010 the average contribution is -0.08 percentage points. The increased importance of the output gap during the GFC is not only due to a higher volatility of economic slack but also to a temporary increase of structural relevance in the inflation process. The coefficient of economic slack increases from 0.03 in 1995 to 0.54 in 2008 and thereafter declines to 0.3 in 2015 (Figure 19 panel b).

Figure 18: Main Inflation Components: Thailand

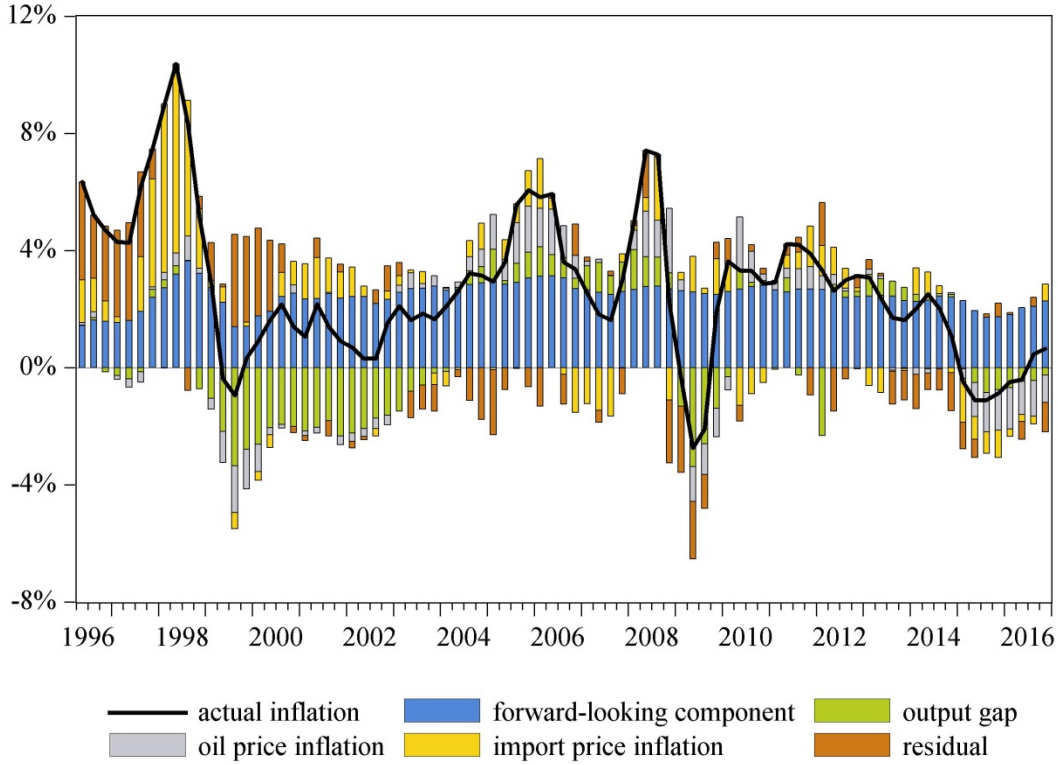
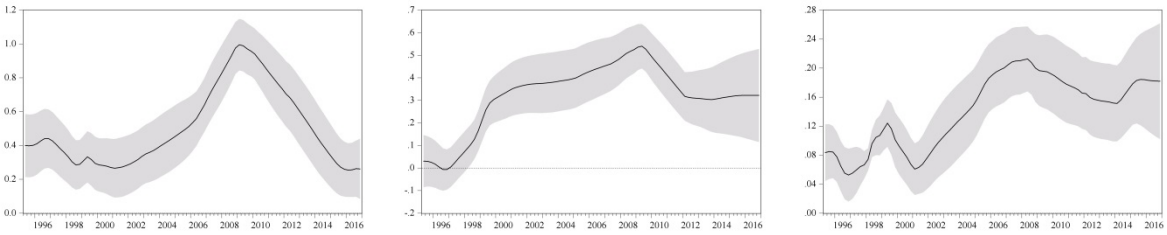


Figure 19: Time-varying Coefficient Estimates: Thailand

(a) Trend expectations (b) Economic slack (c) Import inflation



Contributions of oil and non-oil-import price inflation are rather stable over-time and do not solely explain recent disinflation pressures. Being a strong oil importer, it is natural that oil price movements should have an important effect on Thai headline inflation. In the recent episode of disinflation (and temporary deflation) the oil price pass-through to consumer prices appeared to be particularly strong. However, Figure 18 reveals that the contribution of oil price movements to headline inflation has been rather constant, which may reflect Thai government's efforts to stabilize domestic oil prices by means of an oil fund levy and fuel excise (see Direkudomsak, 2016). For the entire sample the absolute contributions of non-oil-import and oil price inflation are on average 0.54 and 0.75 percentage points. Thereby, contribution of non-oil-import inflation declines from an average of 1.44 percentage points during the AFC to 0.47 percentage points for the remaining sample. The coefficient of import

inflation increases from 0.08 in 1996 to 0.2 in 2008 and remains stable thereafter. The unchanged quantitative impact of import inflation on headline inflation is a combined effect of lower non-oil-import price volatility and altered sensitivity to import price inflation.

The evolution of the key drivers of Thailand's inflation dynamics over the last two decades has important implications for monetary policy. Thailand is the only country among the ASEAN-5 countries that experienced deflation during the GFC. In fact, while Thailand's headline inflation dynamics became increasingly forward-looking after the AFC, since the GFC the weakening of the expectation component has made Thailand's inflation more vulnerable to adverse price shocks.

Thailand's well developed monetary policy framework contributed to anchor inflation expectations before the GFC. Since 2000 onwards, the Bank of Thailand (BOT) has operated under an inflation targeting regime, maintaining low inflation rates and stabilizing the exchange rate.[8] The BOT has continuously developed its monetary policy framework as well as transparency and communication strategy.[9] In particular, the change from core (target of 0.5%- 3% for quarterly average core inflation) to headline inflation target (annual average of 2.5%±1.5%) in early 2015 coincided with the intensification of the disinflationary pressures stemming from the decline in oil prices, and represented an important challenge for central bank's communication. The Memorandum of Understanding with the Minister of Finance specifies that the Monetary Policy Committee (MPC) should explain the reasons for missing the inflation target every year. Moreover, in addition to its regular communication and official publications on the state of the economy and monetary policy decisions, the BOT must issue a letter detailing the period within which inflation is expected to return to the target band, and how the Committee contemplates the appropriate monetary policy response. Unfortunately, BOT's assessment of headline inflation returning to target did not materialize in 2015 and 2016.[10]

Our results suggest that the reduced importance of the forward-looking component could not offset the oil price shock that pushed Thailand into deflation. The development of monetary policy framework, communication strategy and expectations management strengthened forward-looking component of Thailand's headline inflation until the GFC. However,

[8] The monetary policy framework of the Bank of Thailand (BOT) in the last two decades can be categorized into three different regimes. During 1995 until 1997 the BOT followed a pegged exchange rate regime to the US Dollar, from 1997 to 2000 monetary targeting comprised BOTs monetary policy framework.

[9] The latter, a Monetary Policy Report, the publication of decisions of Monetary Board meetings, speeches by BOT officials as well as the economic forecasting models and a monetary policy outlook.

[10] In February 2015, the Thai MPC attributed negative inflation to the sharp decline in oil prices. While noting potential downside risks to its forecasts, the MPC expected inflation to return into positive territory in 2015 Q3, benefitting from lower oil prices raising disposable income and still high inflation expectations. No policy stimulus was envisaged at that stage, but policy rates were cut twice to 1.5% by April 2015. Throughout 2015, however, inflation remained in negative territory, driven by persistent declines in energy prices, fresh food prices and low demand pressures. By January 2016 the return to positive territory was expected within the first half of 2016, to the target band in the second half of 2016, and to the mid-point target within two years. Monetary policy has remained on hold since April 2015, and attention to adverse consequences of excessively aggressive policy actions on financial market volatility and financial stability risks was stressed.

(continued…)

disinflationary pressures and deflation in recent years do not solely hinge on falling oil prices, but on the increase in inflation persistence, Continuous communication and policy actions to manage expectations and better align them to the inflation target can help counteract adverse cost-push shocks, like the oil price fall in 2014 and 2015. Among others[11], Chantanahom et al (2004) find that well anchored inflation expectations had been instrumental to prevent second-round effects from excessive swings in commodity prices in Thailand.

The recent downward trend in long-term inflation expectations in Thailand may become a risk for future inflation (see Figures 3 and 4). BOT's communication is crucial to manage inflation expectations and dismiss the perception of constrained monetary policy. Further guidance in terms of envisaged actions to achieve the target over a given time horizon is fundamental to avoid a de-anchoring of long-term inflation expectations after quite a protracted period of below-target inflation. A critical assessment of past performance, a detailed discussion of the shocks impairing the achievement of the inflation target and a further elaboration on the internal debate underlying the policy decisions — reflecting dissenting views and arguments in the MPC minutes if applicable — can be instrumental to guide private sector's expectations and enhanced the effectiveness of monetary policy. In addition, the announcement of an inflation target over a longer horizon than one year may also contribute to the stronger anchoring of inflation expectations.

V. ROBUSTNESS CHECKS

This section reports a series of sensitivity analyses on our benchmark model, equation (1). We assess the performance of our estimation on two key dimensions, namely data choices of distinct measures and model specifications. Our qualitative findings are robust to all these sensitivity checks.[12]

A. Different Measures of Macroeconomic Indicators

Turning to the specific model variations and re-estimations, the first set of robustness check is concerned with different measures of macroeconomic indicators used in the benchmark estimation.

Measures of the Output Gap

The first variation is related to possible differences in the measurements of the output gap due to different filtering techniques. In our benchmark model specification, we use the standard HP-filter. As a robustness test, we obtain output gap measures from a two-sided band-pass filter, which also limits the sample size compared to the benchmark model. Differences between the results from the re-estimated benchmark model with band-pass filtered output gap and HP-filtered output gap are quantitatively marginal and are therefore omitted. Qualitatively

[11] Manopimoke and Direkudomsak (2015), Khemangkorn et al (2008), Carney (2015)
[12] Detailed results are shown in the Appendix, which is available upon request from the authors.

(continued…)

the results of coefficients and contributions are also very similar. Quantitative differences appear in the coefficients of output gap that are slightly higher during the GFC across countries. Also, the median contribution of time-variation of output gap and import price inflation is marginally lower.[13]

Indicators of Inflation Expectations

The second variation is concerned with possible differences between the estimates of the long-term inflation trend-expectations and more traditional survey-based expectations. Since survey-based expectations might be systematically biased we use long-run trend expectations estimates, incorporating information from survey-based expectations. Our results show that inflation expectations are a crucial driver for inflation dynamics that can potentially outweigh exogenous cost-push shocks. Therefore, it is important to verify whether coefficients and contributions are robust across different measures of inflation expectations. Re-estimating our benchmark model using Consensus long-run inflation expectations yields qualitatively similar results in terms of variable contributions to inflation dynamics. As it can be seen in Figure 3 and 4, trend expectations and consensus expectations show some quantitative differences depending on the point in time and the respective country. Overall, Consensus survey expectations are systematically higher than the long-run inflation trend estimates. This is also reflected in the median contributions of forward-looking component using Consensus expectations compared to the benchmark results. The median contributions related to the time-variation in parameters are quantitatively slightly larger for the output gap and import price inflation and less pronounced for the forward-looking component. Estimated coefficients, however, show little differences compared to the benchmark results.[14]

Import Price Measures

Import price inflation data might depend on whether it is retrieved from terms of trade or obtained from national accounting. Albeit data quality and provision has been improving constantly, depending on the country there are still substantial differences across import price series retrieved from different sources. Thus, we also re-estimate our benchmark model with import prices obtained from the WEO database as a third variation. Overall, qualitative implications of the re-estimated coefficients and contributions are in line with our benchmark model estimates and respective contributions. Although the combined contribution of oil and import price inflation is quantitatively very similar to the benchmark results, the weight between the contribution of import and oil price inflation shifted towards the latter.

[13] We have also investigated with one-sided and two-sided HP filtering over different end-points. The impact is generally quantitatively small, and does not affect our qualitative findings. Output gap estimates can also be obtained using multivariate filters, which add some economic structure to the estimates of potential output by conditioning them on some basic relationships based on economic theory (e.g. a Phillips curve). While multivariate filters may therefore provide estimates that are more consistent with theory, they may also entail the cost of model mispecification (see Alichi and others, 2015, for a comparison of results).

[14] Estimation results for Singapore are exclusively based on long-term Consensus Forecasts as the estimation of trend inflation was subject to unusual uncertainty.

B. Model Specifications

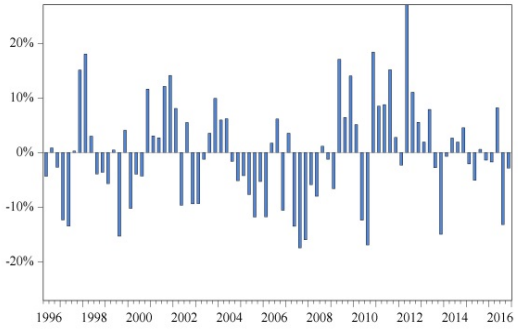
The second set of robustness checks is concerned with the model specification.

Impact of Time-varying Parameters

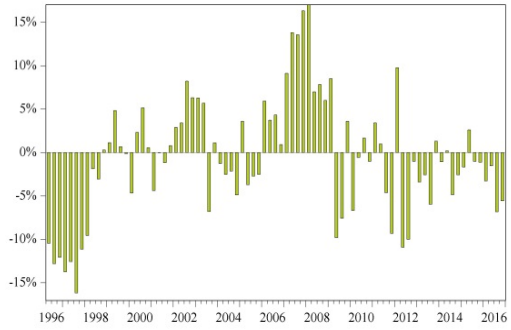
A crucial element of the analysis is the estimation of the Phillips Curve allowing for time-varying parameters to capture potential changes in inflation dynamics over time. As quantitative illustration of their importance, Figure 20 below shows the differences, as the medianacross countries, in the contributions to inflation from constant parameters with respect to that from our benchmark time-varying parameter specification.[15]

Figure 20: Differences in Contributions to Inflation: Constant vs Time-varying Parameters

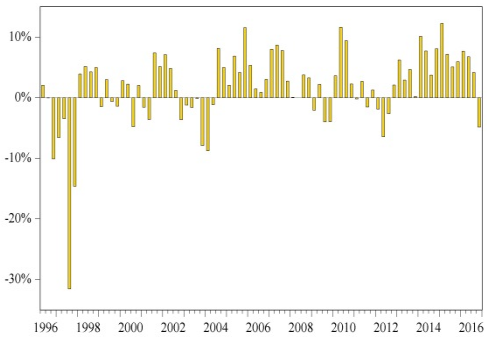
(a) Forward-looking dynamics



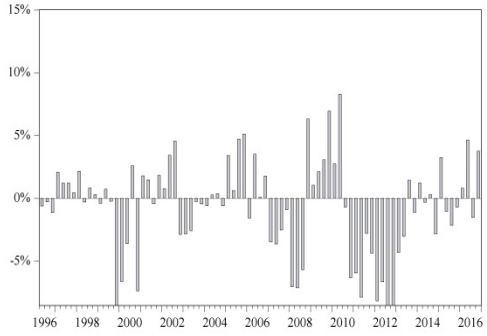
(b) Economic slack (output gap)



(c) Non-oil-import price inflation



(d) Oil price inflation



For the contribution of forward-looking dynamics (see Figure 2 panel a) a constant parameter estimation would imply ignoring a significant amount of variation in inflation overall, alternating periods of broad underestimation (e.g. 2004-08), with overestimation (2009-13) and again mild underestimation (2015-16).

The time-variation of the slope parameter becomes most relevant during recessionary episodes. Panel b evidence however suggests that constant parameters may both underestimate the

[15] This illustration compares the median contributions across ASEAN-5 countries between the two model specifications.

impact (as during the AFC) or overestimate it (as during the GFC). The contribution from non-oil-import inflation instead tends to be generally overestimated under constant parameters (see Panel c), while the evidence is not so clear for those from oil price inflation, with persistent episodes of overestimation alternating with other of overestimation (particularly over 2010-13, Panel d).

Coefficients of Non-Oil-Import Price and Oil Price Inflation

We also investigated possible differences of coefficients of non-oil-import price inflation and oil price inflation in the PC. As already mentioned in the estimation section, in our benchmark model we only estimate three parameters; a coefficient for the forward-looking dynamics, a coefficient for the economic slack (the Phillips Curve slope), and a coefficient for overall import price inflation, averaging across different dynamics of non-oil-import prices and oil prices. We decompose the contributions using the import price coefficient for both series ex-post. The reasoning for our benchmark procedures is that import price inflation should in principle contain oil price inflation for oil importing countries. But since not all ASEAN-5 countries are oil importers, in an alternative specification we explicitly include non-oil-import price inflation and oil price inflation in the model, estimating four parameters.

Results from the model with four parameters depict much higher contributions of the residuals to median and to country-specific headline inflation, whereby median contributions account for around 30% as compared to roughly 10% in the benchmark estimation. Moreover, the contribution of oil price inflation is substantially altered, whereby the contributions of forward-looking dynamics are quantitatively lower as compared to benchmark results. The country-specific coefficients of non-oil-imports are systematically higher by roughly 0.05 but reveal the same dynamics as in the benchmark case. For the oil-exporting countries (Indonesia and Malaysia) the coefficients of oil price inflation are significantly positive throughout the sample but reveal little time variation. The oil price inflation coefficients are small and do not change significantly over time across countries. The significant levels of coefficients range from 0.005 to 0.028 across countries and time. The remaining coefficients are negligibly different quantitatively. Overall, the fourth specification reveals qualitatively similar result of the benchmark estimation.

Models including oil price inflation and exchange rate

As most of the ASEAN-5 economies are highly open economies, exchange rate movements might have a relevant pass-through to headline inflation. When we augment the model specification by the exchange rate[16] in addition to expectations, economic slack and oil price inflation, we find evidence of limited pass-through for the ASEAN-5 countries, in line with Devereux and Yetman (2014). The coefficient on exchange rates is not significant across

[16] We take the nominal exchange rates (local currency to US Dollar) from Haver.

(continued…)

countries and time.[17] The median contributions of the forward-looking component only reveals slight quantitative differences compared to the benchmark model. The median and country-specific contributions of the exchange rate are quantitatively very small. In turn the median and country-specific contributions of oil price inflation are larger as in the benchmark model.

VI. CONCLUSIONS

This paper provides quantitative evidence on the evolution of consumer price inflation dynamics in ASEAN-5 economies since the AFC. We focus on four key inflation drivers ─inflation expectations, economic slack, non-oil-import and oil price inflation─ and assess how their role has evolved over the last 20 years. To that end, we estimate Phillips Curves for each country allowing for time-varying parameters along the lines of recent literature.

We find a strong role for monetary policy frameworks in shaping inflation dynamics in the ASEAN-5 countries. Inflation has become increasingly forward-looking (less persistent), with the contributions of inflation expectations becoming the most important component of inflation in all countries. Specifically, our results show that inflation expectations have gradually become better anchored and that both the forward-looking coefficient (lower inflation persistence) and the overall contribution of inflation expectations display a positive relation with the evolution of ASEAN-5 central banks´ transparency as measured by Dincer and Eichengreen (2014). The quantitative impact of cyclical fluctuations in contrast has gradually diminished over time. Indeed, our results point to a significant flattening of the Phillips curve in ASEAN economies since the GFC. At the same time, increased exchange rate flexibility and further economic integration may have reduced the effect of non-oil and oil import inflation on headline inflation.

This paper focuses on the experience of the ASEAN-5 countries in the gradual improvement of their monetary policy frameworks, how that contributes to shape inflation dynamics along with the increased integration of their economies into the global economy. We also provide a more detailed analysis of the individual country experiences that may serve as useful reference for many other Emerging Economies. Indeed, although our findings suggest that the improvement of monetary policy frameworks has contributed to make ASEAN-5 countries more resilient to price shocks than in the past, challenges remain. The strong disinflation and in some case outright deflation in oil-importing economies over 2014-16 indicate that supply-side shocks have not been completely offset by the forward-looking component of the inflation process. Moreover, our country-specific analysis also suggests that the protracted period of low inflation in Thailand following adverse price shocks partly reflects a weakening of the forward-looking dynamics and of the anchoring of long-term inflation expectations. In addition, the flattening of the Phillips curve in ASEAN-5 economies we have unveiled here helps explain the relatively low inflation experienced across ASEAN-5 economies in 2017 despite the significant acceleration of economic activity in all the countries in the region and worldwide.

[17] Singapore is an exception with a significant coefficient of -0.8. The coefficient does not change significantly over time.

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