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Effects of Emerging Market Asset Purchase Program Announcements on Financial Markets During the COVID-19 Pandemic

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Abstract

The COVID-19 pandemic led many emerging market central banks to adopt, for the first time, unconventional policies in the form of asset purchase programs. In this study, we analyze the effects of these announcements on domestic financial markets using both event studies and local projections methodology. We find that these asset purchase announcements lowered bond yields, did not lead to a depreciation of domestic currencies, and did not have much effect on equities. While the immediate effect of asset purchases appears positive, further consideration of the risks and longer-term effects of unconventional monetary policies is needed. We highlight the trade-offs involved with the implementation of these measures, and discuss their risks. This working paper adds to the debate on how asset purchase programs should be a regular part of the emerging market policy toolkit.

JEL Classification Numbers: E51, E58, F30, G12, G14, G15

Keywords: COVID-19, pandemic, asset purchase program, quantitative easing, bonds, policy announcement, policy spillover, equities, foreign exchange, central banks, emerging markets.

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I. Introduction and Summary of Findings

The COVID-19 pandemic caused a synchronized and deep global recession. The reaction of policymakers was swift and, in some instances, unprecedented. Since March 2020, nearly all major central banks responded forcefully including by lowering rates, providing liquidity to the financial system, and adopting or expanding unconventional monetary policy measures[1] to diffuse financial market stress and ease financial conditions. In particular, nearly 20 emerging market (EM) central banks resorted to asset purchase programs (APPs).

While asset purchase programs have traditionally been used in the context of regular open market operations, the COVID-19 episode saw a broad-based widening of these measures, in terms of the stated objectives, the scale as well as the breadth of assets purchased. The simultaneous emergence of nearly 20 APPs since March 2020 and their intended objectives, are new and indicative of the unprecedented policy action. For the purpose of this paper, asset purchases refer to the purchase of private and public sector bonds with the intention of providing monetary accommodation, broadly easing financial conditions, reducing market volatility, or possibly engaging in monetary financing via primary market purchases. Some countries in our sample increased the limits of their open market operation purchases to achieve such objectives while others set up separate purchase programs. Table 2.1 in IMF (2020) discusses the set and motivation of EM central bank APPs and their stated objectives.

In this study, we examine the effects of APP announcements by EM central banks on domestic financial markets, across multiple asset classes (including fixed income, foreign exchange (FX) and equity markets). We do it two ways: 1) an event study analysis at various frequencies to understand the immediate impact over different windows; 2) a regression analysis, using local projections methodology, that allows us to control for global factors such policy measures announced by the Federal Reserve, swings in global risk appetite as proxied by the VIX, and domestic policy rates changes; and also to capture the persistence of the effect. The results from either analysis are consistent with each other, as mentioned below.

First, we find that APP announcements in EMs reduced long-end bond yields in a significant and persistent way. The event study analysis highlights that median bond yields (and term premia) declined by almost 35 (25) basis points (bps), in the few days (and in some cases, on an intra-day basis) following the announcements. The results are corroborated by the local projections methodology, where the size of the effect ranges from 20 to 60 bps for up to 6 trading days in the aftermath of the announcements. Moreover, the announcement by the Federal Reserve for extensive new measures to support the US economy, including QE,[2]

[1] Open market operations, aimed at market liquidity dynamics, are also included as part of these measures so the expansion pertains to such kind of policy measures.

[2] For the purposes of this study, Federal Reserve's announcement of March 23 is considered to be the QE announcement date. While a few other measures were introduced before this, the announcement on March 23 had the most comprehensive introduction of policy measures including 1) expanding the QE program to include purchases of commercial mortgage-backed securities in its mortgage-backed security purchases; 2) establishing three new emergency facilities including

(continued…)

also helped lower bond yields in EMs, whereas a rise in the VIX had a negative effect thereby increasing EM yields. Domestic policy rate cuts, however, did not have a significant effect on bond yields, after controlling for APP announcements.

Second, we find that APP announcements did not lead to a depreciation or a significant change in EM currencies against the dollar. This may reflect the intention of several central banks to sterilize purchases[3], which in turn may have alleviated market concerns about exchange rate depreciation pressures (e.g., due to liquidity injections from APPs driving overnight rates below policy rates). Furthermore, decisive actions taken by fiscal and monetary authorities in advanced economies likely played a large role in restoring investor confidence. For example, we find that the QE announcement by the Federal Reserve was followed by an appreciation of EM currencies against the US dollar, whereas the increase in the VIX was followed by a depreciation. Domestic policy rate cuts during the period of COVID-19 generated either short-lived depreciations, or less significant effects on currencies.

Third, domestic APP announcements did not have a strong effect on EM equities, although we document that they somewhat helped stock markets rebound. Global factors seem to have had a more significant effect on domestic stock markets tough. The QE announcement by the Federal Reserve supported EM stock markets, whereas a higher VIX put downward pressures. Domestic policy rates appear to have no significant effect on equities.

The policy implications of market reactions to APP announcements are significant. Our findings suggest that APPs could be an additional tool to achieve a central bank's monetary policy objectives, diffuse financial market stress and promote stability. This is particularly important for central banks with relatively limited conventional monetary policy space, such as when policy rates are close to the effective lower bound (Cavallino and Sandri, 2020), or where domestic bond markets are being severely disrupted. As with other unconventional monetary policies however, there are inherent risks to APPs relating to weakening of the institutional credibility, intensification of capital outflow pressure, distortion of market dynamics, and concerns of fiscal dominance. These risks (as also discussed in IMF, 2020) underscore the need for an ongoing evaluation of these policies, and whether they should be a part of the regular policy toolkit.

Primary Market Corporate Credit Facility (PMCCF), Secondary Market Corporate Credit Facility (SMCCF) and a revival of the Term Asset-Backed Securities Loan Facility (TALF); and 3) expanding many other funding facilities—many of which were introduced for the first time. Consequently, March 23 also acted as the inflection point, and global markets recovered sharply after.

[3] For example, the Polish Central Bank has sterilized a significant portion of its asset purchases through the sale of 7-day NBP bills. The Chilean central bank has a transparent breakdown of the liquidity drains it performed to counterbalance the liquidity injections due to bond purchases and other exceptional policy measures. The South African central bank governor was explicit that persistent and unsterilized increases in bank reserves due to asset purchases would create downward pressure on interest rates which would be inflationary in his view.

A. Literature

While there is an extensive literature on the impact of QE announcements and implementation in the advanced economies (Singh and Goel, 2019; Arrata and others, 2018; Brainard, 2017), the new trend of EM central bank asset purchases will attract significant interest among policymakers, market participants and academics. To our knowledge, this is one of the first studies to analytically explore the impact of EM asset purchase programs on domestic financial markets. The closest study to ours is by Arslan and others (2020). The authors take a similar approach and show that domestic APP announcements by EM central banks had an impact on bond yields. Our findings on bond yields are somewhat consistent with theirs. However, we have several incremental contributions. First, we explore the effects of domestic APP announcements and global factors conditional on each other. This helps us compare both the size and persistent of those effects. Second, our estimation methodology is prone to a potential downward bias arising from consecutive APP announcements in EMs to be explained in detail below. Third, our analysis extends to stock market implications of domestic and global factors in the period of COVID-19.[4]

Second, we contribute to the relatively large literature on the spillovers from the US monetary policy, and also global financial conditions, to EM financial markets. The majority of these papers document evidence on the presence of such spillovers from global financial conditions to EMs, which is mainly driven by the US policy actions and the global risk appetite (see Giovanni and others, 2017; Bruno and Shin, 2015; and Rey, 2013). More specifically, the US monetary policy actions are found to have sizable effects on EM sovereign bond yields, particularly at longer maturities. For instance, Albagli and others (2019) document that the effects of US monetary policy shocks on 10-year bond yields in EMs are much larger than the effect on 2-year bond yields.[5] Moreover, policy actions by the Federal Reserve are discussed to affect investor risk tolerance for EM assets by rising equity prices in EMs (Chari and others, 2020) and improving EM currencies (Albagli and others, 2019 and Curcuru and others, 2017). We extend this literature by documenting similar findings in the case of the recent COVID-19 episode. We show that the QE announcement by the Federal Reserve helped EMs improve bond yields, currencies and equities; whereas weaker global risk aversion, proxied by the VIX, had an opposite impact on those markets. The only paper we are aware of is by Beirne and others (2020) showing some evidence for such a spillover from the QE announcement by the Federal Reserve to EM bond yields during the COVID-19 episode. We extend that by presenting evidence for the persistence of the effect.

The rest of this paper is organized as follows. Section 2 explains the data. Section 3 illustrates the methodology. Section 4 documents the results from the event study analysis.

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[4] Other recent studies by Hartley and Rebucci (2020) and Fratto and others (forthcoming), using event studies or panel regressions, focus on shorter term effects of unconventional domestic policies on bond yields in the COVID-19 period and document facts similar to ours.

[5] Also see Caballero and Kamber (2019), Curcuru and others (2017), and Bowman and others (2015).

Section 5 documents the results from the regression analysis. Section 6 discusses the trade-offs involved in the implementation of these APPs. Section 7 concludes.

II. DATA

For the daily event study analysis, the sample includes Chile, Colombia, Hungary, Malaysia, Indonesia, India, South Africa, Poland, Turkey, and the Philippines (over a total of 16 dates). The data on bond yields, exchange rates and equity markets are gathered from Bloomberg. The change in bond yields is calculated in basis points while those in exchange rates and equity markets is calculated in percentage terms. Both are normalized at the announcement date (which is considered t=0 in all the charts). Term premia calculations are based on the methodology detailed in Adrian and others (2013) and sourced from BNP Paribas. The methodology uses principal components of bond yields as pricing factors.

For the intra-day event study analysis, high-frequency financial markets data is sourced from Bloomberg. The bond yields and exchange rates are sourced and analyzed at a tick level (then aggregated to a minute level data). Given the data specificity and constraints, the analysis is focused on just three countries: South Africa, India and Poland.

For the regression analysis, we use 3 different dependent variables in our analysis: Changes in (i) 10-year government bond yields in basis points, (ii) the nominal exchange rate vis-à-vis the US dollar, and (iii) equity market indexes in percent.

- Two variables on domestic policies are the dates for APP announcements by EM central banks and the domestic policy rate cuts. The former is a dummy variable which takes 1 in the dates of announcements, and 0 otherwise.[6] To assign the dates, we rely on the websites of EM central banks. The set of dates are illustrated in Table A.1 in the Appendix. APP announcement dates used in this study is largely consistent with Arslan and others (2020) and Hartley and Rebucci (2020). However, we still employ a large set of robustness checks to alleviate any potential concerns about the choice of dates. Domestic policy rates are obtained from Bloomberg.

- Global factors are either the dummy variable for the QE announcement of the Federal Reserve, or the VIX in different regressions. The dummy variable for the QE announcement of the Federal Reserve is assigned 1 on March 23, and 0 otherwise. The VIX is obtained from Bloomberg.

- The sample consists of 13 EMs between the beginning of January and the mid-May at daily frequency using trading days only. The list of countries is illustrated in Table A.1 in the Appendix. We make sure that there is no specific country out of these 13

[6] This dummy variable approach comes with a caveat, since it ignores the size, duration or specific nature of each announcement—which can potentially affect the consequences of the announcement. However, it is not straightforward to apply this analysis using size or other features of APP announcements, since they have not been very clearly defined by EM central banks in many cases.

EMs driving the results in this analysis. Moreover, results remain almost the same if we start the period of the analysis from February or end it at the beginning of May.

III. METHODOLOGY

Our goal is to analyze the size and persistence of effects of domestic APP announcements by EM central banks on domestic bond, FX and stock markets. While event study analysis helps highlight that the announcement dates acted as an inflection point, the daily analysis does not adjust for other potential drivers of these markets, namely, domestic policy rate cuts and global factors, such as the QE announcement by the Federal Reserve or the VIX. We address this in two ways:

1) We deploy event studies at an intra-day level with asset prices available at a very high frequency (tick levels). The assumption is that any sharp asset price movements at this level, is likely due to any major policy announcements or news, rather than the global financial conditions.

2) We deploy a more formal regression analysis. Throughout the regressions, we control for exogeneous factors to isolate the effects of domestic APP announcements, and also observe relative significance of those factors on EM financial markets. The estimation aims to capture both the size and the persistence of the impact. For this purpose, local projections methodology -proposed by Jorda (2005) with the extension introduced by Teulings and Zubanov (2014)—is used in the empirical analysis.[7] This allows to capture the full dynamics of the dependent variable in the aftermath of the announcements by EM central banks. The specification is as follows:

$$\Delta Y_{c,t-1\rightarrow t+p} = \sum_{r=0}^{p} \alpha_1^{p,r}\, APP\ announcement_{c,t+p-r} + \sum_{r=0}^{p} \alpha_2^{p,r}\, Global\ factor_{t+p-r} + \sum_{r=0}^{p} \alpha_3^{p,r}\, \Delta Policy\ rate_{c,t+p-r} + \sum_{l=1}^{4} \Omega_1^{l}\, APP\ announcement_{c,t-l} + \sum_{l=1}^{4} \Omega_2^{l}\, Global\ factor_{t-l} + \sum_{l=1}^{4} \Omega_3^{l}\, \Delta Policy\ rate_{c,t-l} + \mu_c + e_{c,t+p} \quad (1)$$

where *c* stands for country and *t* stands for day. The dependent variable $\Delta Y_{c,t-1\rightarrow t+p}$ is the cumulative change in the dependent variable Y_c from day *t*-1 to day $t+p$. We use three different dependent variables in different regressions, namely, 10-year local currency

[7] Teulings and Zubanov (2014) show that the original local projections methodology by Jorda (2005) may generate biased estimates, if the lead values of explanatory variables are not controlled for. This is particularly important in our analysis, since there are consecutive APP announcements in several EMs (see Appendix, Table A.1). Thus, skipping this extension of the local projections methodology may lead to a downward bias in our estimation in our estimation. By controlling for forward values of APP announcements, we are able to observe the effect of each individual announcement. We discuss this issue further in detail in Section V.

sovereign bond yields,[8] the nominal exchange rate of local currencies vis-à-vis the US dollar and stock market indexes.

The variable $APP\ announcement_c$ is a dummy variable which takes 1 in the dates of APP announcements by EM central banks, and 0 otherwise. The variable $Global\ factor_t$ is either (i) the dummy variable indicating the date for QE announcement by the Federal Reserve to capture the direct effect of that on yields, or (ii) the VIX as a proxy for global risk aversion. The third explanatory variable is the percentage points decrease in policy rates ($\Delta Policy\ rate_c$).

Four lags of all explanatory variables are included in the regressions. However, using lower/higher number of lags does not affect the results. Any bias from unobserved country-specific features are absorbed by country fixed effects (μ_c). This is important in the estimation, since those characteristics such as pre-COVID-19 market conditions, institutional capacity, policy credibility, accountability or central bank independence may yield a bias in the results by altering the impact of APP announcements.[9] Standard errors are robust.[10]

The coefficient estimates $\alpha_i^{p,p}$ with *i*=1, 2, 3, are plotted for 6 trading days (for p=0,...,6) following each action, where day 0 is the day of the event, to shed light of effects of all three factors on the financial markets. Thus, the estimation is able to capture the full dynamics the response of yields, currencies and stock market indexes for 6 days in the aftermath of events, i.e., the persistent of the effects. The 1-standard error confidence interval is also reported.[11]

IV. RESULTS: EVENT STUDY ANALYSIS

A. Daily Analysis

We first analyze the trends in financial markets, around the APP announcement dates, through an event study. We use daily data (Figure 1) across four major indicators: 1) 10-year sovereign bond yields; 2) 10-year sovereign bond term premia; 3) currencies; and 4) equity markets. We observe that the financial conditions reversed materially post the announcements, across a number of classes.

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[8] Such effectiveness analysis for advanced economies has typically focused on using term (or risk) premia as a dependent variable (for instance, Singh and Goel, 2019). We use bond yields for two reasons: 1) Compressing risk premia has not been the major stated focus for most EMs, unlike many advanced economies; and 2) Model based estimates of term premia might add another layer of uncertainty in the analysis, especially as many of these estimates are not widely available / vetted for EMs.

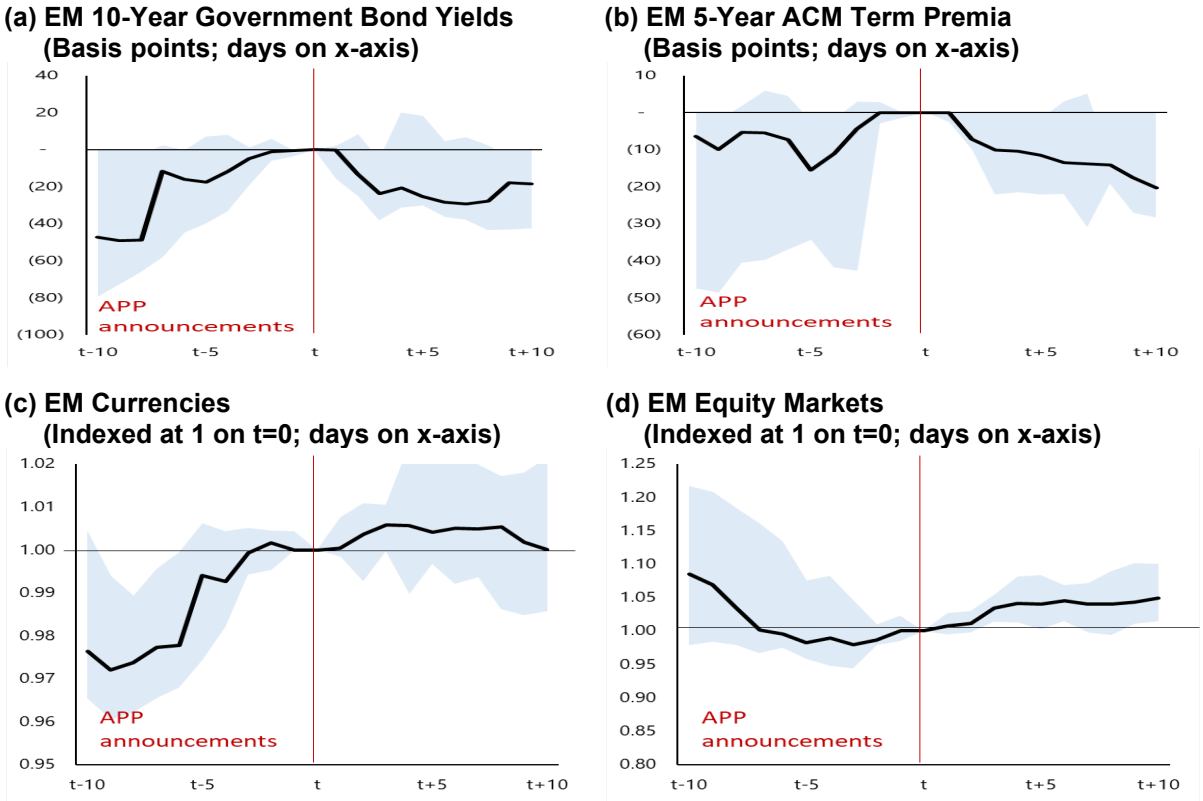
[9] For instance, see the discussions in Arslan and others (2020), Çakmaklı and others (2020), and Hartley and Rebucci (2020).

[10] Results remain virtually the same, if we cluster standard errors at the country-level.

[11] See Appendix (Table A.2) for the coefficient estimates of the dummy for APP announcements, together with the standard errors and the statistical significance at the 10, 5 and 1 percent levels.

Government bond yields (Figure 1.a) saw an inflection point and declined sharply after the announcements. The median bond yields declined by almost 35 bps over the next few days after the announcement, compared to an average 50 bps tightening prior to the announcement. While this has not been the stated objective of launching APPs for most EMs (IMF, 2020), a key channel of transmission is through the reduction in term premia. Median ACM term premia (Figure 1.b), reduced by almost 20 bps in a week after the announcement, as compared to a 15 bps tightening going into the announcements. On the other hand, the impact on currencies (Figure 1.c) was relatively limited. This potentially reflects the fact that the asset purchases were planned to be sterilized in nature. EM equity markets (Figure 1.d) also improved a few days post the announcements.[12]

Figure 1. Market Reaction to Domestic APP Announcements



Sources: Bloomberg Financial L.P.; BNP Paribas estimates; National Authorities; and IMF staff estimates.
Note: Results are based on daily data. In the charts, x-axes represent trading days around APP announcement events. (a) and (b) are simple basis points changes. (c) currency vis-à-vis the US dollar and (d) equities are with the index normalized to 1. Blue area represents the interquartile range across our entire sample of events. In panel 2, term premium calculations are based on the methodology detailed in Adrian, Crump, and Moench (2013) and sources from BNP Paribas analysts.

[12] These results are also broadly in line with the initial assessments done by the BSP staff which show that the BSP's purchases of NG securities in the secondary market were associated with restoring confidence and a general improvement of performance of financial market as seen in the easing of liquidity conditions, lowering of the loan rates between banks, narrowing term spreads, the recovery in the Philippine Stock Exchange Index (PSEi), and the recent appreciation of the Philippine peso.

B. Intra-Day Analysis

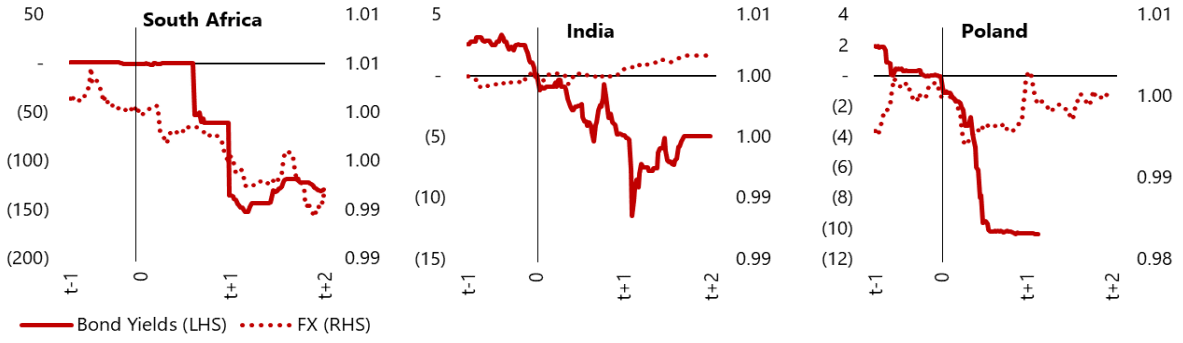
While the daily analysis above is informative, it cannot be used very effectively for identifying the effect of a single event because of the role played by global factors, as well as other domestic policies over the course of the analysis. We thus look at intra-day data (sourced at a high frequency)—that will be less affected by global and exogenous factors compared to changes in end-of-day levels. Furthermore, many of these announcements happened when the US trading markets were closed, reaffirming our assertion that any swift change in the financial assets must be attributable to domestic news or policy announcements.

The results, from the previous section, are corroborated here as well with a sharp decline in the government bond yields.[13] For South Africa, yields declined by almost 150 bps intra-day, while for India and Poland—it was relatively modest at around 10 bps. Currencies, on the other hand, displayed mixed and relatively limited impact. The South African rand appreciated potentially reflecting increased investor confidence after the announcement (as well as a reversion from the sharp 7 percent depreciation in the last few days), while the Indian rupee and Polish zloty were relatively unchanged.

It is also interesting to also note the wide variation across countries (in Section IV.A, and Section IV.B), implying that country specific factors in terms of vulnerabilities, buffers and details of the program mattered significantly. Motivated by these facts, next we formally test the effect of domestic APP announcements on domestic markets using the local projections methodology the estimation in (1).

Figure 2. Intra-Day Market Reaction to Domestic APP Announcements

Intra-Day Asset Price Movement on the Days of APP Announcements for Selected Emerging Markets
(Change in basis points on left scale; indexed FX performance on right scale; hours passed on the x-axis)



Sources: Bloomberg, National Authorities; and IMF staff estimates.
Note: EM = emerging market. Results are based on intra-day data. In the charts, x-axes represent trading hours around APP announcement events (so, one hour before the announcement and two hours after). A declining trend in the FX lines imply an appreciation of the local currency versus the US dollar.

[13] Given the data specificity and constraints, we do this analysis only for few selected EMs, namely, South Africa, India and Poland. Similarly, the analysis is not done for equities because of lack of data availability.

V. RESULTS: REGRESSION ANALYSIS

A. Baseline Results

In the baseline regressions, we control for the QE announcement by the Federal Reserve in equation (1). Figure 3 plots the results in the case of (a) government bond yields, (b) FX markets and (c) stock indexes. We explore the effects of all 3 factors, namely, domestic APP announcements, the QE announcement by the Federal Reserve and domestic policy rate cuts.

Figure 3(a) shows that domestic APP announcements lowered bond yields in EMs, even controlling for other factors. The effect was persistent and significant upwards of 6 trading days. The point estimate suggests that yield was 35 bps lower than the pre-announcement level where one standard error confidence interval ranges between around 20 to 50 bps, even in the 6th day after the announcement. Hence, the effect was also persistent.[14] The results are broadly consistent with what we found in Section IV's event study analysis. The chart in the middle documents that the QE announcement by the Federal Reserve also had a long-lasting effect on EM bond yields. In the 6th day following the announcement, the yield was 17 bps lower than the pre-announcement level, while the range of the effect was 5–30 bps. The results are broadly consistent with the US monetary policy spillovers to EMs that have been documented elsewhere in the literature (IMF, 2020). We conclude that both the size and persistence of the effect of domestic APP announcements was similar to that of the QE announcement by the Federal Reserve. The chart on the right shows that domestic policy rate changes, controlling for the other factors, did not affect long-end bond yields significantly. This might partially be because risk premia in general remains high, and part of these policy rate cuts were already expected (IMF, 2019).

Figure 3(b) runs the analysis for the changes in domestic currencies vis-à-vis the US dollar, with the left chart illustrating that domestic APP announcements were not followed by significant depreciations in local currencies.[15] This is in line with priors as many of the asset purchase programs were sterilized in nature, so unlikely to have a material impact on FX (IMF, 2020). Furthermore, the restoration of stability and the decisive actions taken by advanced and EM central banks may have also contributed to the investor confidence and reversal of the earlier considerable FX sell-off. On the other side, the QE announcement by the Federal Reserve helped EM currencies, as shown by the middle chart. This positive effect was persistent and around 1 percent (appreciation) even in the 6th trading day in the aftermath of the announcement. The chart on the right shows that a 1 percentage point cut in domestic policy rates led to a depreciation in domestic currencies, which reaches

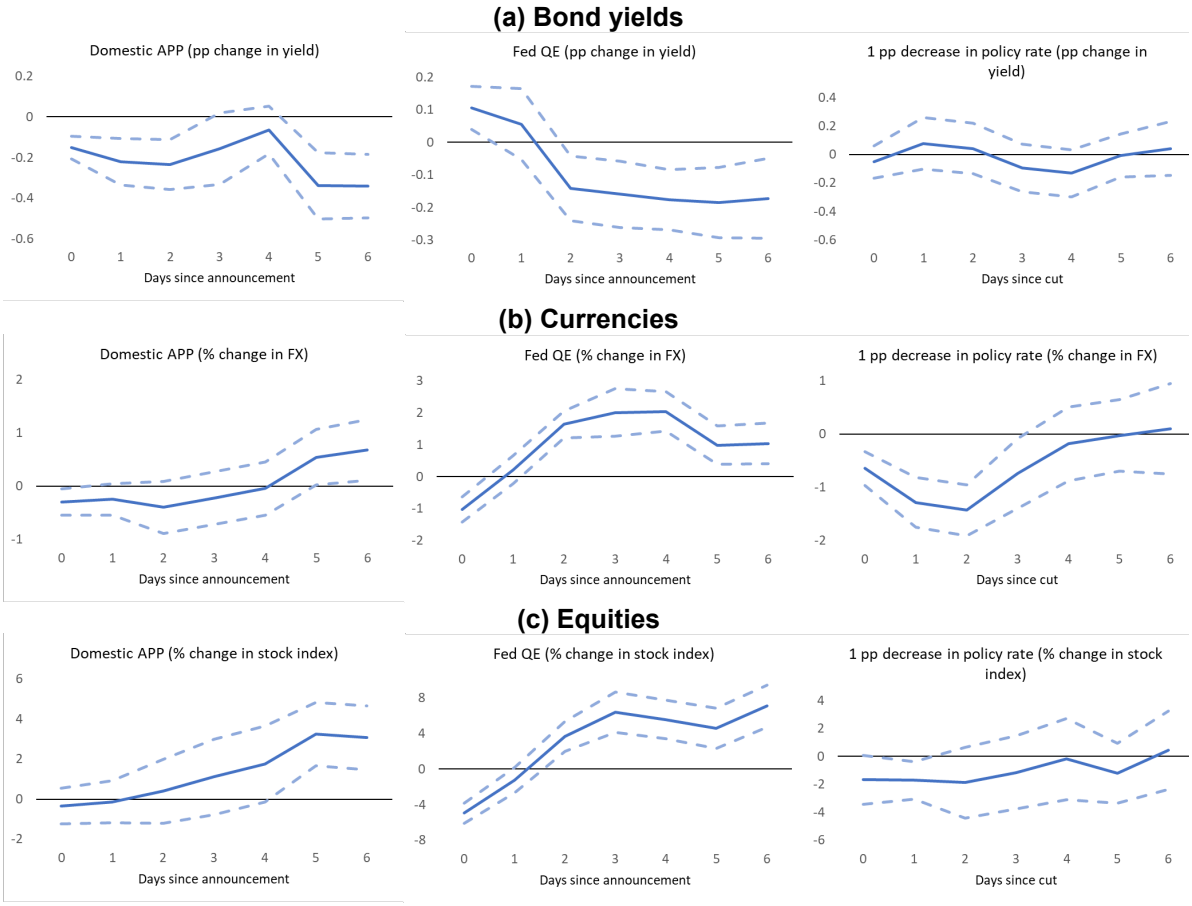
[14] We also do the same analysis using the change in the yield in percent, instead of percentage points, as a further check. That is, we take the difference between two days and then normalize it with the initial value of the yield. The persistence and shape of the responses are almost the same for charts (a), (b) and (c) in that case. Quantitatively, both APP announcements and the QE announcement by the Federal Reserve are found to lower the yield around 6 percent of its initial level even in the 6th trading day following the events.

[15] This result stays the same, if we use the changes vis-à-vis the euro for currencies of European EMs.

up to 1.4 percent in the second day after the cut, but then becomes statistically insignificant from the fifth day.

Finally, Figure 3(c) represents the results for stock markets, with the left chart showing that domestic APP announcements did not have much impact in very short-term but started to have somewhat a statistically significant positive effect in later days. This is broadly consistent with the event study findings as well. The size of the impact was around 3.3 percent in the 5th day following the announcements. The chart in the middle documents a more pronounced positive effect of the QE announcement by the Federal Reserve on EM equities. The effect was persistent and around 7 percent in the 6th day of the event. The relative magnitude probably makes sense as equity markets remain highly sensitive to global financial conditions. Domestic policy rate cuts appear to have no effect on equities.

Figure 3. Domestic APP Announcements and the Fed QE Announcement

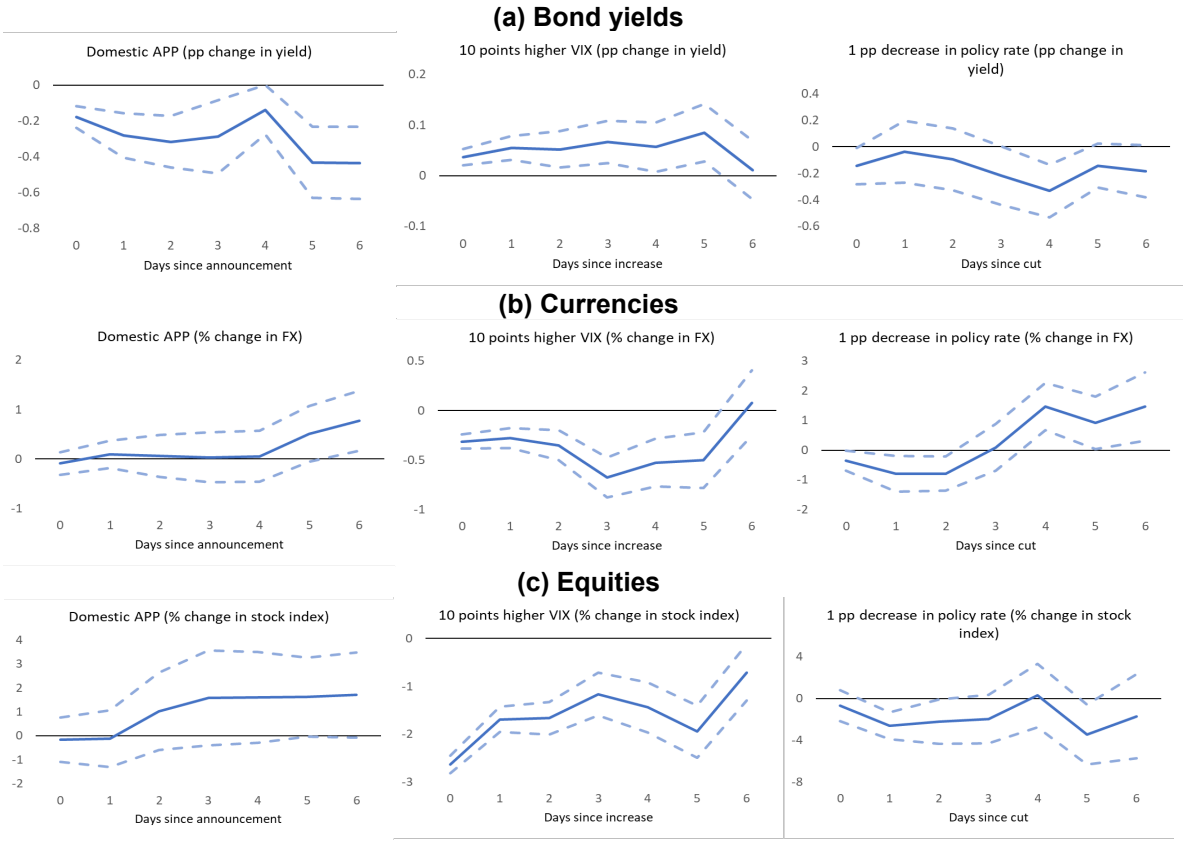


Sources: Bloomberg Financial L.P.; National Authorities; and IMF staff estimates.
Note: Results are based on equation (1), where the global factor is the Federal Reserve QE announcement. In the charts, x-axes represent trading days, (a) y-axis represents percentage point change in the bond yields, (b) y-axis represents percent change in the value of the currencies vis-a-vis the US dollar, (c) y-axis represents percent change in the stock market indexes. Solid lines are the coefficients estimates, and dashed lines are 1-standard error confidence interval.

B. Controlling for the VIX

Next, we replace the QE announcement by the Federal Reserve in equation (1) with the VIX. Figure 4 illustrates the results for (a) bond yields, (b) FX markets and, (c) equity market indexes. We explore the effects of all 3 factors, namely, domestic APP announcements, the VIX and domestic policy rate cuts. The results are broadly similar to the findings represented in Figure 3.[16] Domestic APP announcements have lowered bond yields (Figure 4.a), did not have much effect on FX markets (Figure 4.b) and stock markets (Figure 4.c). On the other side, an increase in the VIX increased bond yields, led to depreciations in EM currencies and lowered EM equities, in line with priors. Similar to the previous findings, domestic policy rate cuts did not appear to have much effect, controlling for the other variables.

Figure 4. Domestic APP Announcements and the VIX



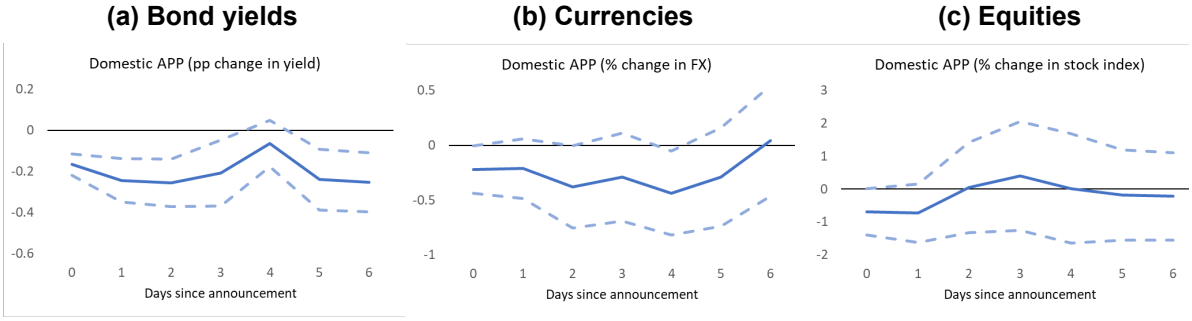
Sources: Bloomberg Financial L.P.; National Authorities; and IMF staff estimates.
Note: Results are based on equation (1), where the global factor is the VIX. In the charts, x-axes represent trading days, (a) y-axis represents percentage point change in the bond yields, (b) y-axis represents percent change in the value of the currencies vis-a-vis the US dollar, (c) y-axis represents percent change in the stock market indexes. Solid lines are the coefficients estimates, and dashed lines are 1-standard error confidence interval.

[16] The consistency amongst the results is also reflecting the fact the QE announcements by the Federal Reserve helped bring down global risk aversion, and thus act as proxies in the regressions.

C. Day Fixed Effects

Until now, our aim was to observe relative effects of domestic and global factors in the estimation. Now, we include day fixed effects in (1) to examine if our results on the effect of domestic APP announcements remain similar. This aims to alleviate concerns about the variables used for the global factors in previous estimations, since day fixed effects account for all possible daily shocks common across EMs, instead of focusing on specific actions or proxies.[17] The results documented in Figure 5 are similar to the previous results. It shows that domestic APP announcements had a significant and persistent effect on bond yields, whereas the effects are much less clear in the case of currencies and equities.[18]

Figure 5. Domestic APP Announcements — Controlling for Day Fixed Effects



Sources: Bloomberg Financial L.P.; National Authorities; and IMF staff estimates.
Note: Results are based on equation (1). Day fixed effects are included. In the charts, x-axes represent trading days, (a) y-axis represents percentage point change in the bond yields, (b) y-axis represents percent change in the value of the currencies vis-a-vis the US dollar, (c) y-axis represents percent change in the stock market indexes. Solid lines are the coefficients estimates, and dashed lines are 1-standard error confidence interval.

D. Further Checks

The following robustness steps are taken in the unreported results. First, in the case that APP announcement dates in a country in the sample may be particularly problematic, we re-run the test in (1) with 12 EMs dropping one country at a time. Throughout those regressions, results in Figure 3 and 4 stay very similar. Hence, results are not driven by any of the countries in the sample, and the dates in any countries.[19]

[17] Note that we still include domestic rate cuts, but do not report those responses, since they do not differ much.

[18] Moreover, if we include a linear common day trend in the regressions, results stay almost the same.

[19] We also note that the announcement dates used in our analysis are mostly consistent with those used in both Arslan and others (2020) and Hartley and Rebucci (2020) aforementioned.

Second, there exist APP announcement dates which are close to each other, e.g., in India. This may lead to a concern on that the specification may generate biased results in such cases given the length of the analysis (i.e., 6-day period). For instance, when we explore the effect of an APP announcement at day *t* on the yield at day *t+6*, in the case where there is a consecutive announcement after *t* but before *t+6*, the estimation would be problematic, if we do not take such cases into account in that case. However, as we mentioned before, by applying the extension by Teulings and Zubanov (2014), the analysis controls for the forward values of the announcements dates to isolate the effect of each announcement date. Hence, the empirical analysis alleviates a potential bias arising from consecutive announcements in the sample. As an additional check to address such a concern further, when the only fist announcement date is adopted for each country with multiple dates, results remain very similar. Finally, a large set of alternative combinations/identifications of domestic APP announcement dates is employed, and results stay almost the same.

VI. TRADE-OFFS

The experience with emerging market asset purchase programs was largely positive in the months following their rollout. Nevertheless, further expansion of duration or size could create risks and thus warrant an ongoing evaluation of risks. If large-scale APPs are used beyond the current pandemic-related extraordinary situation, the following risks could arise, especially for open-ended programs (as discussed in IMF, 2020, and Hofman and Kamber, forthcoming):

- **Institutional and central bank credibility may be weakened.** Credible monetary policy frameworks and sound governance are prerequisites for effective unconventional policy actions such as APPs. Early evidence suggests that APPs by central banks with higher institutional quality tended to have a greater reduction of their local market stress (IMF, 2020). Increased balance sheet exposure to long-term debt may raise concerns about a central bank's ability to raise interest rates when conditions warrant to achieve price stability.

- **Asset purchases may invite concerns about fiscal dominance.** When central banks become buyers of last resort, with large-scale and open-ended APPs in economies with weak monetary and fiscal policy frameworks, it can lead to fiscal dominance, resulting in higher risk premiums and steeper government bond yield curves.

- **APPs may intensify capital outflow pressure, especially in countries with weaker fundamentals.** Expectations of large-scale APPs may put downward pressure on long-term yields and foreign exchange rates, putting capital flows at risk, especially during risk-off periods, when emerging market assets are seen as risky. In particular, investors may decide to rebalance their portfolios more decisively if APPs result in an excessive gap between domestic and peer-group term premiums across the yield curve.

- **The lasting presence of central banks as buyers in the local currency bond market may distort market dynamics.** APPs can end up substantially increasing the role of the

central bank as a market maker, impairing the price discovery process, especially in primary markets,[20] and the development of the financial market. Considerations should also be given to the effect of APPs on collateral availability in the banking system and its impact on the policy rate transmission (Singh and Goel, 2019) as well as possible overvaluation of assets.

VII. Conclusion and Ideas for Further Research

The COVID-19 pandemic led many emerging market central banks to adopt, for the first time, unconventional policies in the form of APPs. This new policy tool, especially if it becomes part of toolkit available to central banks in EMs, could have important implications for financial markets in EMs. In this study, we shed light on the effects of APP announcements by emerging market central banks during the COVID-19 pandemic on bond yields, currencies and stock markets. Examining the period following the March 2020 selloff, we find that these policies lowered bond yields, did not lead to a depreciation of domestic currencies, and did not have much effect on equities. Moreover, we document that global factors, such as the QE announcement by the Federal Reserve and an increase in the global risk appetite had a significant impact on all EM assets under consideration.

Our analysis suggests that, so far, the APP announcements have not led to heightened investor concerns about fiscal dominance, and may have a role to play in monetary policy. Fiscal dominance concerns would have likely led to higher yields, weaker currencies as well as rise in inflation expectation measures;[21] this study finds no evidence of that. This was likely due to the small scale of these programs and explicit aims towards restoring market functioning. Additionally, even in cases where APP objectives were linked to deficit financing objectives, market appear to have been reassured by the limited and time bound implementation of such measures during the extraordinary circumstances of the pandemic. Asset purchases could become part of the monetary policy toolkit for central banks constrained by their effective lower bounds, have steady inflation expectations, concerns over capital outflows and FX depreciation are generally low or where the domestic absorption capacity of new bond supply is limited. More broadly, however, policymakers should consider both the benefits and potential significant costs of APPs, especially if large-scale and open-ended programs are used beyond the current pandemic-related state.

Given the limited experience regarding the effectiveness of APPs in emerging markets, it is worth noting that these are preliminary results in a rich field and additional work is needed. The effectiveness of APPs with respect to lowering domestic bond yields or boosting other asset prices, diffusing stress in bond markets, and promoting stability merits further investigation, beyond the initial post-COVID-19 period and as more data become

[20] As the IMF GFSR October 2020 highlights, in markets that lack financial depth and where the government has large crisis-related short-term financing needs, there may be scope for the central bank to provide, under conditions, temporary support directly to the primary market to assist with the absorption of large issuance.

[21] Although this paper does not empirically test for the impact of APPs on inflation expectations, as the WEO October 2020 highlights: (1) asset purchases, have not unanchored inflation expectations; and (2) inflation expectations have remained relatively low compared with historical averages.

available. Importantly, it is key to analyze the impact of actual implementation vs the announcements that have been considered till now. For example, it is worth noting that in some cases during the COVID-19 period, APP purchases (that by design reduce the interest rate duration risk market participants hold) coincided with periods of increased local currency government net issuance (that increase the duration risk). The effect of APPs during their implementation period on bond yields (e.g., by controlling their effect on duration risk supplied to the market) and other market variables during these periods are beyond the scope of this paper, however are useful areas to do further research upon. Specific elements of APPs are also important to consider, for instance whether the effectiveness of time-bound APPs differ from open-ended programs, or whether purchases in secondary markets have a different signaling effect from those in primary markets, or to what extent sterilization had a role to play in driving financial markets. Finally, the trade-offs between the ameliorating effects of asset purchases discussed in this paper and the risks relating to weakening of central bank credibility, fiscal dominance, loss of the monetary anchor and distortion of market dynamics merit close evaluation.

APPENDIX

As mentioned earlier, the dates for APP announcements by EM central banks are mainly based on our own research, but we also benefit from Arslan and others (2020) and Hartley and Rebucci (2020). Table A.1 illustrates the list of 13 EMs in the sample together with APP announcement dates.

Appendix Table A.1. Dates for APP Announcements in Emerging Markets

Country	Date	Country	Date
Chile	March 16, April 8	Philippines	March 24, April 10
Colombia	March 23	Poland	March 17, April 8
Hungary	March 24, April 7, April 28	Romania	March 20
India	March 18, March 20, April 23	South Africa	March 25
Indonesia	April 1	Thailand	March 19, March 23, April 7
Korea	March 19, March 25, April 9	Turkey	March 31, April 17
Mexico	April 21		

Sources: EM central bank websites; and IMF staff research.
Note: The dates are based on the official statements in central bank websites. The main sample includes South Korea, although it is not listed as EM in the IMF World Economic Outlook, as well as "operating twist" type of announcements, e.g., Mexico and April 23 date for India. The results remain robust if individual countries or dates are removed from the sample, as mentioned in the text.

Table A.2. reports the coefficient estimates for the dummy on APP announcements from the regression results represented by the left charts in Figures 3.a, 3.b and 3.c, respectively.

Appendix Table A.2. Effect of APP Announcements

The effect of APP announcements on	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Yields (percentage points)	-0.151***	-0.221**	-0.235*	-0.157	-0.064	-0.339**	-0.340**
	(0.055)	(0.113)	(0.121)	(0.116)	(0.117)	(0.162)	(0.156)
Currencies (percent)	-0.297	-0.244	-0.399	-0.224	-0.044	0.546	0.681
	(0.257)	(0.295)	(0.495)	(0.494)	(0.505)	(0.525)	(0.571)
Equities (percent)	-0.337	-0.139	0.394	1.118	1.748	3.257**	3.067**
	(0.888)	(1.050)	(1.593)	(1.883)	(1.966)	(1.588)	(1.560)

Sources: Bloomberg Financial L.P.; National Authorities; and IMF staff estimates.
Note: Results are based on equation (1). In rows 1,2 and 3, we report the coefficient estimates for the dummy on APP announcements from the regression results represented by the left charts in Figures 3.a, 3.b and 3.c, respectively. Day 0 is the day of the announcement. Days represent trading days. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

REFERENCES

Albagli, Elias, Luis Ceballos, Sebastian Claro, and Damian Romero. 2019. "Channels of US monetary policy spillovers to international bond markets." *Journal of Financial Economics* 134, no. 2. 447–473.

Arrata, William, Benoit Nguyen, Imene Rahmouini-Rousseau, and Miklos Vari. 2018. "The Scarcity Effect of Quantitative Easing on Repo Rates: Evidence from the Euro Area," IMF Working Paper 18/258, Washington: International Monetary Fund.

Arslan, Yavuz, Mathias Drehmann, and Boris Hofmann.2020. *Central Bank Bond Purchases in Emerging Market Economies*. No. 20. Bank for International Settlements.

Beirne, John, Nuobu Renzhi, and Eric Alexander Sugandi. 2020. "Financial Market and Capital Flow Dynamics During the COVID-19 Pandemic." Asian Development Bank Institute. June.

Bowman, David, Juan M. Londono, and Horacio Sapriza. 2015. "US unconventional monetary policy and transmission to emerging market economies." *Journal of International Money and Finance* 55, 27–59.

Brainard, Governor Lael. 2017. "Cross-Border Spillovers of Balance Sheet Normalization," Speech at the National Bureau of Economic Research's Monetary Economics Summer Institute, Cambridge, Massachusetts, July.

Bruno, Valentina, and Hyun Song Shin. 2015. "Cross-Border Banking and Global Liquidity." *The Review of Economic Studies* 82, No. 2, 535–564.

Caballero, Ricardo J., and Gunes Kamber. 2019. *On the Global Impact of Risk-Off Shocks and Policy-Put Frameworks*. No. w26031. National Bureau of Economic Research, 2019.

Cavallino, Paolo and Damiano Sandri. 2020. "*The Open-Economy ELB: Contractionary Monetary Easing and the Trilemma," CEPR Discussion Paper 14683.*

Chari, Anusha, Karlye Dilts Stedman, and Christian Lundblad. 2020. "Taper Tantrums: Quantitative Easing, Its Aftermath, and Emerging Market Capital Flows." *The Review of Financial Studies*.

Curcuru, Stephanie E., Steven B. Kamin, Canlin Li, and Marius Rodriguez. 2018. "International spillovers of monetary policy: Conventional policy vs. quantitative easing." *FRB International Finance Discussion Paper* 1234.

Çakmaklı, Cem, Selva Demiralp, Şebnem Kalemli-Özcan, Sevcan Yesiltas, and Muhammed A. Yildirim. 2020. *COVID-19 and Emerging Markets: An Epidemiological Multi-*

Sector Model for a Small Open Economy with an Application to Turkey. No. w27191. National Bureau of Economic Research.

Fratto, Chiara, Brendan Harnoys Vannier, Borislava Mircheva, David de Padua, and Hélène Poirson. Forthcoming, "Unconventional Monetary Policies in Emerging Markets". IMF Working Paper. International Monetary Fund, Washington, DC.

Giovanni, Julian di, Sebnem Kalemli-Ozcan, Mehmet Fatih Ulu, and Yusuf Soner Baskaya. 2017. *International Spillovers and Local Credit Cycles*. No. w23149. National Bureau of Economic Research, 2017.

Hartley, Jonathan S., and Alessandro Rebucci. 2020. *An Event Study of COVID-19 Central Bank Quantitative Easing in Advanced and Emerging Economies*. No. w27339. National Bureau of Economic Research.

Hofman, David, and Gunes Kamber. Forthcoming. "Unconventional Monetary Policy in Emerging Market and Developing Economies." Special Series on COVID-19, International Monetary Fund, Washington, DC.

International Monetary Fund (IMF). 2019. *Global Financial Stability Report*. October. Chapter 4.

_____. 2020. *Global Financial Stability Report*. October. Chapter 2.

Jordà, Òscar. 2005. "Estimation and Inference of Impulse Responses by Local Projections." *American Economic Review* 95, No. 1, 161–182.

Rey, Hélène. 2015. *Dilemma not Trilemma: The Global Financial Cycle and Monetary Policy Independence*. No. w21162. National Bureau of Economic Research.

Singh, Manmohan, and Rohit Goel, 2019, "Pledged Collateral Market's Role in Transmission to Short-Term Market Rates," IMF Working Paper 19/106, Washington: International Monetary Fund.

Teulings, Coen N., and Nikolay Zubanov. 2014. "Is Economic Recovery a Myth? Robust Estimation of Impulse Responses." *Journal of Applied Econometrics* 29, No. 3 (2014): 497–514.