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Abstract

The paper extends a standard semi-structural model to account for nonlinear and asymmetric effects of monetary policy credibility. In our setting, central bank credibility is proportional to the deviation of inflation expectations from the announced inflation target, with positive deviations being more costly compared to negative ones. A loss in policy credibility as a result of shocks leads to a more persistent, backward-looking inflation process, and is associated with lower output. We find that the extended model with credibility effects matches well the key macroeconomic data over specific past episodes for Indonesia and Philippines and consider its adaptation to integrated policy frameworks as an area for further exploration.

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Keywords: Monetary policy credibility; Inflation expectations; Inflation targeting; Indonesia; Philippines

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I. INTRODUCTION

Policy credibility is touted as providing substantial benefit to consistent policy making. For central banks, policy credibility is key to the efficacy of monetary policy, including the monetary transmission mechanism, especially during periods of significant shocks. In this paper, we extend a semi-structural new-Keynesian linear model with features of nonlinearity and endogenous monetary policy (MP) credibility. The linear version of such models greatly simplifies the analysis and is widely used as an analytical tool by inflation-targeting central banks; see Berg et al. (2006) for a conceptual overview of a practical model-based approach to monetary policy analysis and processes, Epstein et al. (2006) for a model application to Israel, and Laxton et al. (2009) on the use of the model for developing a structured application to inflation-forecast targeting regimes. However, linearity and symmetry may not fully capture the effects of large shocks or policy decisions that have implications for MP credibility.

MP credibility is a complex concept, but it is generally reflected in the public's assessment of the central bank (CB) actions and capacity to achieve its mandated objectives. In the case of an inflation targeting (IT) framework, where the CB's objective is numerically clear, measurable and easily observed, the literature has generally converged on defining MP credibility in relation to the deviation of inflation expectations from the announced inflation target, starting with the seminal contribution of Svensson (1997). In the IT framework, deterioration of policy credibility is mirrored by persistently high inflation expectations – possibly as the result of the public misbelieving the announced numerical target or their imperfect understanding of the CB actions and commitment to the target. These and related aspects are covered in a vast body of literature, which can be structured under two main strands.

First, a mostly theoretical stream analyses MP credibility in an imperfect information framework, reflecting deviations from the rational expectations hypothesis embedded in typical structural models. Cukierman and Meltzer (1986) implement an imperfect monetary control model with a learning mechanism linking the MP credibility to the speed with which agents recognize the CB tradeoff between monetary stimulation and higher inflation expectations, providing also a theoretical underpinning for the observed positive relation between inflation level and inflation variability. Bomfim and Rudebusch (2000) compare the

disinflation outcomes achieved under a "deliberate policymaker" which announces the new inflation target and takes concrete actions (e.g. monetary tightening) to achieve it, against an "opportunistic policymaker" that eschews deliberate actions and waits for unforeseen favorable shocks that reduce inflation. MP credibility and transmission mechanism improve under transparent actions taken to achieve the price stability goal; accordingly, an "opportunistic" CB generally implies higher disinflation costs and undermines disinflationary expectations. Erceg and Levin (2003) assume a Bayesian updating mechanism, in which agents are uncertain about the CB interest rate rule but learn it over time by observing actual outcomes.[2] Using a similar signal extraction technique, Adler et al. (2019) consider a multiple-instrument setting (interest rate and foreign exchange interventions) and show that as MP credibility improves – i.e. agents observe and understand the monetary policy rules – additional instruments provide support to the inflation targeting regime.

Second, the empirical literature attempts to tackle the fact that MP credibility is related to agents' perceptions about CB actions and intentions, and thus is not directly observable or measurable. For example, Laxton and N'Diaye (2002) use long-term interest rates data to measure MP credibility in OECD countries, assuming that, under stable long-run real interest rates, variations in nominal yields reflect inflation expectations. They find that the measure improves out-of-sample forecasting accuracy of the inflation-unemployment process. Levieuge et al. (2018) use survey-based inflation expectations to compute MP credibility indices for IT emerging economies, considering also the asymmetric effects that above-target versus below-target expectations imply. Focusing on Brazil, de Mendonça and de Guimarães e Souza (2009) analyze alternative formulations for the CB credibility index, including by taking into account the presence of announced target bands and the gradual accumulation of CB reputation over time, based on the track record of fulfilling price stability. Carriere-Swallow et al. (2016) estimate that the observed decline in exchange rate passthrough across a large set of economies is driven by better-anchored (survey-based) inflation expectations, reflecting the emergence of more credible monetary policy frameworks globally. A widely used index of CB transparency and independence – which is closely related to MP credibility

[2] This framework generates significant inflation persistence and matches well the US disinflation in the 1980s.

and the anchoring of inflation expectations, as shown in IMF (2018a) – was developed by Dincer and Eichengreen (2014) by aggregating a set of CB institutional factors. Overall, the multitude of approaches to measuring MP credibility highlights the ambiguity associated with this unobserved indicator, with certain advantages and limitations of each method.

Both the theoretical and empirical literature strands acknowledge the feedback between CB credibility, the formation of inflation expectations, efficiency of the transmission mechanism, and ability to achieve monetary policy goals. Accordingly, in a broader sense, MP credibility can be interpreted as a component of the CB's institutional setting, along with independence, communications, transparency, and accountability, all of which are tightly linked and determine the degree to which inflation expectations are anchored around the price stability objective, as described in Adrian et al. (2018) and Unsal (2020).

Our paper – along with Argov et al. (2007), Alichi et al. (2009), and Benes et al. (2017) – implements a non-linear MP credibility channel extension within a standard gap model, widely used for policy analysis and forecasting by IT CBs. We offer a conceptual framework with MP credibility linked to deviation of inflation expectations from the announced inflation goal. This framework is particularly relevant for IT regimes, with a clear numerical and observed indicator consistent with the price stability objective. Building on Argov et al. (2007), we model the inflation expectations channel through an augmented Phillips curve in which the weights on backward- and forward-looking components are time-varying and proportional to the public's expectation of the CB's ability to meet its inflation objective over the policy horizon, i.e. taking into account the policy transmission lags as explained in Svensson (1997). For example, when credibility is low – i.e. because of a poor record in achieving price stability in the past, including in the face of transitory shocks that produce second-round effects – the inflation process is largely driven by persistence and hence backward-looking dynamics, requiring aggressive and timely actions by the CB to bring inflation back toward its target.

A key contribution of this paper to the theoretical stream of related literature is modeling the effects of MP credibility (i.e. un-anchored inflation expectations) directly on aggregate demand. Specifically, a loss of MP credibility is assumed to erode confidence and raise

uncertainty, hence negatively impacting output through lower private spending. Conversely, gains in credibility mean that inflation expectations are formed in a more forward-looking manner, consistent with the inflation objective, hence raising confidence and positively impacting output. The assumption that losses in credibility lead to both build-up in inflationary pressures and falling aggregate demand highlights the tradeoffs CBs face and the importance of rebuilding public confidence to re-anchor inflation expectations and avoid second-round inflationary spirals.

The model also accounts for asymmetric effects of shocks, which require different policy reactions depending on their magnitude and sign.[3] This asymmetric property is also explored in empirical literature that computes credibility indices, e.g. Levieuge et al. (2018). Specifically, credibility falls more and faster for positive deviations of inflation expectations from the target, as compared to negative deviations; in other words, positive surprises are costlier than negative ones.[4] The timing of the policy response is also important, since a delayed reaction to shocks can erode credibility and de-anchor inflation expectations, which subsequently lead to sharper and costlier policy responses.[5] As such, CB credibility improves the transmission of monetary policy measures through both the expectations channel – via keeping agents' expectations aligned with the definition of price stability and avoiding large second-round effects – and the interest rate channel – via milder interest rate changes being sufficient to bring the economy back to its equilibrium path.

In terms of relevant contributions to the empirical stream of the literature, we apply this framework to two IT countries in Asia: Indonesia and Philippines. We use a "case study"

[3] Alichi et al. (2009) note that while favorable supply shocks help boost MP credibility, unfavorable shocks pose severe challenges for medium-term price stability via un-anchored inflation expectations and persistence of second-round effects.

[4] The notion that the public "penalizes" episodes of above-target inflation more so than below-target inflation is intuitive, given the public's tendency to associate price stability more with "low" inflation than with "high" inflation.

[5] Levieuge et al. (2018) find a positive relation between central bank credibility and interest rate stability across a representative sample of emerging economies. In a model framework like ours, Alichi et al. (2009) and Benes et al. (2017) discuss the relation between timely interest rate reactions and minimizing second-round effects.

approach to analyze model implications associated with shocks reflecting recent historical episodes and compare model outcomes with actual data. In these experiments, we construct shock scenarios that are meant to replicate the real-time economic and policy developments during the "taper tantrum" episode in mid-2013 (for Indonesia) and the inflation-acceleration episode in 2018 (for Philippines). We apply model simulations from the policymaker's perspective, providing counterfactual policy scenarios during these episodes. The model simulations provide illustrative evidence that extending the standard model with the nonlinear MP credibility channel provides an amplification effect and reproduces more accurately Indonesia's macroeconomic and policy developments in the aftermath of the "taper tantrum" episode. Specifically, the 2013 aggressive interest rate tightening cycle is matched in our simulations, in line with the evidence that inflation expectations for various horizons were overshooting the upper limit of the inflation target range.[6] Likewise, simulation results for Philippines during its inflation-acceleration episode in 2018 suggest that the extended model with the credibility channel seems to replicate the observed macroeconomic developments more accurately as compared to the standard linear model.

The above findings are particularly relevant for IT frameworks, given that credibility is associated with deviation of inflation expectations from the target. In addition, IMF (2018a) documents that in emerging markets the degree of anchoring inflation expectations is generally weaker as compared to advanced economies. With the emerging discussion of integrated policy frameworks (IPFs) and the application of hybrid MP regimes, where the CB mandate is subject to multiple objectives and policy instruments, understanding the credibility effects becomes even more relevant, but at the same time more challenging. Indeed, it is the complexity and opacity of hybrid regimes that raise the importance of capturing the credibility channel in such frameworks. Given the relevant credibility effects documented in this paper, the spillovers on monetary policy transmission mechanism in a more complex MP framework should not be underestimated. While we do not apply the model extensions to hybrid regimes, we reflect on

[6] The more aggressive tightening stance can also be interpreted as a reaction to rapid capital outflows, given that Indonesia's relatively large capital market can be considered a proxy for a broad emerging-market asset class.

the nature of these frameworks, including the role of communications, to motivate such considerations.

The paper is organized as follows. Section II discusses the characteristics and specifications of our extended model. Section III presents the applications of the model to Indonesia and Philippines. Section IV reviews the emergence of hybrid MP regimes and the scope for incorporating the credibility channel in IPFs. We conclude in Section V.

II. THE MODEL

In this section, we present the structure of the extended semi-structural model. It builds upon the standard linear version of the quarterly projection models (QPMs), or "gap models", used widely within inflation-targeting CBs. The additional channels and propagation mechanisms that we analyze refer to the endogenous MP credibility along the lines of Argov et al. (2007) and Alichi et al. (2009), with implications for the formation of inflation expectations, as well as for exchange rate and aggregate demand dynamics. The model comprises a domestic block and a foreign economy block; the latter is exogenous to the model. There are four main equations describing the domestic economy: aggregate supply (Phillips curve), aggregate demand, uncovered interest rate parity (UIP) and a monetary policy rule.

A. Aggregate Supply

The aggregate supply equation is represented by the Phillips curve in equation (1), expressing quarterly annualized CPI inflation rate (π_t) as a function of expected annual inflation over the next four quarters ($\pi 4_t^e$), previous period annual inflation ($\pi 4_{t-1}$), and real marginal costs, which comprise three channels: domestic, via output gap (y_t) term; imported, via the real exchange rate (RER) gap ($z_t - z_t^*$) term; and international commodity prices (world oil prices in this case, where πoil_t denotes real oil price inflation):

$$\pi_t = \alpha_1 \pi 4_t^e + (1-\alpha_1)\pi 4_{t-1} + \alpha_2[0.5y_t + 0.5y_{t-1}] + \alpha_3[z_t - z_t^*] + \alpha_4 \pi oil_t + \varepsilon_t^\pi \qquad (1)$$

where ε_t^π is a cost-push or aggregate supply shock.

In the formation of inflation expectations, $\pi 4_t^e$ equals a weighted average between model-consistent (rational) four-quarter ahead expectations ($E_t \pi 4_{t+4}$) – converging to the announced inflation target (denoted π^*) – and previous quarter annual inflation ($\pi 4_{t-1}$); in addition, inflation expectations also account for an "inflation expectations bias" (b_t, discussed below):

$$\pi 4_t^e = \left(\frac{\gamma_t}{2}\right) E_t \pi 4_{t+4} + \left(1 - \frac{\gamma_t}{2}\right) \pi 4_{t-1} + \mu_b b_t + \varepsilon_t^{\pi^e} \quad (2)$$

The standard linear QPM version of equation (2) is represented by constant equal weights on backward- and forward-looking components (i.e. $\frac{\gamma_t}{2}$ replaced by 0.5 in our calibration), and no effect coming from the inflation bias term (i.e. $\mu_b = 0$). In the extended model, the weights are proportional to the "monetary policy credibility stock" (γ_t), which takes values between zero (no credibility) and one (full credibility); note that the standard linear model is consistent with a permanent full credibility state, which ensures the weights are equal to 0.5. The credibility channel affects inflation expectations by adjusting dynamically the relative importance of backward- versus forward-looking components: e.g., as the CB loses credibility, the weight of past inflation increases, causing inflation to be more persistent and requiring a stronger and bolder CB reaction in order to stabilize the economy.[7]

The credibility stock follows a first-order autoregressive process, augmented with a term capturing period-by-period credibility build-up, λ_t:

$$\gamma_t = \rho_\gamma \gamma_{t-1} + (1 - \rho_\gamma)\lambda_{t-1} + \varepsilon_t^\gamma, \quad (3)$$

where ε_t^γ is an exogenous component.

The credibility build-up (or loss) is determined in a nonlinear and asymmetric manner using a hypothetical environment with two inflation regimes – low ("L") and high ("H"):

[7] Adrian et al. (2020) mention imperfect MP credibility when interpreting the calibration of a larger share of the adaptive component when forming inflation expectations in emerging economies relatively to advanced economies. In contrast, in this paper, we provide an endogenous mechanism that links MP credibility to the inertia of price dynamics and inflation expectations.

$$\lambda_t = \frac{(\pi 4_t^H - \pi 4_t)^2}{(\pi 4_t^H - \pi 4_t)^2 + (\pi 4_t^L - \pi 4_t)^2} \quad (4)$$

$$\pi 4_t^L = \rho_L \pi 4_{t-1}^L + (1 - \rho_L)\bar{\pi}^L \quad (5)$$

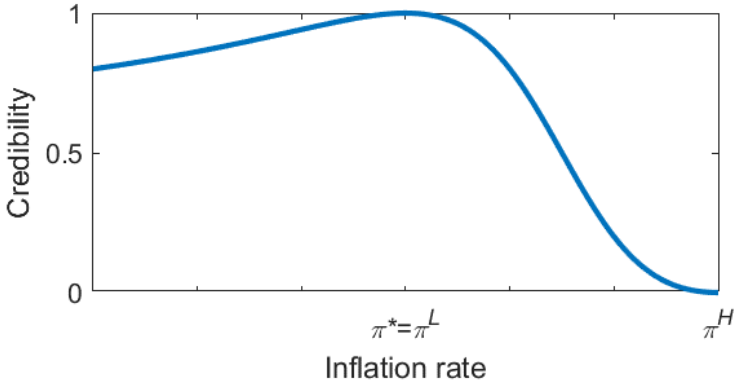
$$\pi 4_t^H = \rho_H \pi 4_{t-1}^H + (1 - \rho_H)\bar{\pi}^H \quad (6)$$

The specification of λ_t allows us to differentiate between low and high inflation regimes.[8] In the "L" regime, inflation is converging to the announced target ($\bar{\pi}^L = \pi^*$), at which point λ_t equals 1 and, by extension, γ_t converges to 1 and MP credibility increases. Conversely, in the "H" regime, inflation spirals away from the target to a higher level $\bar{\pi}^H > \bar{\pi}^L = \pi^*$, at which point λ_t converges to 0 and γ_t declines, reflecting a loss of confidence in the CB's ability to tame inflation. In this high inflation regime, the loss in MP credibility further increases inflation persistence and, per equation (2), leads to stronger inflationary pressures in the future, or de-anchoring of inflation expectations.

Credibility build-up has also the propriety of introducing important nonlinearities in the model. Specifically, credibility declines relatively faster when inflation deviation from the announced target is positive as compared to the credibility decline corresponding to a negative deviation of the same magnitude (in absolute values), as shown in Figure 1. This outcome is in line with the empirical approach in Levieuge et al. (2018) on the construction of CB credibility indices, implying agents penalize inflation overshooting more than inflation undershooting.

[8] The term λ_t provides a measure of the extent to which inflation outcomes are perceived as consistent with the low-inflation scenario. The specification is in line with the gap models literature (e.g. Argov et al. (2007), Alichi et al. (2009)) and matches empirical papers that construct MP credibility indices (e.g. Levieuge et al. (2018)). It is also consistent with the outcome-based credibility process discussed in the theoretical framework of Bomfim and Rudebusch (2000).

Figure 1: Relation between inflation dynamics and credibility build-up



The inflation expectations bias, b_t, is defined in equation (7) as the difference between the weighted average of regime-specific four-quarter ahead inflation expectations and the inflation target:

$$b_t = \gamma_t \pi 4_t^{e,L} + (1-\gamma_t)\pi 4_t^{e,H} - \pi_t^* \quad (7)$$

$$\pi 4_t^{e,L} = {\rho_L}^4 \pi 4_{t-1} + (1-\rho_L)\sum_{i=0}^{3} {\rho_L}^i \bar{\pi}^L \quad (8)$$

$$\pi 4_t^{e,H} = {\rho_H}^4 \pi 4_{t-1} + (1-\rho_H)\sum_{i=0}^{3} {\rho_H}^i \bar{\pi}^H \quad (9)$$

In the case of full credibility, when γ_t equals 1, b_t converges to 0 since inflation expectations are well-anchored and consistent with both the "L" regime and with the announced target. Conversely, when credibility is completely lost, i.e. γ_t equals 0, b_t is positive and equals to the difference between inflation expectations in the "H" regime (consistent with the stationary level $\bar{\pi}^H > \bar{\pi}^L = \pi^*$) and the announced target π^*. In other words, the public assigns a higher probability to the relevant inflation level being (temporarily) above the announced CB target. The strength of the credibility channel is determined by the parameterization of equations (5)-(6) and (8)-(9), in particular the relative persistence of the corresponding autoregressive processes.

B. Aggregate Demand

The aggregate demand equation (10) models the output gap as a function of fundamental factors, measured also as gaps, or deviations from the respective equilibrium levels denoted with "*" – real interest rate (RR), log real exchange rate (z), and foreign (US) demand (y_t^{us}). Additional dynamics are provided through past and expected output gap terms. Unlike previous studies on semi-structural models with endogenous credibility (Argov et al. (2007), Alichi et al. (2009), Benes et al. (2017)), we model the link between MP credibility and the business cycle by including the inflation expectations bias (b_t) directly in the output gap equation:

$$y_t = \beta_1 E_t y_{t+1} + \beta_2 y_{t-1} - \beta_3 (RR_{t-1} - RR_{t-1}^*) + \beta_4 (z_{t-1} - z_{t-1}^*) + \beta_5 y_t^{us} - \beta_6 \Delta b_t + \varepsilon_t^y \quad (10)$$

The motivation for including the inflation expectations bias directly in the output gap equation is based on the nexus between the public's perception of economic and political conditions (i.e. uncertainty valuation), and their spending behavior; see e.g. Bloom (2009). This channel is also reminiscent of Keynes' "animal spirits" concept, whereby households' and firms' decisions to consume and invest are driven by subjective factors, including uncertainty. In our model, the deterioration of CB credibility is associated with economic agents assigning greater importance to the high-inflation regime, which creates an upward bias in their inflation expectations. This leads to greater uncertainty and depresses economic sentiments, putting a drag on their spending behavior and reducing output.[9]

C. Uncovered Interest rate Parity (UIP)

The arbitrage condition between real returns on domestic deposits and foreign deposits gives rise to the UIP condition in equation (11):

[9] In our representative agent model, the proxy for the uncertainty channel, as reflected in the inflation expectations bias, is represented by the deviation of average inflation expectations from the announced target. A related proxy for uncertainty measures – employed primarily in empirical analyses and not considered in our model – is related to the dispersion of individual agents' forecasts, with no explicit reference to the CB target. Carriere-Swallow et al. (2016) show that the correlation between these two measures – inflation forecast disagreement and mean forecast deviation from the target – is positive and significant across IT central banks.

$$z_t = z_t^e - \frac{[RR_t - RR_t^{us} - \rho_t^*]}{4} + \varepsilon_t^z \quad (11)$$

where z_t^e is expected RER, RR_t and RR_t^{us} represent real domestic and foreign (US) interest rates, ρ_t^* is the sovereign risk premium, and ε_t^z is a shock that captures unexpected deviations from the UIP. RER expectations are formed as a weighted average between model-consistent expectations and past values, but are also affected by the inflation expectations bias:

$$z_t^e = \delta_1 E_t z_{t+1} + (1 - \delta_1) z_{t-1} + \delta_2 b_t + \delta_3 \Delta b_t \quad (12)$$

The motivation for this modified UIP specification is to provide stronger feedback loop between inflation, inflation expectations, and real exchange rate dynamics. Empirical studies observed that in emerging economies episodes characterized by elevated uncertainty and loss of MP credibility have been associated with concurrent and expected local currency depreciation.[10]

D. Monetary policy rule

The conduct of monetary policy is determined by a standard Taylor rule: nominal interest rate (RS) is set as a function of past values, neutral interest rate level (proxied by $RR_t^* + \pi 4_t$), four-quarter ahead inflation deviation from the target, and output gap, as well as by an idiosyncratic shock ε_t^{RS}:

$$RS_t = \gamma_1 RS_{t-1} + (1 - \gamma_1) * \left(RR_t^* + \pi 4_t + \gamma_\pi E_t[\pi 4_{t+4} - \pi_{t+4}^*] + \gamma_y y_t\right) + \varepsilon_t^{RS} \quad (13)$$

[10] Levieuge et al. (2018) recognize that a loss in MP credibility can lead to economic vulnerabilities reflected in speculative attacks on the domestic currency. Accordingly, the inflation expectations bias in (12) can be interpreted as an endogenous component of the sovereign risk premium, in addition to the term ρ_t^*. IMF (2018a) documents that anchored inflation expectations improve resilience to external shocks and limit exchange rate passthrough to inflation in emerging economies. Carriere-Swallow et al. (2016) estimate that increased monetary policy credibility – reflected in well-anchored survey-based inflation expectations – is the main determinant of the observed decline in exchange rate passthrough.

The model is complemented by a set of additional equations that do not play any role in the particular model applications we employ in the next section: AR(1) processes for trends, real oil prices, other exogenous variables (e.g. $RR_t^* = \rho_{RR} RR_{t-1}^* + (1-\rho_{RR})\overline{RR} + \varepsilon_t^{RR}$); three equations for US variables – output gap, inflation, and nominal interest rate – which are equivalent to the closed-economy, standard linear version of the aggregate demand, aggregate supply, and Taylor rule equations described above, respectively. Our model nests the standard (linear) semi-structural model, in which the MP credibility channel is removed by constraining γ_t to equal 1, and by setting to zero all coefficients associated with the inflation expectations bias.

E. Model calibration

The model is calibrated to an emerging market economy; see Table 1 for the model parameters. In section III, we use the model to interpret specific episodes for Indonesia and Philippines; accordingly, several parameters are set to fit the individual characteristics of these two economies. In setting parameter values, we follow relevant literature that covers both semi-structural and dynamic stochastic general equilibrium (DSGE) models featuring Indonesia and Philippines.[11] Overall, parameter values are well within the range typically considered for emerging market economies. Additional simulations we performed showed that marginal changes to baseline parameter values do not alter our main conclusions. The robustness of our framework and model calibration is also reflected in mutually consistent results across the two country-episodes we analyze (see next section).

The Phillips curve parameterization features equal weights on future and past inflation (α_1=0.5), as well as moderate effects coming from aggregate demand (α_2=0.3) and oil prices (α_4=0.05). The extent of exchange rate passthrough to domestic prices (α_3) is two times lower in Philippines as compared to Indonesia, in line with the observed ratio of inflation volatility to exchange rate volatility being significantly lower in the former than the latter.

[11] See McNelis et al. (2009) DSGE model designed at the Bangko Sentral ng Pilipinas, McNelis and Bagsic (2007) small gap model for Philippines, Andrle et al. (2009) gap model for Indonesia, Dutu (2016) DSGE model estimated for Indonesia, and Sangaré (2016) structural models for individual Southeast Asian economies.

The parameterization of the inflation expectations formation (2) features a multiplier of μ_b=0.15 associated with the inflation expectations bias term, which is identical to the value set in Argov et al. (2007) for Israel. The persistence of the monetary policy credibility stock (ρ_γ) is set agnostically such as to imply a half-life of about 2.5 quarters. The two inflation regimes are set to converge to different levels. Low-inflation stationary levels are fixed to the announced inflation targets: 4.5 percent for Indonesia (in 2013) and 3 percent for Philippines (in 2018). The high-inflation regime is somewhat arbitrarily set to converge to 10 percent. This level can be motivated by historical inflation spikes and sub-sample averages across Southeast Asian economies; e.g. average annual CPI inflation rate in Indonesia was 9.5 percent in 2001-2008, with a maximum of 17.8 percent in 2005Q4.[12] The relative persistence of the two regimes is calibrated to allow for more inertia to the H-regime ($\rho_H > \rho_L$) – implying that the public assesses the duration of the high-inflation regime to be longer once the economy enters it, in line with the asymmetric costs of inflation deviations (i.e. above-target inflation is more costly as compared to below-target inflation).

The dynamics of real exchange rate expectations allow for equal weights on backward- and forward-looking components (δ_1=0.5). The bias term coefficients (δ_2 and δ_3) are 50 percent higher in Philippines relative to Indonesia on account of differences in inflation and exchange rate variability mentioned above.

The parameterization of the aggregate demand equation (10) is standard, with more weight assigned to past, as opposed to expected, values (β_2>β_1), and moderate magnitudes for fundamental factors – real interest rate gap (β_3), real exchange rate gap (β_4), and foreign demand (β_5). While largely open, the economies under study are also dollarized (e.g. private sector borrowing in foreign currency is important), counteracting the positive effect of RER depreciation; accordingly, the coefficient β_4 is set to a relatively low value. The impact of the

[12] The value of 10 percent for the high-inflation regime can also be defended on account of limited rationality and cognitive biases that characterize households' and firms' decision-making: i.e. a round number that agents are likely to associate with a "bad" inflation state, thus being plausible as a subjective anchor or reference value.

inflation bias (β_6), that captures the direct spillover from MP credibility to aggregate spending behavior, is a non-standard parameter; it is set at a conservative value of 0.25 for Indonesia and 0.5 for Philippines, accounting for somewhat larger volatility of the filtered real GDP in the latter country. In the next section, we provide a detailed assessment of the contribution of the confidence channel by comparing extended model simulations to the counterfactual dynamic responses under $\beta_6 = 0$.

The monetary policy rule is calibrated in line with the literature cited above, with a somewhat lower interest rate smoothing (γ_1=0.5) as compared to advanced economies, to account for generally more volatile interest rates, and conventional values for expected inflation and output gap terms.

Table 1: Model calibration

Phillips curve		"L" and "H" regimes		Aggregate demand		Taylor rule	
α_1	0.5	ρ_L	0.4	β_1	0.2	γ_1	0.5
α_2	0.3	$\bar{\pi}^L$	4.5 / 3	β_2	0.8	γ_π	1.5
α_3	0.25 / 0.125	ρ_H	0.8	β_3	0.15	γ_y	0.2
α_4	0.05	$\bar{\pi}^H$	10	β_4	0.05		
Inflation expectations bias		RER expectations		β_5	0.1		
μ_b	0.15	δ_1	0.5	β_6	0.25 / 0.5		
Credibility		δ_2	0.1 / 0.15				
ρ_γ	0.75	δ_3	0.5 / 0.75				

Note: cells with two values indicate calibrated values for Indonesia and for Philippines, respectively.

III. MODEL APPLICATIONS TO INDONESIA AND PHILIPPINES

In this section, we use a "case study" approach to analyze model implications tailored to two specific episodes. In these experiments, we construct shock scenarios that aim to replicate real-time economic and policy developments during the "taper tantrum" in mid-2013 for Indonesia, and inflation-acceleration during 2018 for Philippines. The motivation of the empirical component of the paper is to identify isolated episodes of sustained deviations of inflation expectations from the target among the Asian IT countries (the starting point of which was a fairly limited pool of candidates). Accordingly, the taper tantrum shock in Indonesia stood out as a relevant episode. In order to showcase the flexibility and robustness of our modelling

framework, we then searched for temporary accelerations of inflation in more recent years, and Philippines proved to be a relevant example in that regard.

Using the model, we simulate the counterfactual dynamic economic responses (or impulse response functions, IRFs) to a set of shocks. These are selected and calibrated in magnitudes using higher frequency data (e.g. monthly government bond yield spreads), approximating as realistically as possible the information set available to the policymakers at certain moments during the analyzed periods. In order to facilitate visual comparison of model outcomes with actual data, we normalize model's steady state to be equal to the actual data observations in the quarter prior to the shocks' occurrence.[13] Observed variables are policy interest rate (end-of-period), quarterly annualized CPI inflation rate (seasonally adjusted), quarterly annualized nominal exchange rate dynamic (NER; an increase indicates depreciation), and output gap obtained as the band-pass filtered real GDP (seasonally adjusted); we also plot the model-implied inflation expectations, but without setting them side-by-side with any survey-based available measures since the concepts are not comparable neither in terms of information set available to the agents, nor the forecast horizon.[14]

Our experimental approach is similar in spirit to imitating the real-time circumstances for the CB during regular forecasting rounds. As such, running the simulations is equivalent to replicating macroeconomic forecasts that the CB would prepare using the model to inform its policy discussions. An important drawback of the model is that it features only the interest rate as the policy instrument, while in practice the CBs of Indonesia and Philippines deploy an array of instruments, like foreign exchange interventions, macroprudential policy measures,

[13] This assumption implies that the modeled economy was in equilibrium in the period prior to the shocks. While non-trivial, the conjecture is supported by the observation that there are no obvious major economic disruptions in the periods preceding the analyzed events.

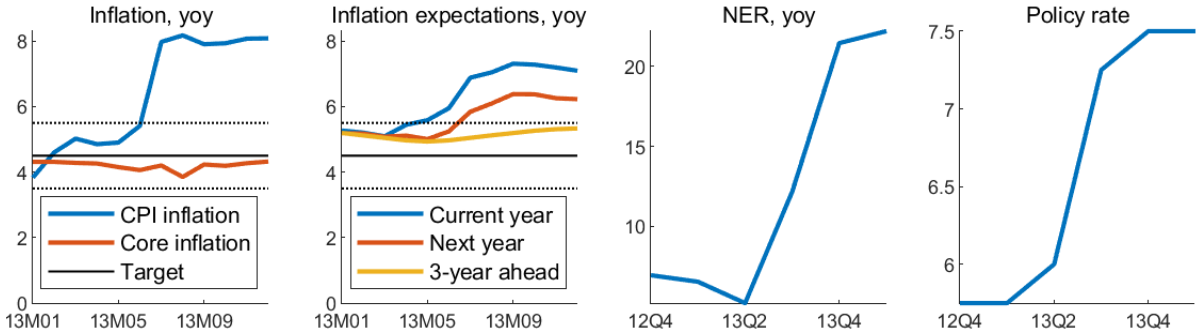
[14] Another caveat related to data comparison refers to the fact that we use revised data, while the policymakers and the public had real-time data available (this is relevant for real GDP and seasonally adjusted CPI inflation). In addition, we compute the output gap using a band-pass filter, while in practice there are multitude of methods to estimating this unobserved variable. However, historical GDP growth rates are stable in both Indonesia and Philippines, which translate into modest amplitudes of business cycle fluctuations, reducing the differences among the methodologies.

capital flow measures, etc. We provide a more pointed discussion about this aspect in section IV.

A. Indonesia

We study the "taper tantrum" episode – the May 2013 announcement by the US Federal Reserve that signaled the slowdown in the pace of future bond purchases under its quantitative easing policy. This shock hit emerging market economies (EMEs) particularly hard, raising financial market volatility, reversing capital flows, and exerting exchange rate depreciation pressures.[15] Over the May-September period, Indonesia witnessed an increase of about 300 basis points in its 1-year bond yield spread, rapid depreciation of the rupiah (between 5 percent and 15 percent annually), and an acceleration of inflation to 8 percent annually in 2013Q3; see Figure 2. While the latter was also driven by a cut in fuel subsidy in June, short- and medium-term inflation expectations increased markedly, significantly above the upper band of the inflation target range of 4.5 percent +/–1 percentage point. Fiscal expansion over 2013-2014 was likely to contribute further to inflation acceleration. Analysts surveyed by Consensus Forecasts revised their inflation expectations for 2013 and 2014 from 5.6 percent and 5 percent in May to 7.3 percent and 6.4 percent in September, respectively. While the revision for 2013 was likely driven by several transitory shocks, the revision for 2014 suggests the presence of second-round effects and a possible de-anchoring of inflation expectations.

Figure 2: Indonesia: Inflation, exchange rate and policy interest rate



[15] See Sahay et al. (2014) for an overview on EMEs experience at the time and lessons learned.

While the three-year ahead inflation expectations did not breach the 5.5 percent upper limit of the target range, its upward trajectory starting mid-2013 – right after the Federal Reserve announcement – represents a significant reversal of the medium-term inflation outlook relatively to early-2013. While the nexus between long-term inflation expectations and the CB credibility level is widely accepted, the literature also acknowledges the importance of shorter-horizon expectations – e.g. Erceg and Levin (2003) consider one-year ahead expectations within their structural model, and both Carriere-Swallow et al. (2016) and Levieuge et al. (2018) use one- and two-year ahead expectations in empirical cross-country frameworks, in line with the policy horizon for most IT CBs. Svensson (1997) also recognizes the need to measure MP credibility by comparing inflation expectations and the announced target, while also accounting for the monetary policy transmission lags and the associated MP forecast horizon. The sharper increase in one- and two-year ahead inflation expectations alongside a milder increase of three-year ahead expectations can be naturally accommodated in our framework, with the credibility stock representing a continuous (i.e. not binary) endogenous variable, fluctuating in response to economic developments and shocks.

Figure 3 depicts the dynamic responses to a UIP shock (ε_t^z) of 300 basis points in 2013Q3, in line with the increase in bond yield spreads over that quarter.[16] This simple scenario – with only one structural shock – is deemed as a reasonably clean identification of the "taper tantrum" episode; Sahay et al. (2014) argue that the associated tightening in external financial conditions (that we frame as a UIP shock) was the major driver of the economic developments in EMEs in mid-2013. As expected, in both the standard (linear) model and our extended model, higher sovereign risk perception leads to significant depreciation and, consequently, to higher inflation. Positive output gap increases in the standard model, on the account of real exchange rate depreciation effects via the net export channel, but falls in the extended model – matching the observed output gap dynamics – as a result of the deterioration in MP credibility which puts a drag on consumer spending. Inflation developments prompt the CB to tighten the monetary policy stance. The responses in our extended model are stronger and more aligned

[16] The UIP shock is usually used to approximate disturbances such as sovereign risk premium shocks, capital outflows, or tightening in external financing conditions. An alternative approach is to use foreign interest rate shocks, which – given the small open economy framework – produces similar results; see Adler et al. (2019).

with ex-post Bank Indonesia's measures as compared to the standard model, because of credibility loss considerations. Moreover, the one-quarter ahead response (125 basis points hike) is matched perfectly; in addition, the interest rate is projected to increase further in 2013Q4 and slightly in 2014Q1.

Figure 3: Indonesia: Dynamic responses to UIP shocks

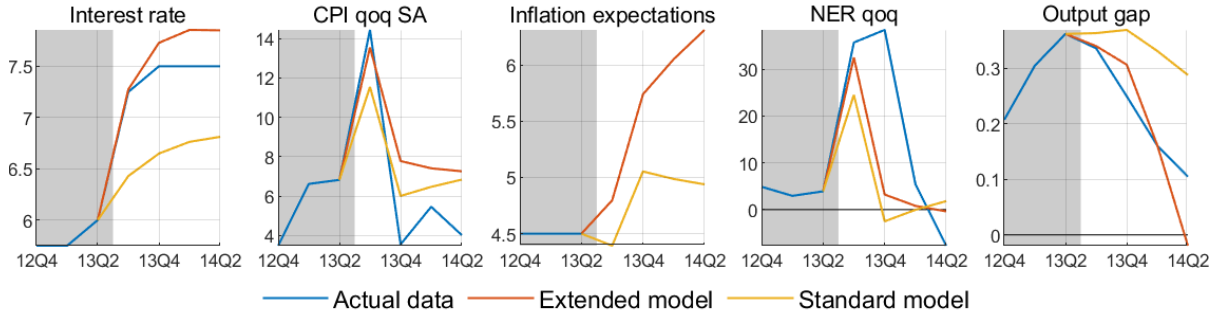


Figure 3 shows how the credibility channel amplifies the effects of the UIP shock, which temporarily reduces the MP credibility stock – in line with observed inflation expectations increasing during mid-2013, as well as with the reduction of Bank Indonesia's credibility index as computed by Levieuge et al. (2018) for the mid-2013 period. This propagation mechanism allows for higher exchange rate depreciation and more persistent inflation dynamics, with the formation of inflation expectations shifting more toward the backward-looking component, as agents lose confidence in the CB's ability to bring inflation back to the target within 12-18 months. While in principle it is possible to recalibrate the standard model to better match the data – e.g. by adjusting the parameters in the Phillips curve – our extended model has the advantage of offering a structural interpretation and a plausible propagation mechanism (namely the expectations channel) for the actual developments during the studied episode.

In parallel, the inflation expectations bias becomes more aligned with the high-inflation regime, accelerating further the build-up of inflation expectations and currency depreciation. The output gap is worsening, as the loss of MP credibility leads to higher uncertainty and falling confidence. This prompts a significant reaction by the CB in response to the anticipated

persistence of inflationary pressures driven by the higher expected price dynamics.[17] Overall, the extended model matches the actual data exceptionally well.

Figure 4: Indonesia: Inflation expectations

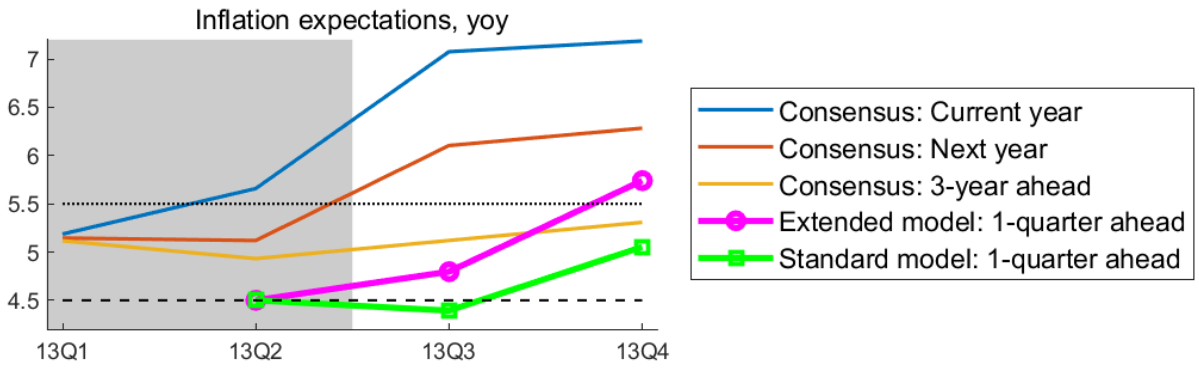


Figure 4 displays the evolution of inflation expectations in Consensus Forecasts surveys against our model simulations. While not directly comparable (because of different forecast events – e.g. over next quarter in the models versus average for the entire year in the surveys – and different forecast horizons – e.g. one-quarter ahead in the model versus current year/next year/3-years ahead in the surveys), the extended model picks up the upward trend reflected in analysts' expectations starting 2013Q3 and accelerates further over 2013Q4. In contrast, in the standard gap model inflation expectations are flat in the quarter with the UIP shock and increase only slightly in the following quarter.

Next, in Figure 5 we show the importance of the direct effect of inflation expectations bias in the output gap equation. The credibility channel is crucial to obtain a reduction in aggregate demand in our extended model, as the counterfactual simulation with the associated parameter (β_6) set to 0 results in a strong positive output gap effect that is inconsistent with the data. One distinct feature of this alternative simulation is that the other key macroeconomic variables – interest rate, inflation, nominal depreciation – are matched as accurate as in the baseline

[17] According to Bank Indonesia's Monetary Policy Review (2013), the decision to increase the key policy rate by 25 basis points in June 2013 was in part a response to "rising inflation expectations and to maintain macroeconomic stability and financial system stability amid increasing uncertainty in global financial markets."

calibration. Accordingly, the modelling of the direct inflation expectations bias effects in the aggregate demand equation brings the benefit of approximating better the output gap dynamics, with no costs in terms of matching the nominal variables.

Figure 5: Indonesia: Dynamic responses to UIP shocks; no direct output gap effect

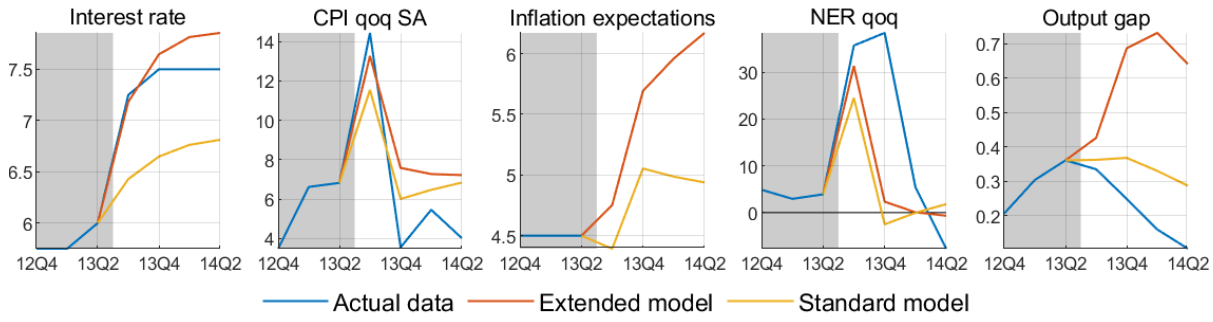


Figure 5 also shows that unlike typical small-open economy models which deliver a positive co-movement between RER depreciation and output dynamics (on the account of a strong net export channel), in our extended model depreciations are contractionary. We offer a plausible structural interpretation for this result – currency depreciations can have a negative effect on MP credibility, making inflation dynamics more persistent, depressing confidence and requiring stronger CB response, with a negative effect on consumer spending. Alternative modelling approaches in the literature that generate contractionary depreciations consider dollarization and balance sheet effects. Although both MP credibility and dollarization approaches deliver similar outcomes with respect to aggregate demand effects of exchange rate shocks, they are fundamentally different in nature and in terms of the corresponding policy implications.

Overall, the simulations provide illustrative evidence that extending the model with a MP credibility channel (including with direct effect on the output gap) helps in reproducing economic developments and monetary policy actions taken in Indonesia in the aftermath of the 2013 "taper tantrum." The corollary of this statement is that the monetary transmission mechanism and Bank Indonesia's policy action during the analyzed episode appear more consistent with the extended model-implied dynamics as compared to the standard (linear) model specification. As such, during episodes of large shocks, policymakers could benefit from

model extensions incorporating the credibility channel in their policy deliberations and decision-making.

B. Philippines

Here we study the early-2018 episode in which Philippines' annual inflation rate increased from an average of 3.2 percent in 2017 to 4.3 percent year-on-year in March 2018, breaching the Bangko Sentral ng Pilipinas (BSP) inflation target objective of 3 percent +/–1 percentage point. Although these dynamics were partly driven by a sequence of supply-side shocks – higher international fuel and food prices, bad weather and low agricultural output, taxation changes, etc. – core inflation also displayed an upward trajectory, in line with the assessments in Guo et al. (2019) and IMF (2018b) regarding the presence of both supply- and demand-side factors; see Figure 6.[18] Given the nature of the shocks, which entails a tradeoff between price stability and economic growth, and despite early indications of inflationary pressures persisting, the BSP did not have a compelling case for tightening its monetary policy stance at the time.[19]

Once headline inflation kept accelerating during mid-2018 to 4.6 percent in May, which translated into higher inflation expectations and second-round effects, the BSP began a steady tightening cycle, with its policy interest rate rising by a cumulative 175 basis points between May and November 2018.[20] Like Indonesia in 2013, inflation expectations for various horizons

[18] Given the structure of the core-goods basket, the supply-side factors contributed to the acceleration of the core inflation as well, via higher food and beverage prices, driving up restaurant prices, and tax adjustments impacting specific categories of core goods/services.

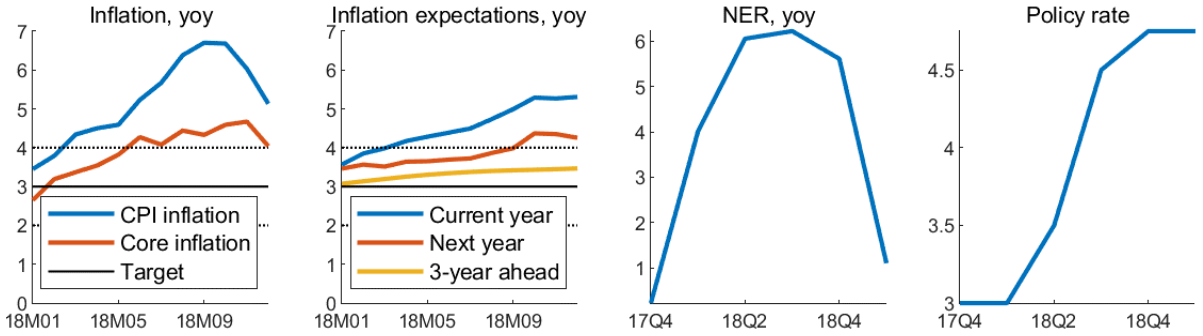
[19] According to the Bangko Sentral ng Pilipinas Inflation Report (2018), the decision to keep the monetary policy stance unchanged was motivated as follows: "while recent inflation outturns show an elevated path in 2018, the latest baseline forecasts […] showed inflation remaining within the inflation target in 2018 and moderating further in 2019". As explained in the BSP (2019) "Open Letter on 2018 Inflation", "[…] the capacity of monetary policy to combat inflation is limited when price spikes are driven by cost-push forces such as the rising price of crude oil in the international market, adverse weather conditions, or tax reform measures. Like most central banks, the BSP would rather look through the initial effects of supply shocks, which tend to be transitory based on past experiences."

[20] The tightening cycle was also explained in the BSP (2019) "Open Letter on 2018 Inflation": "[…] rising inflation expectations and early signs of second-round effects during the second quarter of the year underscored

(continued…)

in Philippines in 2018 displayed upward trajectories. For example, one-year ahead expectations breached the 4 percent upper limit of the target band in 2018Q2, two-year ahead expectations in 2018Q4, while the three-year ahead expectations were constantly revised upward within the 3-to-4 percent upper half of the target range.[21] These developments could suggest some risk of a partial de-anchoring of inflation expectations over the analyzed time interval. IMF (2018b) acknowledges the increase in inflation expectations and potential second-round effects in Philippines over 2018, mentioning that the monetary policy tightening actions are expected to help anchor inflation expectations.

Figure 6: Philippines: Inflation, exchange rate and policy interest rate



In the simulation scenario we impose simultaneously a 0.25 percent supply (inflation) shock and a 200 basis points UIP shock in 2018Q1. These match the main unexpected developments as observed in the very-early-2018 data releases for prices and yield spreads, being relevant from a policymaker's perspective. In particular, annual inflation accelerated from 3.3 percent in December 2017 to 4.0 percent in January 2018 and 4.5 percent in February 2018, while sovereign yield spreads widened moderately between end-2017 and early-2018. Also, Consensus Forecasts surveys taken over early-2018 indicated that analysts were revising upward their inflation forecast for 2018 and 2019. The multiple shock scenario is also in line

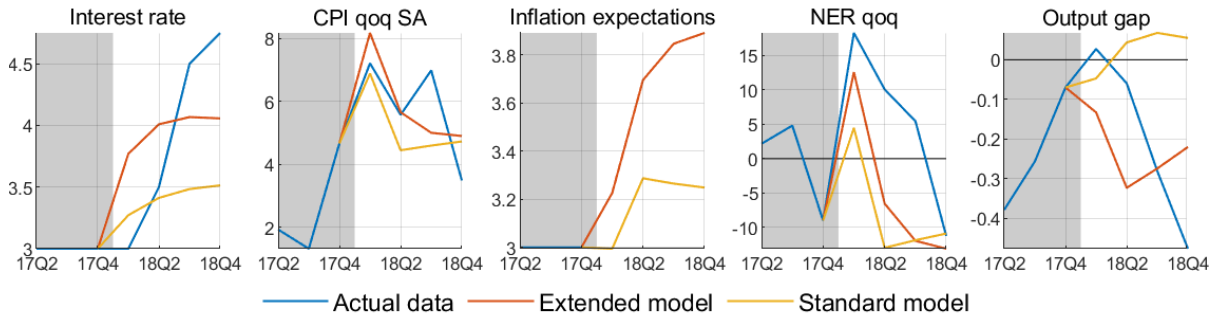
the risk posed by sustained price pressures on future wage and price outcomes. For this reason, the BSP delivered a series of monetary tightening measures from May to November 2018."

[21] The upward revisions of Consensus forecasts were likely to be limited, as Español (2018) shows that private sector's inflation expectations are partly determined by the BSP published forecasts. On the other hand, IMF (2018a) finds evidence of adaptive behavior of inflation expectations in emerging economies, which in the case of Philippines were negatively affected by above-target inflation readings as of early-2018.

with the analytical evaluations in Guo et al. (2019) and IMF (2018b) regarding the prevalence of both supply- and demand-side factors in driving inflation acceleration in Philippines in 2018.

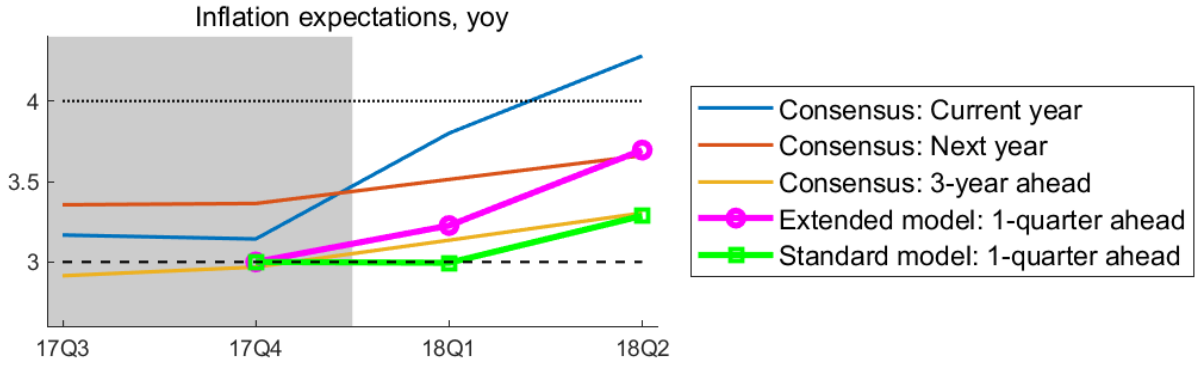
Figure 7 shows the dynamic responses in this scenario. In terms of the direction of the effects, the extended and standard models deliver similar results: inflation rises and the nominal exchange rate depreciates, calling for an interest rate hike. However, the magnitudes are significantly different. In particular, the credibility channel amplifies the effects of the shocks. Temporary deterioration of the economic landscape – as suggested by observed increase in headline CPI and core inflation numbers, worsening of risk perception, and upward revisions of inflation forecasts – allows for a better replication of the sharp exchange rate depreciation that ensued in 2018Q1, at the expense of slightly overestimating the inflation dynamics in the initial quarter. This result is driven by the inflation expectations increasing markedly over 2018H1. The suggested interest rate hike amounts to about 75 basis points, against 25 basis points in the standard model; in practice the BSP held the policy interest rate fixed until May 2018.

Figure 7: Philippines: Dynamic responses to UIP and inflation shocks



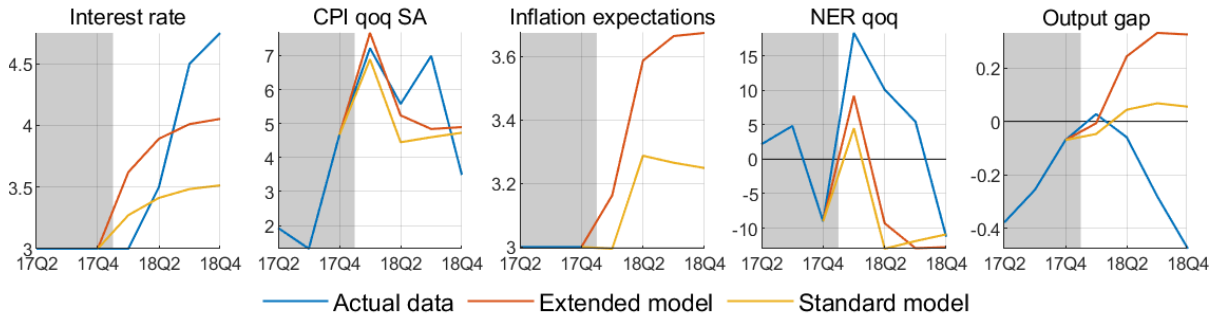
In the context of the materialized shocks and absent policy rate decision in 2018Q1, analysts were revising upward their short- and medium-run inflation forecasts during 2018H1, as shown in Figure 8. This tendency is matched in the extended model (in terms of one-quarter ahead annual inflation rate). Similar to the case of Indonesia, in the standard model inflation expectations are not contemporaneously affected by the considered shocks, increasing only marginally in the following quarter.

Figure 8: Philippines: Inflation expectations



The direct link between the inflation expectations bias and the output gap in the extended model ensures a negative effect of the shock scenario on aggregate demand. Note that the filtered real GDP data registers a slight increase in 2018Q1 and then a sharp fall starting 2018Q2, possibly reflecting a delayed launch of the monetary policy tightening cycle in May 2018. Figure 9 repeats the simulation with the direct effect of credibility on aggregate demand turned off ($\beta_6 = 0$), confirming the importance of this mechanism for obtaining a negative output reaction to depreciation shocks (given that in our scenario the magnitude of the inflation shock is relatively less important as compared to the UIP shock, it is the latter disturbance that accounts for the bulk of the effects).

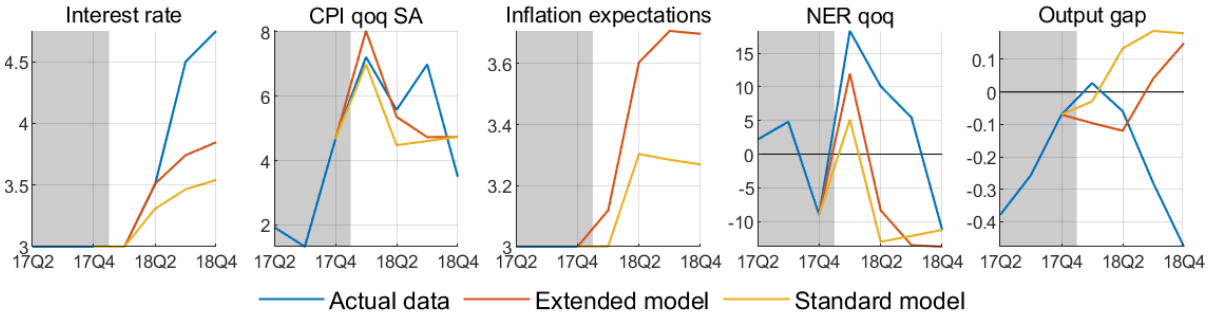
Figure 9: Philippines: Dynamic responses to UIP and inflation shocks; no direct output gap effect



In Figure 10, we complement the shock scenario with a constant interest rate assumption in 2018Q1, replicating actual BSP decisions. The results are close to the ones above, where the

extended model matches better the exchange rate depreciation but overestimates slightly the inflation rate dynamics in the initial quarter.[22]

Figure 10: Philippines: Dynamic responses to UIP and inflation shocks; fixed IR



Overall, like the "taper tantrum" episode in Indonesia, simulation results for Philippines during its inflation acceleration over 2018, suggest the extended model seems to replicate some of the actual data – in particular nominal depreciation and output gap – more accurately compared to the standard model. These results point to the potential relevance of adding the MP credibility channel to model episodes characterized by shocks with a large inflationary impact.

IV. Modeling Credibility in Hybrid MP Regimes: Preliminary Consideration

The above findings on the effects of the credibility channel in MP transmission are particularly relevant for IT frameworks, given that MP credibility is associated with the deviation of inflation expectations from the target. However, these findings also have important implications for modeling credibility in monetary policy frameworks with multiple objectives and tools, including IPFs, considering the complexity and related challenges in communicating which objectives are pursued with which instruments and henceforth establishing credibility; see Georgieva (2020), Basu et al. (2020) and Adrian et al. (2020) for preliminary considerations on IPFs.

[22] Guo et al. (2019) use a standard (linear) semi-structural model calibrated for Philippines to perform counterfactual simulations with a constant interest rate over 2018. They arrive at the conclusion that delayed monetary policy tightening could imply higher inflation rate for an extended period of time, requiring more aggressive interest rate increases.

A key strand of the IPF-related work puts balance sheet effects and the need to counteract associated shocks with multiple instruments front and center. At the same time, emerging market central banks may be worried about the communication challenges inherent in IPFs, namely how well objectives are achieved, and hence about credibility. In this paper, we show that adding MP credibility channel to a standard model replicates the challenges posed by the balance of payments (exchange rate) shocks reasonably well. In that regard, incorporating a credibility channel in frameworks with multiple goals and tools can be seen as a complement to balance sheet considerations in the context of IPF.

Central banks, whether they are subject to IT mandates or not, by and large frame their key objective in terms of "price stability over the medium term." In practice, however, many CBs follow multiple objectives, including those related to economic growth, full employment, financial and exchange rate stability. To achieve these (possibly conflicting) goals, CBs use multiple tools, including various interest rates (and corridors), open market operations, macroprudential and capital flow measures, foreign exchange rate interventions, etc. The choice and specification of such hybrid regimes depend on the nature and configuration of the shocks hitting the economy, as well as on the country-specific factors. For example, aggregate demand shocks, which produce procyclical effects on inflation and credit conditions (e.g. a fall in aggregate demand lowers output, inflation and borrowing levels), could be counteracted using the policy interest rate alone, which "gets in all the cracks." However, in practice, shocks oftentimes arrive simultaneously, with their identification being highly uncertain, which raises non-trivial tradeoffs. Depending on policymakers' tolerance and priorities, which the literature attempts to summarize in a "loss function," central bank actions involve a more elaborate policy response, including judicious calibration of instruments deployed and their individual intensities. A large body of theoretical and empirical literature on these issues has emerged, e.g., Mimir and Sunel (2015), Ghosh et al. (2016), Cavallino (2019), Carrillo et al. (2020), IMF (2020b), Basu et al. (2020), Adrian et al. (2020) and Brandao-Marques et al. (2020).

The complexity of optimal policy design implies important coordination and communication challenges. For example, a potential tradeoff between price stability and financial stability can

require temporary prioritization of the two objectives, which can be complicated to achieve, especially if these are under the responsibility of different agencies (i.e. central banks versus financial stability authority). Importantly, multifaceted policy design that involves multiple instruments is difficult to communicate to the public. This tradeoff issue is long-standing and akin to the rules versus discretion debate as conceptualized in Kydland and Prescott (1977).

All these considerations matter to the reputation and credibility of policymakers, and to the role that communications play in anchoring inflation expectations in line with the price stability objective.[23] There is broad agreement among policymakers that IT regimes have laid a solid foundation for clear communication to help anchor inflation expectations. However, as CBs depart from "pure" forms of IT, monetary policy communication becomes more difficult. Indeed, the IT version of mapping the instrument (policy interest rate) to objective (inflation) may no longer be optimal. The more complex the policy design, the more difficult it is for the CB to communicate clearly its policy goals and responses; and as the mapping becomes multidimensional, the tendency for opacity grows. Consequently, in hybrid regimes, the CB needs to have greater clarity of its operational framework to ensure consistency with the stated policy objectives. All these have implications for MP credibility, and hence integrating the credibility channel in such frameworks becomes especially relevant.

A potential avenue to adapt the model presented in this paper to account for MP credibility in hybrid regimes is (i) to specify policy rules for the additional instruments and (ii) extend the definition of credibility build-up to account for the deviations of all the relevant objective variables from their corresponding target values. For example, in the case of exchange rate objective complementing the price stability objective, the rule for foreign exchange interventions could be used to model the convergence of nominal exchange rate to the CB's exchange rate target level/path (see Ghosh et al. (2016) for related contribution). Additional challenges relate to the weights to be assigned to the individual components of the credibility process, especially if there is no clear subordination of objectives and the preferences of

[23] See IMF (2018a) for an analysis of the role of central bank communications in anchoring inflation expectations, and IMF (2020a) for additional related discussion on unconventional monetary policies.

policymakers are likely to be shock-specific, in line with the loss function framework used in the relevant literature to estimate optimal policy strategies. We consider this as an area for further exploration.

V. CONCLUSION

In this paper, we extend a standard semi-structural model to account for nonlinear and asymmetric effects of monetary policy credibility. We offer a conceptual framework that links credibility with the deviation of inflation expectations from the announced inflation goal, with positive deviations being more costly compared to negative ones. We model the effects of credibility, arising from the inflation expectations bias, both in the Phillips curve and the UIP equations, but also directly on aggregate demand. A loss in policy credibility as a result of shocks leads to a more persistent, backward-looking inflation process and is associated with lower output. The assumption that losses in credibility lead to both build-up in inflationary pressures and falling aggregate demand highlights the tradeoffs central banks face and the importance of rebuilding public confidence to re-anchor inflation expectations.

We employ simulation scenarios to analyze model implications for specific past episodes in Indonesia and Philippines. We find that the extended model matches well the Indonesia data during the "taper tantrum" episode in 2013 and Philippines data during the inflation-acceleration episode in 2018. Importantly, simulation results provide illustrative evidence that extending the standard model with the nonlinear monetary policy credibility channel accurately reproduces economic developments and central bank policy reactions during these respective periods characterized by adverse shocks.

Our findings highlight the benefit of extending standard semi-structural models with nonlinear policy credibility to help better capture relevant stylized facts and dynamic macroeconomic responses to shocks. Moreover, with the emerging discussion on IPFs, where the central bank mandate is subject to multiple objectives and policy tools, and where policy communication is more challenging, the scope for incorporating monetary policy credibility in macroeconomic models becomes significantly pertinent. We consider this as an area for further research.

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