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The Transmission of External Shocks in Asia: Country Characteristics and Policy Responses

By Pragyan Deb, Sanaa Nadeem, and Shanaka J. Peiris

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I N T E R N A T I O N A L M O N E T A R Y F U N D

IMF Working Paper

Asia and Pacific Department

The Transmission of External Shocks in Asia: Country Characteristics and Policy Responses

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Authorized for distribution by Jonathan D. Ostry

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Abstract

Asian economies are increasingly integrated to the global economy through trade and financial linkages, exposing them to the international financial cycle. This paper explores how external shocks are transmitted to Asian economies and whether the use of policies, such as the monetary policy interest rate, foreign exchange intervention (FXI) and macroprudential measures (MPMs), can mitigate the impact of these external shocks. It uses panel quantile regressions on a sample of 14 Asian advanced and emerging economies (AEs and EMs) to assess the impact of financial and real shocks on investment and GDP growth at the median and 5th percentile tail. It finds that external financial shocks tend to have a larger effect on Asian economies than real shocks, and that the main transmission channels through which shocks are propagated are capital flows (particularly via corporate and bank balance sheets) for EMs, and credit for AEs. It also finds evidence that for Asian EMs, FXI may help dampen the capital flows and real exchange rate channels and mitigate financial shocks in the short run, and monetary policy transmission tends to be relatively weak; meanwhile MPMs can help mitigate the credit channel for both AEs and EMs.

JEL Classification Numbers: E32, E44, F32, F41

Keywords: Spillovers, international financial cycle, capital flows, balance sheet, transmission channels, foreign exchange intervention, monetary policy, macroprudential measures, capital flows measures

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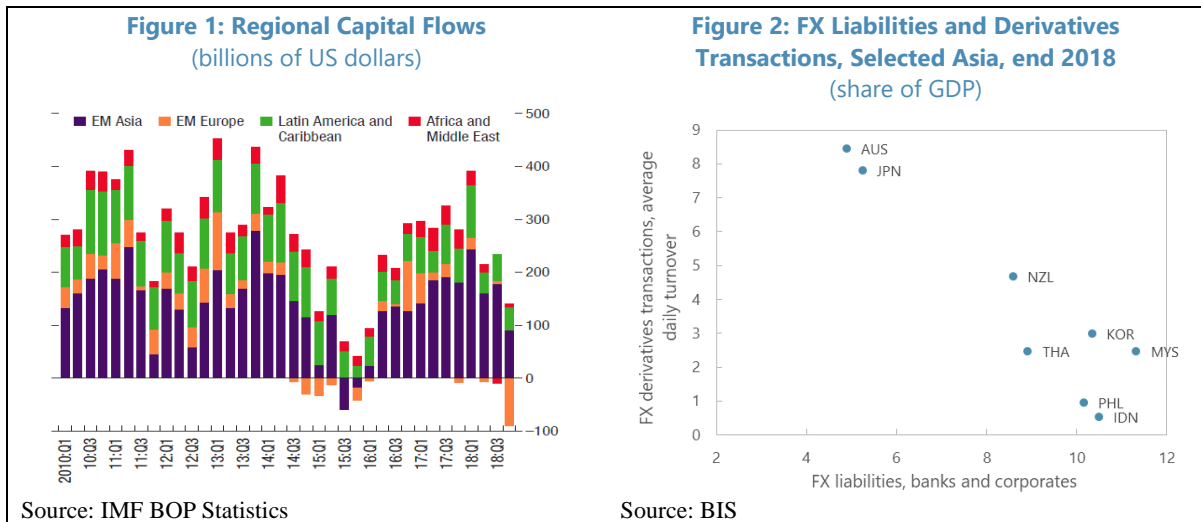
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I. INTRODUCTION¹

Asian economies are increasingly integrated to the global economy through trade and financial linkages, exposing them to the international financial cycle. Since the global financial crisis (GFC), prolonged accommodative financial conditions in advanced economies (AEs) have fueled search for yield behavior. Emerging economies (EMs), particularly in Asia, have been subjected to large (relative to the size of their financial systems) and volatile capital flows (IMF 2019a; Figure 1) that are prone to sudden reversals such as during the taper tantrum or at the outset of the coronavirus pandemic. Asian EMs that are characterized by shallow financial markets, large and unhedged FX liabilities in corporates and banks, and in some cases, weak monetary policy transmission are particularly vulnerable (Figure 2). Given these underlying structural features, the sudden starts and stops stemming from international financial cycle can have far-reaching macroeconomic and financial consequences in these economies (Gelos 2019).



Several kinds of shocks can buffet small open economies. Financial shocks, such as those from global financial conditions or even a generalized risk aversion, such as from the coronavirus pandemic can drive, inter alia, domestic financial conditions, capital flows to banks and corporates, and the exchange rate (Rey 2015). Capital inflows can bring exchange rate appreciations, expansion of balance sheets, and accelerated domestic credit growth, which can create concerns about loss of competitiveness, particularly for economies with a large tradables sector, and the build-up of financial sector vulnerabilities in the medium term (e.g., Cecchetti et al. 2020). On the other hand, outflows, with large exchange rate depreciations and the sharp tightening of financial conditions, can threaten borrowers' access to finance and lead to a decline in asset prices, undermining financial stability and GDP growth (Aoki et al. 2018, and Bruno and Shin 2015). Real shocks, such as those to productivity and foreign demand, can also impact investment and output.

IMF 2019a illustrated how the exchange rate and financial conditions could serve as an amplifier of external shocks for Asian EMs. This raises the question of how these external

¹ We thank Andrew Berg, Davide Furceri, Jonathan Ostry, and Alison Stuart for valuable feedback.

shocks are propagated to small emerging economies in Asia. Borrowing from the literature and ongoing research on the impact of global financial spillovers on EMs (e.g., Bruno and Shin 2015, Cashin et al. 2020, Rey 2015, IMF 2019b, IMF April 2020 WEO), including the recent work on global interest rates being “low for long”, this paper focuses on three transmission channels through which global shocks can be thought to impact the domestic economy: (i) corporate balance sheets effects (proxied by non-FDI capital flows); (ii) the competitiveness channel (proxied by the real exchange rate); and (iii) credit conditions. The paper takes a closer look at which of these transmission channels have the largest impact on macroeconomic outcomes and factors that amplify the propagation of external shocks to small open economies in Asia. Understanding the transmission channels is a valuable exercise as it can inform the design of the appropriate macroeconomic policy response and frameworks in these countries, and more broadly.

This brings us to the second question this paper examines. There is an open debate around the policy mix small open economies could use to best respond to external shocks (see Ghosh et al 2017; Ostry et al 2012). IMF 2019a documents Asian economies’ use of multiple policy instruments to target multiple targets. Drawing from our findings in the first section, this paper further aims to contribute to the literature by examining the effectiveness of macroeconomic policy responses to the international financial cycle (see IMF 2019b, IMF April 2020 WEO, Brandao Marques et al. 2020), leveraging the Asian experience. Therefore, it explores to what degree policy responses, such as the monetary policy interest rate, foreign exchange intervention (FXI), and macroprudential measures (MPMs), can mitigate the macroeconomic impact of the external shocks as well as the transmission channels. We also pay attention to the short- versus medium-term effects of policies in assessing their effectiveness.

We use quantile panel regressions with local projection methods to estimate the impact of external shocks on investment and output in Asian economies. We find that: (i) external financial shocks have a larger effect than real shocks in driving investment and GDP growth for Asian EMs; this result is stronger at the left tails; (ii) capital flows (and their impact on corporate balance sheets) form the dominant transmission channel for EMs, but less so for AEs; (iii) credit conditions are an important channel for both EMs and AEs; (iv) the real exchange rate matters more in EMs than AEs, but has a smaller effect when other channels are controlled for; and, (v) external financial shocks have an additional impact beyond the usual channels, especially at the left tail, highlighting the role of expectations.

We also find evidence that policy responses can help counter the impact of external shocks as well as the temper the transmission channels, but this effect depends on the nature of the shock and the policy in question. FXI can help dampen the capital flows and real exchange rate channels for EMs, and counter adverse external financial shocks, particularly at the tail. However, the effectiveness of FXI relative to monetary policy to real shocks appears limited. We also find evidence that MPMs are able to mitigate the credit growth channel in AEs and EMs more effectively than the policy rate and FXI, lending support to the assignment of well-targeted macroprudential tools for financial stability risks.

Our findings are consistent with that of related work in the literature, but with some important nuances. It extends the conclusions of IMF 2019a by looking at drivers of the real economy in addition to the exchange rate and financial conditions, comparing their relative contributions, and introducing the role of policies. It confirms the findings of IMF 2020 for Asian EMs and shows that policies have a dampening effect on external shocks but extends the analysis to a dynamic setting instead of focusing on contemporaneous short-term impacts and looks at additional shocks and impact variables. On the role of policies, as in Brandao Marques et al. 2020, it supports the role of MPMs in dampening the credit channel, but we also find evidence to support a role for FXI for emerging Asia, as it can mitigate the volatility of capital flows, the exchange rate, and external financial shocks in the short run.

The remainder of the paper proceeds as follows: section II sets out the methodology used in the paper, section III presents results on the relative importance of the different transmission mechanisms and external shocks on macroeconomic outcomes in Asian economies; section IV discusses the role of policies, while section V concludes.

II. METHODOLOGY AND DATA

We use panel quantile regressions to study the impact of external financial and real shocks on macroeconomic outcomes at both at the mean and the left tail for Asian economies. We also examine the relative impact of three different channels to assess how the shocks are transmitted. Our sample consists of fourteen major Asian economies, comprising of 7 advanced and 7 emerging markets.² The analysis uses quarterly data from 1995q1 through 2019q2, though for some countries and specifications the sample is more limited due to data availability. The analysis is conducted on Asian EMs and AEs separately to shed light on potentially differential impact on macro variables as well as policy responses due to shallow financial markets in the EMs.

Following the IMF 2019b, estimation is carried out through a two-step procedure for panel quantile regressions (see also Canay 2011). In the first step, unobserved fixed effects are estimated, using within-estimators. In the second step, the dependent variable is adjusted with the fixed effects obtained from step one, and standardized conditional quantile regressions are then estimated. This allows us to compare the relative impact of different types of shocks. The conditional distribution for adjusted investment and GDP growth, h quarters ahead, for country i , at a specified quantile q , is then estimated on the vector of external shocks and lagged local conditions as below:

$$\Delta_h \widetilde{dep}_{i,t+h,q} = \alpha_{h,q} + \beta_{h,q} shocks_{i,t} + \gamma_{h,q} X_{t-1} + \varepsilon_{i,t,h,q} \quad (1)$$

where $\Delta_h \widetilde{dep}_{i,t+h,q}$ is the impact of external shocks at time t on either (depending on the specification) GDP growth or real investment growth h quarters ahead, $\beta_{h,q}$ measures the direct effect of the external shock, and $\gamma_{h,q}$ measures the effect of controls X_t (lagged values of $\widetilde{dep}_{i,q}$) both measured at quantile q .

² The sample comprises: AEs: Australia, Hong Kong SAR, Japan, New Zealand, Singapore, South Korea and Taiwan Province of China; EMs: China, India, Indonesia, Malaysia, Philippines, Thailand and Vietnam.

External real shocks are proxied by changes in terms of trade, a US total factor productivity (TFP) shock (as in Fernald 2012-19) and a demand shock proxied by US defense spending (see Ramey 2016). For external financial shocks, we consider an exogenous global monetary policy shock (as in Albrizio et al forthcoming)³ and an excess bond premium (as in Gilchrist and Zakrajsek 2012), which also serves as a proxy for ultra-accommodative financial conditions (“low for long”).⁴ These variables are better able to capture the financial shocks compared to the VIX, a broad volatility index, as the latter may still include some element of real shocks. Given data limitations on the external demand shock variable (which is only available until 2015), this is not used in the baseline specification but serves as a robustness check.

Once it is established that external financial shocks have a significant impact on Asian economies, particularly Asian EMs, in the second step, we focus on the three transmission channels identified in the literature: capital flows, the real exchange rate, and growth in credit to the private sector.⁵ To establish their importance as transmission channels for the external shocks, we use specification (2), where $\Delta_h \widetilde{dep}_{i,t+h,q}$ is a transmission channel (either the real exchange rate, capital flows, or domestic credit) at time t , h quarters ahead, $\beta_{h,q}$ measures the direct effect of the external shocks at horizon h , and $\gamma_{h,q}$ measures the effect of controls X_t , measured at quantile q .

$$\Delta_h \widetilde{dep}_{i,t+h,q} = \alpha_{h,q} + \beta_{h,q} shocks_{i,t} + \gamma_{h,q} X_{t-1} + \varepsilon_{i,t,h,q} \quad (2)$$

As a third step, to assess the impact of external shocks through the transmission channels, we use specification (3), where $\Delta_h \widetilde{dep}_{i,t+h,q}$ is the impact of shocks and transmission channels at time t on either (depending on the specification) GDP growth or real investment growth h quarters ahead, $\beta_{h,q}$ measures the strength of different transmission channels at horizon h , and $\theta_{h,q}$ measures the effect of the external shock outside of the transmission channels, and $\gamma_{h,q}$ measures the effect of controls X_t , all measured at quantile q . For the capital flows channel, we also disaggregate the type of capital flows between those to corporates and banks. To control for potential identification issues between the shocks and transmission channels, we use the component of the transmission channels orthogonal to the shocks.

$$\Delta_h \widetilde{dep}_{i,t+h,q} = \alpha_{h,q} + \beta_{h,q} transmission_{i,t} + \theta_{h,q} shocks_t + \gamma_{h,q} X_{t-1} + \varepsilon_{i,t,h,q} \quad (3)$$

In the fourth step, we aim to better understand the use and role of macroeconomic policies to mitigate the effect of these external shocks. Following an approach similar to IMF 2020, we

³ The monetary policy shock is estimated using the residual of the one-year government bond rate regressed on 30-minute changes of the one-month ahead Fed funds futures around FOMC announcements.

⁴ The excess bond premium is the residual component of corporate bond spreads not explained by expected default risk, estimated on a sample of US nonfinancial firms.

⁵ A domestic financial conditions index was also considered as in IMF 2019a, but credit growth provides a clearer identification of the domestic financial channel and more robust results.

introduce interaction terms for different policies (monetary policy interest rate, FXI, and MPMs) with our transmission channels and shocks into specification (3) to yield (4):⁶

$$\Delta_h \widetilde{dep}_{i,t+h,q} = \alpha_{h,q} + \beta_{h,q} transmission_{i,t} + \theta_{h,q} shocks_t + \delta_{h,q} policy_{i,t} + \eta_{h,q} transmission_{i,t} \cdot policy_{i,t} + \mu_{h,q} shocks_{i,t} \cdot policy_{i,t} + \gamma_{h,q} X_{t-1} + \varepsilon_{i,t,h,q} \quad (4)$$

The policy responses are measured as FX purchases, a tightening in the policy interest rate, and tightening in macroprudential measures. The net effect of a policy on a transmission channel (shock) is $\beta_h + \eta_h$ (and $\theta_h + \mu_h$, respectively). We would expect any dampening effect of policies if the coefficient on the interaction terms θ_h, μ_h are opposite in sign to β_h . We include one set of policies in each specification at a time.⁷ Following Brandao Marques et al. 2020, to address potential endogeneity in the policies, we identify the exogenous component of each of the policies by using residuals of the policies individually regressed on macroeconomic fundamentals and financial variables.⁸

While the specification is related to methods outlined in IMF 2020 and Brandao Marques et al. 2020, this paper looks at real in addition to financial shocks to compare them, analyses the impact of transmission channels individually (as opposed to overall financial conditions) and focuses the analysis on fourteen major Asian economies. In addition, to further isolate the impact of external shocks, the transmission channels are first purged of the impact of global shocks using a first stage regression. As a result, the standard errors in the quantile regressions are obtained via bootstrapping to account for the estimated dependent variable.

As noted earlier, we account for country *characteristics* by splitting the sample into emerging and advanced economy subsamples, given that Asian EMs tend to have certain features (shallower financial markets, higher and more unhedged FX liabilities, and weaker monetary policy transmission) that generate financial frictions as compared to advanced Asia. We also differentiate between *normal times and period of stress* by examining outcomes at the median investment and growth and tails (investment busts, recessions). This could help inform policymakers on the relative tradeoffs of using policies at “normal” times or during “stressed conditions”.

We construct a panel dataset with a quarterly frequency on 14 Asian economies. GDP and investment growth is defined as the change in real output and gross fixed capital formation respectively from the IMF’s World Economic Outlook (WEO) database, expressed as quarter on quarter change; the capital flows series (aggregate excluding FDI, other flows to banks, other flows to corporates) are from the IMF’s Balance of Payments Statistics Database, and expressed as a share of GDP; the real exchange rate is the quarter on quarter change in the CPI-based REER from the IMF Information Notice System database; credit is the quarter on

⁶ We also test excluding the interaction terms with shocks, and find that for EMs, there are no significant or persistent dampening effects of any of the policies at the tail. One explanation could be that policies directly impact the confidence/sentiment effect, rather than through the transmission channels, which is why we add the shock interaction terms.

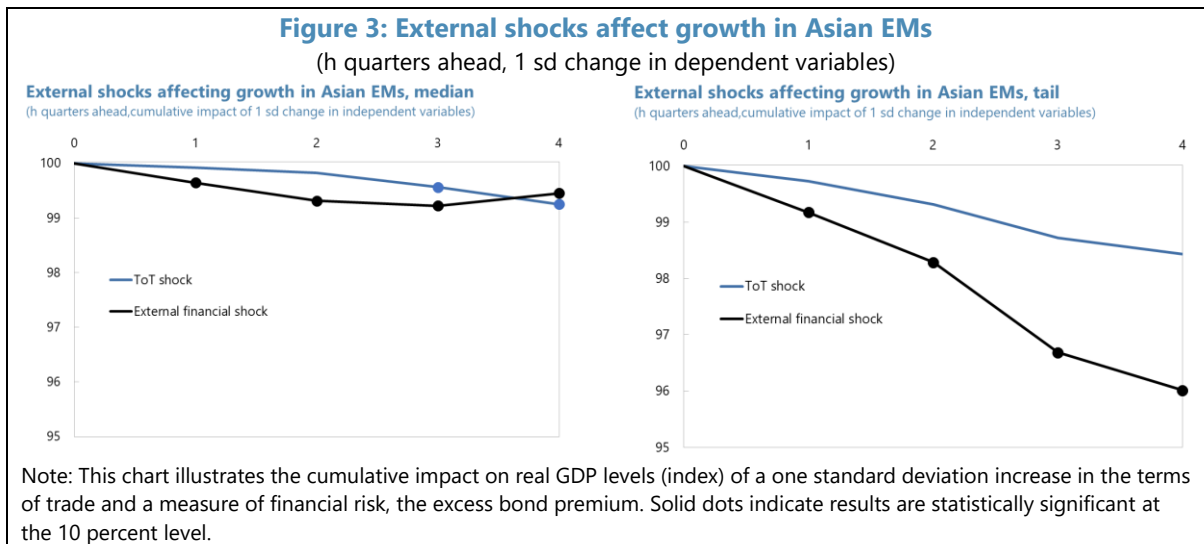
⁷ An alternate specification with all three policies and their interaction terms does not yield significant results for even the noninteraction terms.

⁸ We regress FXI and MPMs on lagged capital flows, the external shocks, commodity prices, and crisis dummies. We add the output gap and lagged inflation for the monetary policy interest rate.

quarter percentage change in credit from other depository corporations to the private sector from IMF’s Monetary and Financial Statistics database. On the policies side we follow IMF 2019a, whereby FXI is calculated as the change in official FX reserves less valuation changes expressed as a share of GDP; MPMs are an aggregate measure of changes in MPMs (tightening or loosening), using the dataset of Alam et al. (2019); and the monetary policy interest rate is taken from WEO. For the external financial shocks, we use the excess bond premium as in Gilchrist and Zakrajsek (2012) and a US monetary policy shock (as in Albrizio et al. forthcoming); for the real shocks, we use a utilization-adjusted TFP shock for a productivity shock (Fernald, 2014) and the terms of trade shock, from the IMF WEO database, expressed as a quarter on quarter change.

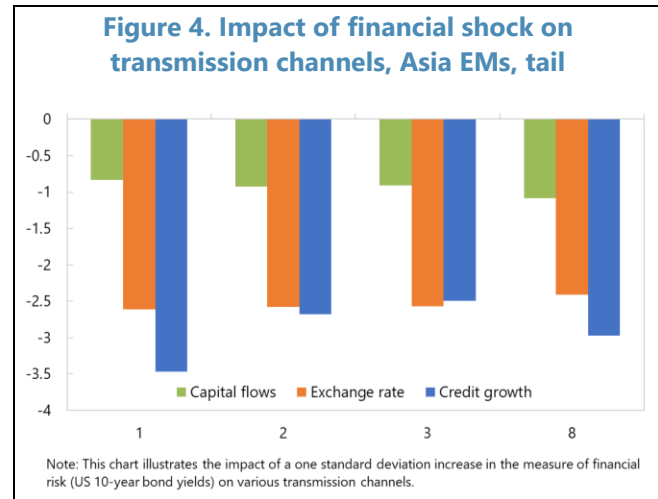
III. WHAT MATTERS FOR INVESTMENT AND GDP GROWTH?

We first establish whether—and what kind—of external shocks drive macroeconomic outcomes in Asian economies. Regressing output and investment on our three exogenous shocks as in (1), our analysis confirms that both real shocks (such as changes in terms of trade and shocks to US TFP) as well as financial shocks (exogenous changes in US monetary policy and financial conditions measured by excess credit spreads) significantly affect real GDP and investment growth in Asian EMs. Comparing between the shocks, financial shocks are the more important driver, particularly at the tails where the effect of real shocks are not statistically significant (Figure 3). By contrast, external financial conditions have a smaller and less persistent impact on AEs. These results are robust to alternate specifications and shocks (including real demand shocks).



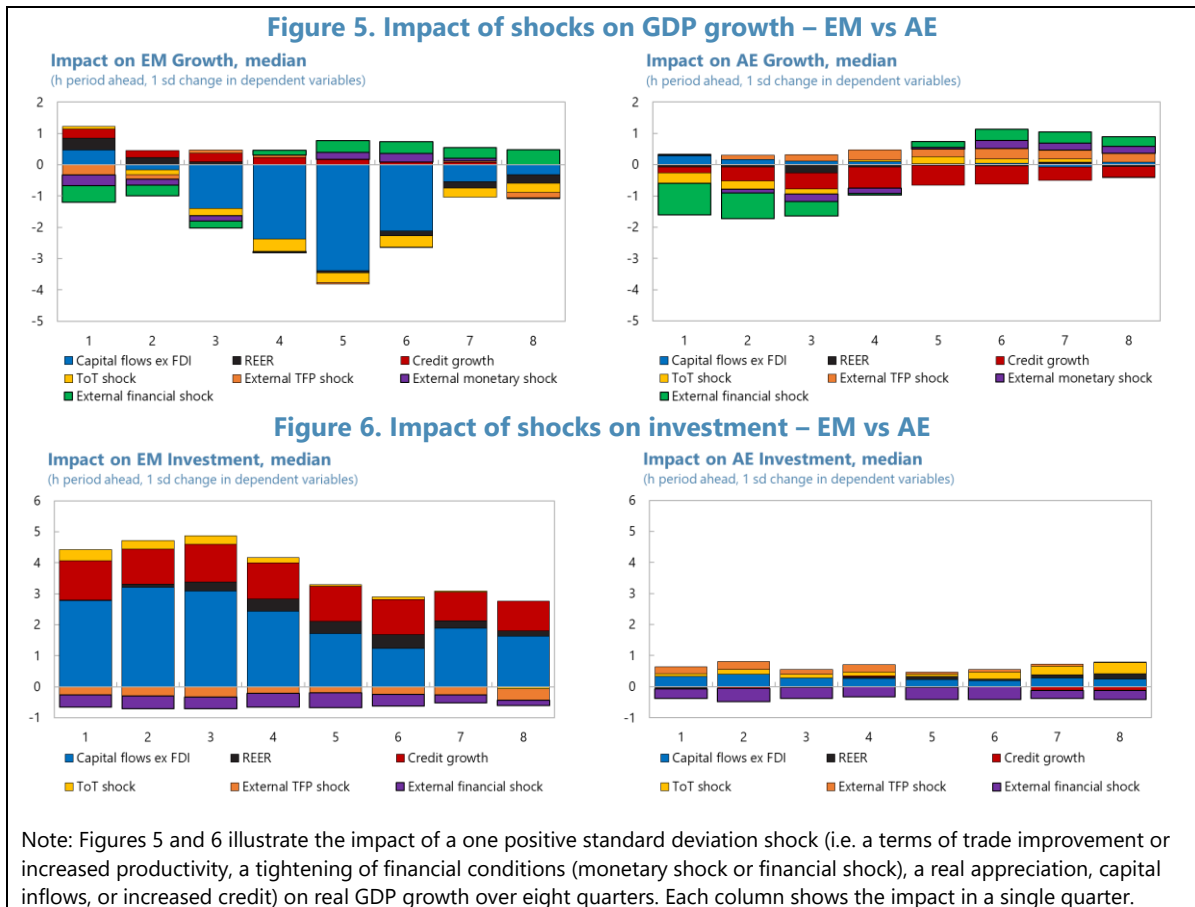
Having established that external shocks have large macroeconomic impact on Asian EMs, we move to the question of how external shocks are propagated. We use equation (2) to establish how the different transmission channels—the exchange rate, capital flows, and credit conditions—are affected by external shocks. We find that that all the three channels are significantly affected by external financial shocks, proxied by US 10 year bond yields (Figure 4). Similar results hold for the VIX.

We next investigate what are significant determinants of investment and output. We use equation (3) to compare the significance of each of our transmission channels. We try this specification with and without shocks, and find that shocks remain significant even when including the transmission channels. To assess the dynamic importance of the channels over time, for each of the regressands, we compute the impact of a one standard deviation shock to each of the regressors over 8-quarters (see Appendix Tables 2 and 3).

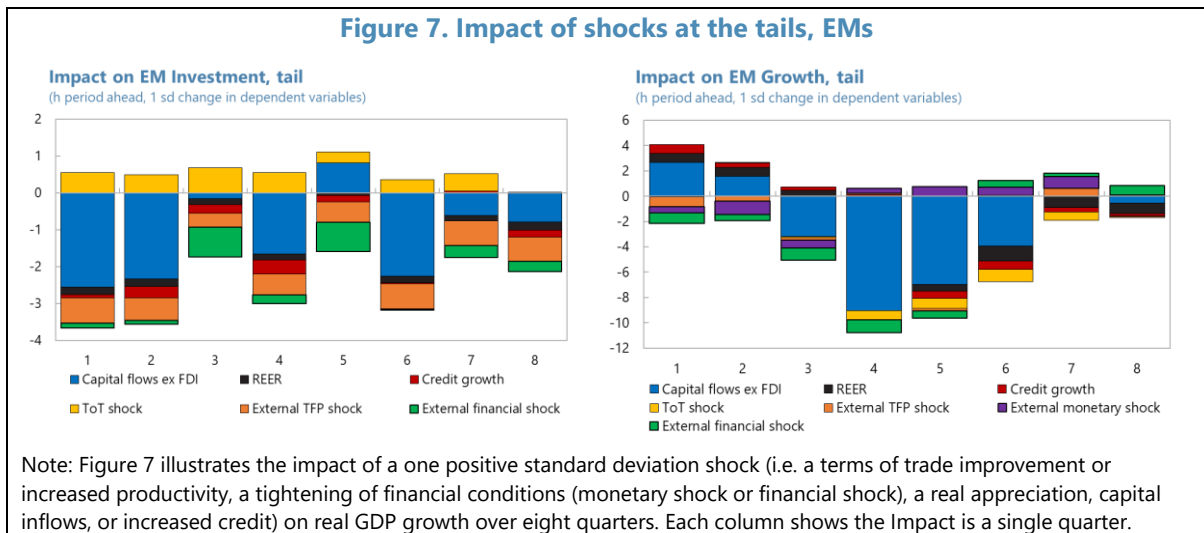


We observe the following:

- The capital flows channel is the dominant transmission channel for EMs; it is generally not significant for AEs.* For GDP growth, the balance sheet channel (proxied by non-FDI capital flows) in EMs is significant and negative in the medium term suggesting that they entail a risk to future growth: higher capital flows today lead to lower growth 4-6 quarters out, suggesting that capital flow surges have a tendency to reverse. A similar result is not observed in AEs, suggesting that they are less vulnerable to capital flow surges, likely due to deeper and better developed financial markets with adequate hedging opportunities (Figure 5). Capital inflows are positive for both EM and AE investment, but while for AEs the impact is persistent in the medium term, the benefit for EMs weakens over time, possibly stemming from their volatility and tendency to reverse (Figure 6).
- The credit channel is significant for growth for both EMs and AEs but appear to operate in different ways.* For EMs, it boosts growth temporarily, while for AEs it acts as a shock amplifier with lower growth in the medium term (similar to the role played by capital flows in the EMs). These results highlight that in contrast to the Asian AEs, the relatively shallow financial markets in EMs are not able to absorb the volatility generated by capital flows and instead transmits financial volatility into the real economy, complicating policymaking.
- The exchange rate remains a significant factor in explaining growth in EMs (in the short-term) but not for AEs.* For investment, the exchange rate channel is only a significant driver for EMs, and in the medium term.



- *The impact of these transmission channels is magnified at the tail.* For EM growth, capital flows and terms of trade shocks generate large volatilities in the medium term, with global monetary and financial shocks generating a short term drag. As in the case of the median, credit and financial shocks play a dominant role in the case of AEs. The investment dynamics at the lower tail in EMs are however driven mostly by real shocks. However, in AEs, capital flows play a more prominent role (Figure 7).
- *The effects of shocks on investment are generally more persistent than for growth.* This could reflect the myriad factors that eventually drive growth beyond investment in such economies, such as consumption and the large tradables sector.
- *External financial shocks also have a direct impact beyond the main transmission channels, with the expected signs, particularly at the tails.* This would suggest there is an expectation/sentiment factor that exerts an additional impact directly.



- *Between the financial shocks, the excess bond premium is significant for both AEs and EMs; and for both investment and growth.* Consistent with the volatility and observed dynamics of financial shocks, such as the VIX, the impact of bond premium shock on growth is short lived and shows signs of mean reversion: while it dampens growth significantly for the first three quarters, it tends to reverse after about five quarters. However, it tends to have a more persistent effect on investment. In contrast, the exogenous US monetary policy shock is only significant for EMs' GDP growth.
- *In contrast, real shocks have a much smaller impact.* Terms of trade shocks are statistically significant in explaining dynamics of medium term-growth in EMs and appear with a negative sign suggesting that gains in terms of trade are short lived and associated with competitiveness loss in the medium term. US TFP shock has a short-term negative effect on EMs, but is beneficial in the medium term in the case of AEs. For investment, US TFP shocks have a more persistent negative effect, but they are not significant for AEs.

Given the large role of the capital flows channel, we look more closely at the type of capital flows. Both bank and corporate balance sheets can potentially play a role in amplifying the effects of external financial shocks (see Bruno and Shin 2018, Chen et al. forthcoming). In order to empirically evaluate the relative importance of banking vs. corporate balance sheet channel, in addition to including credit growth in our analysis, we break out capital flows into banking and corporate flows (subcomponents of other capital flows). We find that corporate flows are a significant explainer for EM investment, but do not matter in AEs. Banking flows do not have an impact on investment in both EM and AEs, beyond their impact via the domestic credit channel, as banks are generally required to hedge or limit open FX positions in the sample countries. For GDP growth, in EMs, both corporate and banking flows act as a shock amplifier in the medium term, with corporate flows playing a relatively larger role; the significance of the banking channel for growth could reflect the role of banks in fueling consumption. From AE growth, they are not significant in most cases. The relative importance of corporate vs. bank balance sheets in emerging Asia could reflect that

corporates are generally less hedged as compared to banks. By contrast, with deep financial markets, in advanced Asia, banks and corporates are likely well-hedged.

An important caveat is that the current specifications do not account for second round effects of the channels and shocks on each other. A multiple equation specification, as in a vector autoregression (VAR) setting could better explore these intermediary relationships.⁹

IV. THE ROLE OF POLICIES

Some of the channels discussed above, most notably the exchange rate, seem to be less significant or short-lived compared to the direct impact of global financial shocks. In addition, real shocks have limited significance for Asian economies. One explanation, as discussed above, is that the direct expectations channel holds significant weight, particularly at the tail. But it is also possible that Asian EMs are able to dampen the impact of transmission channels through offsetting policies and hence only the direct effect appears stronger in the data. Facing more volatility and the potential for costly downside shocks, small open economies are likely motivated to temper the effect of external shocks (Appendix Table 1). In this section, we look at the data to consider the degree to which policies have cushioned against the impact of external shocks in Asian economies, particularly Asian EMs.

IMF 2019a outlined the variety of policies Asian economies have used (the policy interest rate, FXI and MPMs), and the determinants of such policies (external versus domestic macroeconomic and financial conditions). The estimated policy reactions functions suggest that FXI is used to moderate exchange rate fluctuations to temper capital inflows, MPMs respond to the global financial cycle in addition to domestic macrofinancial conditions, and the monetary policy interest rate puts weight on financial and external stability considerations in addition to the output gap and inflation. Given the use of multiple instruments observed in the data, we explore whether such policies could mitigate the impact of adverse external shocks (real and financial) on macroeconomic variables (investment and GDP growth).

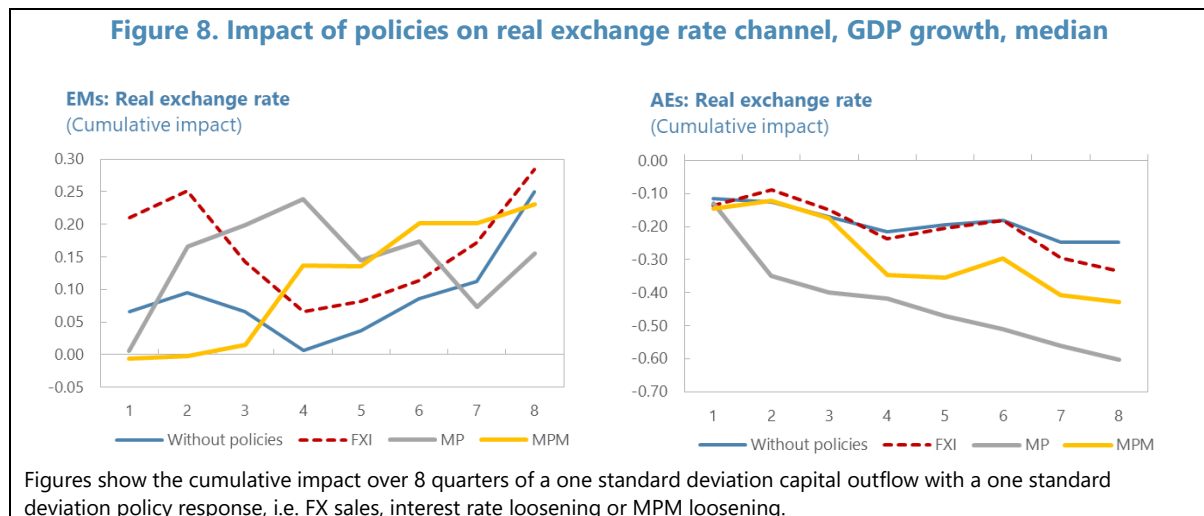
We estimate equation (4) to tease out the relationship of policies (the policy interest rate, FXI and MPMs) with the transmission channels and shocks and their ultimate impact on investment and growth. We compute the impact of a 1 standard deviation shock to each of our regressors on each of investment and growth over an 8-period horizon, controlling for policies. We find that the overall pattern of transmission mechanisms holds: capital flows and credit continue to drive investment and GDP growth relative to other channels for EMs, while the credit channel and external financial shocks (excess bond premium) are the main explanators in AEs. However, there is evidence for policies mitigating the contribution of the external shocks, as given by the negative coefficient for the interaction term of the policies with the shocks.¹⁰

⁹ Chen et al. (forthcoming) use a panel VAR to highlight the role of bank balance sheets in transmitting external shocks in Asian economies, which have large FX assets and liabilities positions. A capital outflow shock depreciates the exchange rate, which contracts bank balance sheets, and reduces credit and investment.

¹⁰ For this section we define the external financial shock as a loosening in financial conditions ($-1 * e_{mp}$) for ease of interpretation; as all transmission channel and shock variables as expecting to have a positive $\hat{\beta}$ coefficient, a dampening (amplifying) interaction term would have a negative (positive) coefficient.

To illustrate, in the following figures, the blue lines depict the cumulative impact over eight quarters of a one standard deviation change in a transmission channel or external shock variable on either growth or investment without policies (the $\hat{\beta}$ coefficient). For ease of discussion, we show the impact of negative (adverse) shocks. The red lines show the impact of a one standard deviation decrease in the regressors with the use of FXI, the gray lines depict the specification with monetary policy, while the yellow lines show the specification with macroprudential measures. The policy responses, given the shocks are in negative direction, are measured as an FX sales, a loosening in the policy interest rate, and a loosening in macroprudential measures. For simplicity and without loss of generalization, the figures illustrate the results on the median. We make the following observations:

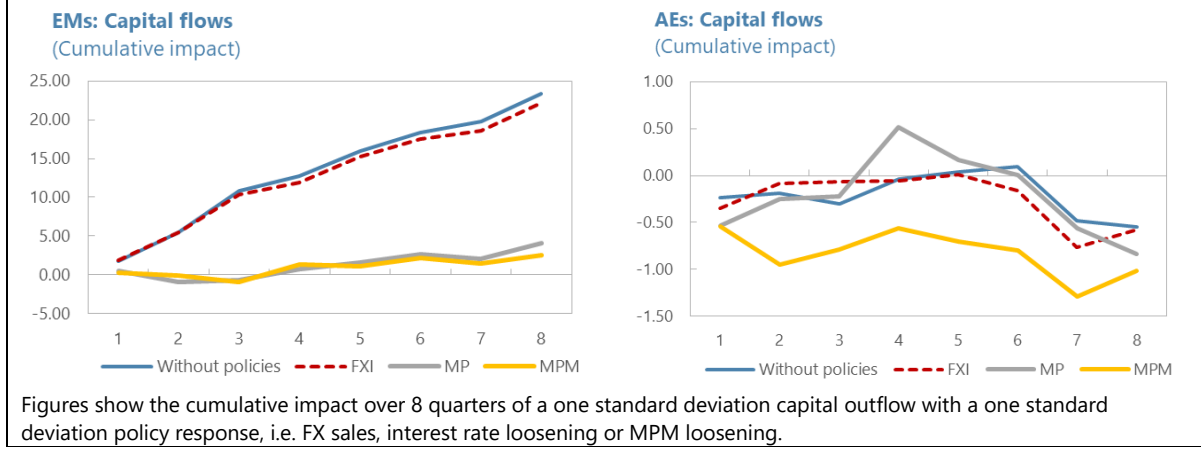
- FXI dampens the real exchange rate channel for EMs (Figure 8 shows that in response to a depreciation, the red line above the blue line) in the short run (outer periods lose significance) relative to other policies. This effect is less discernable for AEs in the sample, which could reflect the role of the exchange rate as a shock absorber in such economies, with deep and liquid financial markets, which FXI could weaken. This effect is also larger when re-estimating keeping only negative shocks. This could reflect that minimizing exchange rate volatility could reduce uncertainty and encourage activity and competitiveness in the tradable sector, helping to support growth in a downturn.



- For EMs, there is some evidence that FXI can mitigate the impact of capital flows on investment and growth in the short run relative to other policies. Figure 9 shows that for EMs, in the face of capital outflows, FXI purchases can reduce the positive impact of growth in the very near term, while other policies can amplify the impact of a shock. For AEs, this effect is not significant or sizable. We also find that this dampening effect is more pronounced when considering only capital outflow shocks. One explanation could be that maintaining exchange rate stability against downside risks may encourage external funding to both corporates and banks in EMs, which in turn supports

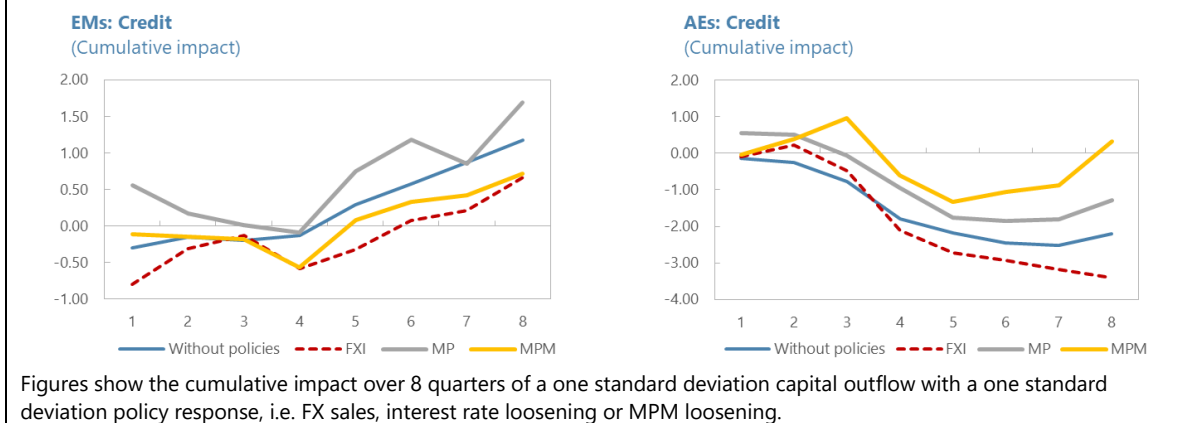
investment. We note however, that the positive effect on GDP growth is more short-lived for EMs.

Figure 9. Impact of policies on capital flows channel, investment EMs and AEs, median



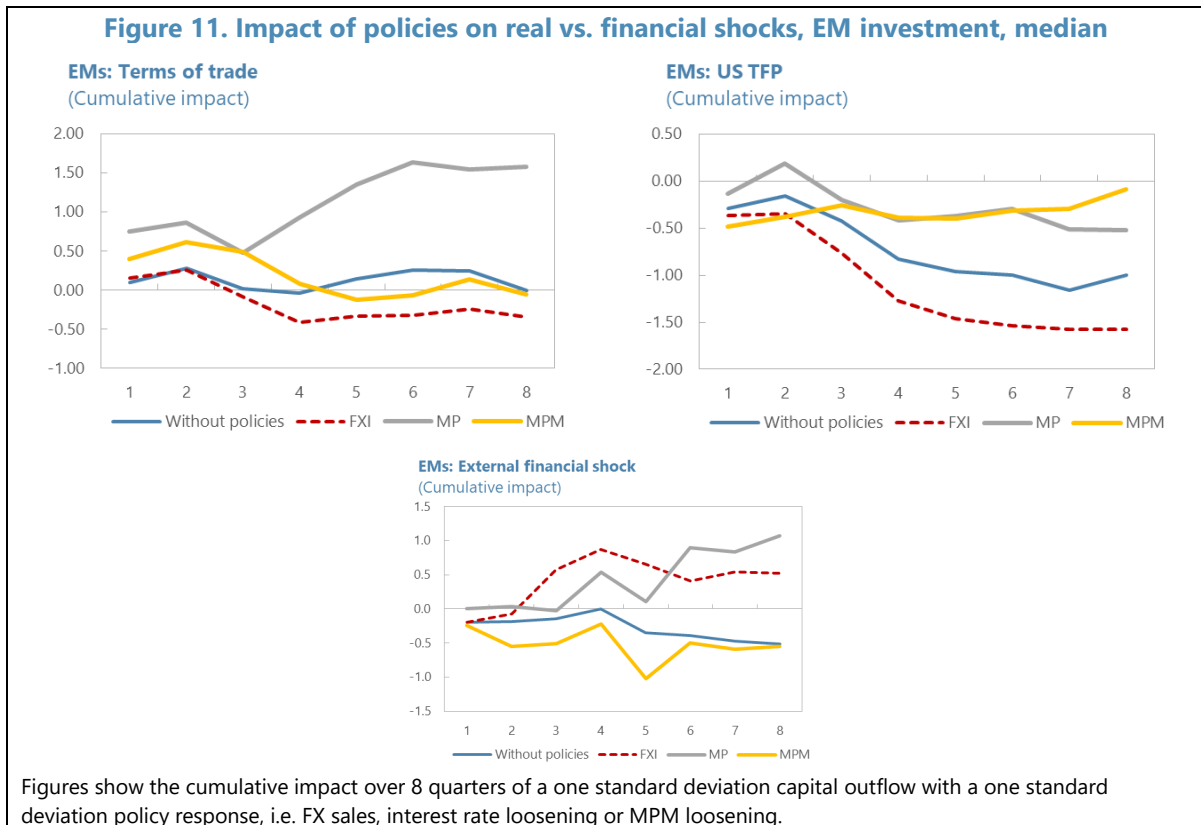
- The use of MPMs appears to be effective in mitigating the effect of negative credit growth (domestic financial conditions) on growth in EMs and AEs (Figure 10). For AEs, credit growth was the main driver of growth and investment in the baseline. MPM measures appear to target credit better than the policy interest rate and FXI, resulting in larger and more stable investment. This could reflect that for AEs, which are often inflation targeters, the policy interest rate is too blunt a tool to address financial stability risks, yielding lower macroeconomic outturns. Well-targeted MPMs could better mitigate the negative impact of credit growth stemming from external volatility. A similar story holds for EMs, but the policy tools appear to be less effective given shallower financial markets and potentially weaker transmission.

Figure 10. Impact of policies on credit channel and terms of trade, EMs



- The relative effectiveness of policies appears to correlate with the nature of the shock – financial versus real—the economy faces (Figure 11). We find that FXI is less effective for real shocks for offsetting the negative impact of adverse shocks such as the terms of trade, but more effective against adverse financial shocks. Financial shocks could be amplified by corporate and bank balance sheets, which as mentioned above have

sizable unhedged FX liabilities that make the exchange rate act as a shock amplifier. Policies that manage volatility of the exchange rate may be able to reduce the exchange rate's tendency to amplify such shocks.



- We also note that FXI may exacerbate the long-term negative impact on growth in a “low for long” environment, as proxied by the excess bond premium. Ultra-accommodative financial conditions today boost growth in the near-term but can present downside risks to growth in the medium-term (see Adrian et al 2019). In a specification with the excess bond premium, we find that a spike (drop) in excess bond premium lowers (raises) growth in the first 3-4 quarters, followed by an increase (decline) in growth. We find that the use of FXI in could lower growth in the medium term for EMs more than the baseline scenario. This could reflect that FXI may only be able to offset short-term volatility in the exchange rate, which may encourage yield-seeking behavior and leverage. However, over the medium term, the costs to growth would be higher. The cost from FXI from AEs appears not as large, however, possibly because of deeper financial markets.
- Finally, as a general point in EMs, we notice that monetary policy is less effective than FXI (for the case of financial shocks) and MPMs (for the credit channel). This consistent with some of the literature (see Ananchotikul and Seneviratne 2015) and could reflect several factors. Low depth of the financial system could constrain monetary policy transmission; interest rates could be driven in large part by those in

advanced economies, reflecting the global financial cycle; and more recently, at historically low levels, interest rates may be approaching an effective lower bounds, where in monetary policy effectiveness is limited. With monetary policy constrained, other instruments may appear more effective at the margin as part of the policy framework.

This section has documented the relative impact of different policies on the effectiveness of the transmission channels and external shocks on the real economy. In many cases, we have seen that the negative impact on growth or investment has been somewhat tapered by the use of different policies, which may provide some rationale for the use of myriad policies by Asian (particularly emerging) economies. However, this analysis does not (and cannot) suggest that such responses are optimal. Such a question could be more thoroughly addressed through a calibrated structural model for instance. In practice, it may also not be possible to observe what kind of shock has been realized, or multiple indistinguishable shocks may be realized together which may make the choice and use of an optimal instrument moot. Such an analysis does not also factor in the impact using multiple instruments can have on the credibility of the policy regime over the medium term (including on inflation expectations, which is outside the scope of this analysis).

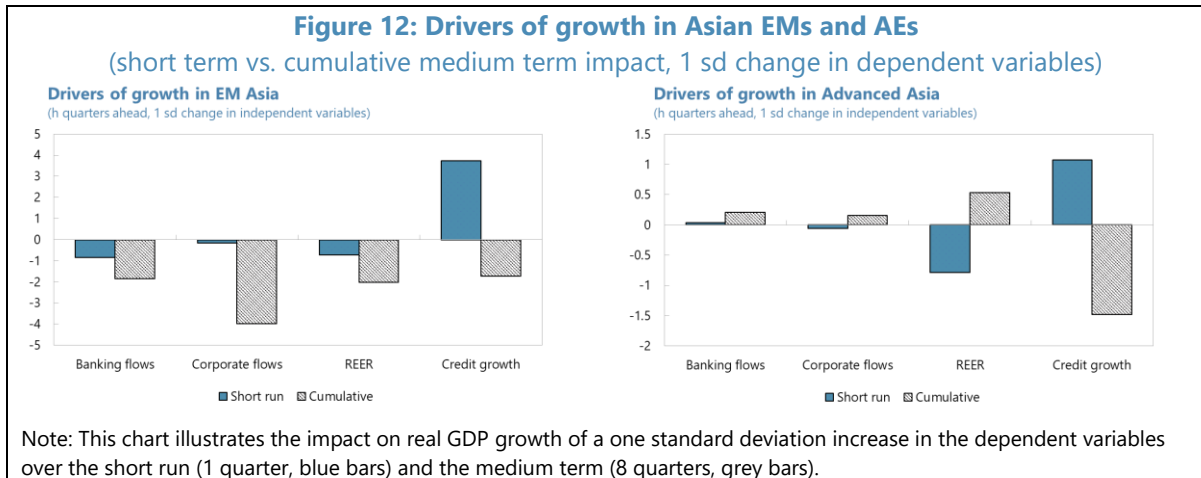
V. ROBUSTNESS CHECKS

As a robustness check, we consider an alternate specification: we look at the impact on investment and GDP growth of only the transmission channels, excluding the direct impact of external shocks, using instead as regressors the predicted values from regressions of the individual channels on the external shocks. We estimate equation (3):

$$\Delta_h \widetilde{dep}_{i,t+h,q} = \alpha_{h,q} \Delta_h \widetilde{dep}_{i,t+h-1,q} + \beta_{h,q} \widehat{transmission}_{i,t} + \varepsilon_{i,t,h,q} \quad (3)$$

The transmission channels we consider are the real exchange rate, credit growth, and balance sheets through capital flows (aggregate, and decomposing between banks and corporates). As before, the dependent variable has been adjusted for fixed effects.

For EMs, consistent with earlier findings, the capital flows channel appears to have a relatively larger effect on investment and output than that of banks. This could reflect that despite large gross FX assets and liabilities positions, banks have more access to FX hedging (or are regulatorily bound to limit FX exposure) to buffer their balance sheets as compared to corporates. For AEs, both these channels are small. Next we continue to find that for both EMs and AEs, credit growth is a key driver with an initial boost to both investment and growth, followed by a decline over the medium term, showcasing medium term financial stability risks. Of note, a real exchange rate appreciation appears to a cumulative negative effect for EMs than in AEs, suggesting the presence of a more persistent competitiveness channel in EMs relative to AEs (Figure 12).



In a second robustness check, we aim to pressure test the corporate balance sheet channel as the predominant source of financial frictions that make emerging Asia vulnerable to external shocks. Rather than using capital flows as a measure of the corporate balance sheets, we look at FX debt of nonfinancial corporates, a significant share of which is likely to be unhedged. In our specification regressing output and investment growth on external shocks alone, we introduce an interaction with the shocks with corporate FX debt as a share of GDP. We find that the interaction terms of FX debt is significant and negative moreso for financial shocks (particularly the excess credit spread), rather than the real shocks. This would suggest that in the event of an adverse financial shock, high FX debt in corporates amplifies the negative effect leaving output and investment growth lower. This result holds for both AEs and EMs.

VI. CONCLUDING REMARKS

The global financial cycle plays a defining role in macrofinancial fluctuations in Asian economies, and presents a central consideration for policymakers as trade and financial integration advance. In order to better understand the spillovers to small open economies, this paper has documented through the lens of the Asian experience the importance of external financial shocks relative to real shocks, and examined the different transmission mechanisms through which these shocks propagate to the real sector. Capital flows and domestic financial conditions drive output and investment in EM Asia, while the credit is a key channel for AEs. We also find evidence for the corporate balance sheets as a source of vulnerability for EM Asia, which could reflect their relatively low degree of FX hedging relative to banks. We also note the importance of the expectations channel for the full sample, as external financial shocks themselves, both policy surprises and cumulatively accommodative financial conditions (low for long) impact output and investment beyond the usual transmission channels. With global financial conditions expected to continue being accommodative, Asian EMs may likely face further ramifications on investment and GDP growth.

With this in mind, policies can play an important role in mitigating the adverse impact of external shocks. We have found evidence that in some circumstances, there are merits to using one type of policy versus another which could provide a rationale for Asian policymakers' use of multiple policy instruments. Several structural characteristics strengthen the case for using multiple policy instruments in some circumstances, such as

balance sheet mismatches, low financial development, or a weak monetary policy transmission mechanism.

Further work could broaden our understanding of the complete effects of external shocks, such as through a multiple equation specification, while structural models could better parse out optimal policy choices in the face of specific shocks. The banking and corporate channels in emerging Asia, which have large FX asset and liabilities positions and were found to serve as a potential amplification channel, could also be more closely examined to better inform policy.

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VIII. APPENDIX

Table A.1: Advanced vs. External Economies, Sample Statistics

Variable	Obs	Mean	Std. Dev	Min	Max
Advanced Economies					
REER change	576	0.00	7.83	-36.61	28.77
Credit growth	576	7.01	6.62	-10.05	28.31
Capital flows	654	-3.06	11.49	-83.43	51.38
Terms of trade	570	-0.10	2.75	-12.19	16.93
Emerging Economies					
REER change	576	0.67	9.36	-64.06	63.02
Credit growth	512	12.65	12.63	-61.13	104.07
Capital flows	597	1.22	43.49	-167.97	880.18
Terms of trade	453	0.17	7.50	-28.44	41.18

Note: AEs: Australia, Hong Kong SAR, Japan, New Zealand, Singapore, South Korea and Taiwan Province of China; EMs: China, India, Indonesia, Malaysia, Philippines, Thailand and Vietnam.

Tables A.2: Impact on EM Investment*Effect at the median*

VARIABLES	(1) Investment /GDP	(2) Investment /GDP	(3) Investment /GDP	(4) Investment /GDP	(5) Investment /GDP	(6) Investment /GDP	(7) Investment /GDP	(8) Investment /GDP
Capital flows ex FDI	2.779* (0.0602)	3.202** (0.0371)	3.091** (0.0184)	2.434** (0.0216)	1.723 (0.156)	1.230 (0.398)	1.897* (0.0771)	1.634 (0.185)
REER	0.0142 (0.940)	0.101 (0.603)	0.296* (0.0931)	0.402** (0.0312)	0.383* (0.0501)	0.454** (0.0277)	0.230 (0.198)	0.171 (0.166)
Credit growth	1.268*** (0)	1.146*** (1.13e-07)	1.214*** (0)	1.160*** (0)	1.133*** (3.21e-10)	1.129*** (3.59e-07)	0.921*** (2.71e-06)	0.960*** (2.71e-10)
ToT	0.356* (0.0623)	0.269* (0.0900)	0.268 (0.111)	0.180 (0.218)	0.0491 (0.742)	0.0803 (0.606)	0.0483 (0.749)	-0.0579 (0.619)
US TFP	-0.256* (0.0950)	-0.304 (0.104)	-0.333** (0.0120)	-0.207* (0.0649)	-0.198 (0.111)	-0.249* (0.0654)	-0.265 (0.130)	-0.383*** (0.00982)
GZ shock	-0.404** (0.0235)	-0.395** (0.0363)	-0.382** (0.0104)	-0.452*** (0.000111)	-0.482*** (0.000237)	-0.368*** (0.00270)	-0.246* (0.0549)	-0.166 (0.150)
Constant	0.196 (0.296)	0.327* (0.0911)	0.299** (0.0466)	0.394*** (0.00897)	0.356** (0.0278)	0.354** (0.0361)	0.217 (0.207)	0.119 (0.431)
Observations	370	370	370	370	370	370	370	370

pval in parentheses

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

Effect at the 5th percentile

VARIABLES	(1) Investment /GDP	(2) Investment /GDP	(3) Investment /GDP	(4) Investment /GDP	(5) Investment /GDP	(6) Investment /GDP	(7) Investment /GDP	(8) Investment /GDP
Capital flows ex FDI	-2.546 (0.303)	-2.337 (0.337)	-0.155 (0.949)	-1.653 (0.452)	0.807 (0.692)	-2.254 (0.281)	-0.616 (0.781)	-0.793 (0.721)
REER	-0.212 (0.466)	-0.194 (0.465)	-0.171 (0.558)	-0.162 (0.532)	-0.0640 (0.833)	-0.185 (0.688)	-0.147 (0.729)	-0.216 (0.529)
Credit growth	-0.0800 (0.736)	-0.316 (0.135)	-0.222 (0.340)	-0.391 (0.191)	-0.185 (0.586)	-0.0239 (0.949)	0.0541 (0.871)	-0.184 (0.507)
ToT	0.553* (0.0558)	0.482* (0.0754)	0.674*** (0.00460)	0.553* (0.0918)	0.297 (0.333)	0.356 (0.276)	0.471 (0.108)	0.0223 (0.942)
US TFP	-0.692** (0.0239)	-0.606*** (0.00640)	-0.383* (0.0938)	-0.565* (0.0620)	-0.547* (0.0744)	-0.687** (0.0319)	-0.667* (0.0585)	-0.662** (0.0433)
GZ shock	-0.137 (0.763)	-0.103 (0.832)	-0.803** (0.0180)	-0.232 (0.642)	-0.791* (0.0941)	-0.0264 (0.961)	-0.322 (0.352)	-0.274 (0.579)
Constant	-4.674*** (0)	-4.550*** (0)	-4.405*** (0)	-4.439*** (0)	-4.165*** (0)	-4.344*** (0)	-4.340*** (0)	-4.125*** (0)
Observations	370	370	370	370	370	370	370	370

pval in parentheses

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

Tables A.3: Impact on EM Growth

Effect at the median

VARIABLES	(1) GDP growth	(2) GDP growth	(3) GDP growth	(4) GDP growth	(5) GDP growth	(6) GDP growth	(7) GDP growth	(8) GDP growth
Capital flows ex FDI	0.476 (0.593)	-0.159 (0.893)	-1.399 (0.288)	-2.374* (0.0962)	-3.385** (0.0178)	-2.118 (0.223)	-0.540 (0.595)	-0.319 (0.823)
REER	0.363*** (0.00931)	0.223 (0.158)	0.0969 (0.496)	0.0135 (0.937)	-0.0613 (0.663)	-0.146 (0.374)	-0.200 (0.215)	-0.270** (0.0458)
Credit growth	0.303*** (0.00910)	0.228* (0.0920)	0.266** (0.0437)	0.212** (0.0366)	0.165 (0.241)	0.0805 (0.637)	0.0711 (0.696)	-0.00358 (0.984)
ToT	0.0799 (0.601)	-0.164 (0.198)	-0.235** (0.0174)	-0.411*** (0.000678)	-0.320** (0.0186)	-0.374** (0.0127)	-0.304* (0.0682)	-0.286* (0.0521)
US TFP	-0.325** (0.0131)	-0.138 (0.260)	0.110 (0.407)	0.0893 (0.508)	-0.0489 (0.729)	-0.0102 (0.947)	0.0395 (0.768)	-0.182 (0.136)
MP shock	-0.338*** (0.00672)	-0.195 (0.201)	-0.171 (0.224)	-0.0327 (0.858)	0.229 (0.164)	0.280 (0.152)	0.0992 (0.471)	-0.00881 (0.949)
GZ shock	-0.546*** (0.00111)	-0.340* (0.0835)	-0.212 (0.314)	0.143 (0.543)	0.375** (0.0459)	0.373** (0.0472)	0.331** (0.0320)	0.470** (0.0114)
Constant	0.0684 (0.549)	0.0221 (0.845)	0.0390 (0.744)	0.114 (0.345)	0.125 (0.342)	-0.0632 (0.681)	0.0792 (0.560)	0.0594 (0.573)
Observations	370	370	370	370	370	370	370	370

pval in parentheses

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

Effect at the 5th percentile

VARIABLES	(1) GDP growth	(2) GDP growth	(3) GDP growth	(4) GDP growth	(5) GDP growth	(6) GDP growth	(7) GDP growth	(8) GDP growth
Capital flows ex FDI	2.696* (0.0639)	1.565 (0.552)	-3.175 (0.358)	-9.031** (0.0239)	-6.964** (0.0123)	-3.917 (0.277)	-0.00709 (0.999)	-0.545 (0.872)
REER	0.684** (0.0127)	0.726** (0.0420)	0.455 (0.405)	-0.0210 (0.964)	-0.560* (0.0795)	-1.191*** (0.00658)	-0.868 (0.109)	-0.841 (0.134)
Credit growth	0.687*** (0.00806)	0.320 (0.387)	0.281 (0.599)	0.0995 (0.856)	-0.559 (0.196)	-0.660 (0.123)	-0.362 (0.415)	-0.187 (0.649)
ToT	-0.0410 (0.881)	0.0323 (0.949)	-0.0878 (0.836)	-0.742* (0.0866)	-0.781** (0.0157)	-0.999** (0.0273)	-0.655 (0.138)	-0.0132 (0.980)
US TFP	-0.770** (0.0144)	-0.368 (0.395)	-0.196 (0.685)	0.121 (0.792)	-0.189 (0.619)	0.0608 (0.864)	0.631 (0.134)	-0.0945 (0.846)
MP shock	-0.483** (0.0109)	-1.096*** (0.000660)	-0.618 (0.257)	0.401 (0.397)	0.771* (0.0588)	0.663 (0.273)	0.922*** (0.00758)	0.0784 (0.823)
GZ shock	-0.852*** (0.000203)	-0.457 (0.266)	-1.000 (0.176)	-0.978 (0.228)	-0.604 (0.232)	0.539 (0.252)	0.255 (0.453)	0.761*** (0.00392)
Constant	-3.485*** (0)	-3.947*** (0)	-3.376*** (2.88e-09)	-3.796*** (0)	-3.543*** (2.87e-10)	-3.737*** (3.15e-10)	-3.883*** (1.86e-10)	-3.773*** (0)
Observations	370	370	370	370	370	370	370	370

pval in parentheses

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