An Examination of Whatever-it-Takes Policymaking

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I Introduction

Former ECB President Mario Draghi is credited with resolving the euro crisis based on his promise to do whatever-it-takes to preserve the euro. In September 2022, the Bank of England echoed the phrase in its announcement that it would purchase long-dated UK government bonds on whatever scale necessary to restore orderly conditions in the gilt market. Likewise, during both the global financial crisis and the pandemic, many central banks established facilities to restore market liquidity and support aggregate demand with explicit no-limit-on-scale provisions.[1] This paper examines the impacts of whatever-it-takes policymaking on market expectations during the pandemic.

Central banks across the globe introduced extraordinary policies to address the unprecedented circumstances experienced during the global pandemic. This project categorizes these central bank pandemic-related policy announcements as unlimited or limited in scale, based both on the texts of the announcement press releases and the news coverage of the announcements in the financial press. Documenting the accompanying news reports of announcements is important, because it is not always consistent with the central bank press release. In some cases central banks indicate they will do whatever-it-takes, but news reports indicate markets do not believe this will be the case.[2] In yet other situations, central banks announce size-limited policies, but markets consider the announcement as a whatever-it-takes moment.

This paper examines market reactions to pandemic-related monetary policy announcements involving asset purchases by a wide array of central banks over the period March 2020 through December 2021. We ask which announcements had the largest impact and whether the way that policies were communicated to the market mattered. In the midst of the financial and economic turmoil it seems likely that countries were influenced by the types of policies and announcements made by other countries, which we describe as peer-pressure-induced policy. Countries are also influenced by the severity of the impacts of the pandemic on domestic economic conditions, which we describe as desperate-times[3] policy. We control for these potential foreign country spillovers and own-country pressures in the analysis and distinguish the impacts of whatever-it-takes announcements relative to similar, but size-limited, policy announcements. Importantly, we measure the effects of the announcement

[1] Examples of these types of facilities are described in detail in Buiter et al. (2023).

[2] The relevant news reports generally did not describe why markets did not find announcements credible. In some cases, central banks may not have been perceived as fully committed to the whatever-it-takes pledge. Other potential grounds for skepticism might arise if the country prioritizes exchange rate stability or if central bank solvency is in question.

[3] The expression "desperate times call for desperate measures" is attributed to Hippocrates.

of policy, not the implementation of the policy. In many cases, the size of the ultimate asset-purchases was far lower than what markets anticipated based on asset price reactions at the time of announcement. An extreme example of this comes from Draghi's now-famous speech in 2012, which resulted in the creation of the Outright Monetary Transaction facility (OMT) that was never tapped.[4]

Our empirical strategy involves using event study and local projection methods to measure the short-term effects of pandemic-related central bank policy announcements on exchange rates and sovereign bond yields. We find evidence that whatever-it-takes policies have stronger effects on asset prices than do size-limited announcements, suggesting that communication of potential policy scale matters. We also find that subsequent whatever-it-takes announcements, especially those made by advanced economy central banks, have little additional impact, suggesting that markets already priced in these policies at the time of the initial announcement.

II Background and Literature Review

China was the first country to lockdown cities in January 2020 in order to reduce the spread of Covid-19 transmission. Numerous other countries followed suit, along with issuing travel bans. The World Health Organization declared Covid-19 a global pandemic on 11 March 2020. By the end of March 2020, over half of the world's population was under some form of stay-at-home mandate. Many businesses were forced to close down, and global economic activity fell sharply. Reactions in the financial markets were immediate and severe: corporate spreads surged, equity prices tumbled, and implied volatilities for a wide range of assets jumped dramatically. Businesses and households around the globe dashed-for-cash as confidence in the financial sector plummeted. Governments responded to the crisis with a range of health-related and fiscal policy announcements, with the underlying objective of providing citizens with resources to cushion the impacts of a sudden reduction in economic activity. Likewise, central banks around the globe announced expansionary monetary policies to support aggregate demand and restore the smooth functioning of financial markets.

[4]Draghi's speech where he used the phrase "whatever it takes," but did not provide any specific policy announcement, was on 26 July 2012. Policy specifics followed in two announcements outlining the terms of the Outright Monetary Transactions (OMT) facility, which allowed the ECB to purchase Eurozone sovereign bonds. The OMT was introduced on 2 August and technical details were released on 6 September. Market reaction to the three 2012 announcements is described in Krishnamurthy et al. (2018), the average yield response across Eurozone countries was between 34 and 63 basis points. No asset purchases were ever made using the OMT, so it is an extreme example of a pure announcement effect.

The Bank of Canada, the European Central Bank, the Bank of Mexico, and the Federal Reserve were the first in a long line of central banks that announced expansions of asset-purchasing facilities to help stabilize financial markets on 12 March 2020.[5] In most cases, advanced economy central banks had used quantitative easing (QE) measures during and in the aftermath of the global financial crisis in 2008, and had continued to expand their balance sheets in the years prior to the pandemic. The pandemic-related central bank announcements were, as a consequence, not introducing new policy tools; they were instead emphasizing the greatly expanded potential size of the interventions they would be willing to take to counteract the negative impacts of the pandemic on financial markets. In many cases, the announcement was not just that the size of operations would increase, but that they could increase by an unlimited amount.

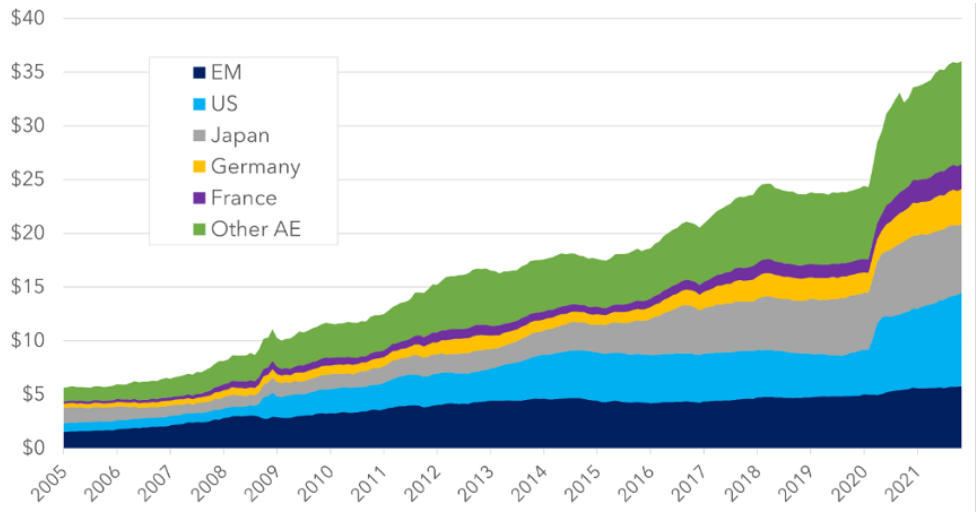
In emerging markets, only the central banks of Hungary and Colombia had pre-existing asset purchasing programs prior to the pandemic, so in the rest of the cases these programs were established for the first time in reaction to the extraordinary circumstances brought about by the pandemic. The central banks of Brazil and Chile needed changes to the legal framework from their legislative branches to allow them to purchase public debt. As was the case for many of the advanced economies, programs in emerging economies included purchases of private sector assets and well as government bonds, public agency assets and provincial and municipal bonds.

Central banks did not just say that they would purchase assets, they did so on an unprecedented scale. Figure 1 shows the dramatic increase in central bank balance sheets during the pandemic. The Bank of Japan saw the largest expansion of assets (70% of 2019 GDP); the ECB (at 20%), Bank of Canada (at 24%) and the Federal Reserve (at 21%) also greatly increased their stock of assets in 2020 and 2021. Emerging market (EM) countries did not expand on the same scale. Among EMs the central banks of Hungary, the Philippines and Poland saw the largest expansion of assets at around 6% of 2019 GDP over the two year period. Many central banks also expanded the range of assets they were willing to purchase, including corporate bonds, commercial paper and asset-backed securities, though the largest share of purchases were government securities.

Measuring the impacts of monetary policy is always complicated by the fact that economic conditions typically drive policy changes. Central banks do not randomly announce

[5]The Bank of Canada announced the expansion of various programs over multiple days in March 2020. The first time it officially announced an unlimited facility was on 27 March, but news reports suggest that it was the first BoC announcement on 12 March that was considered its first whatever-it-takes moment. Arora et al. (2021) only study the announcement on 27 March and find that it reduced Government of Canada bond yields by 10 to 15 basis points.

Figure 1: Assets on Central Bank Balance Sheets (Trillions of US$)



Source: Country Central Banks

policy changes and this is likely to be especially the case for whatever-it-takes announcements: central banks 'go big' in times of crisis. An important reason to emphasize the unlimited size of an intervention is presumably because a similar, but size-limited, intervention might not be large enough to restore confidence.[6]

Most of the whatever-it-takes monetary policy announcements in this time period involved asset purchasing facilities that allowed central banks to expand their balance sheets with a wide array of assets. The first of these announcements by the Federal Reserve on March 15, 2020 stated that the objective was "to support the smooth functioning of markets for Treasury securities and agency mortgage-backed securities that are central to the flow of credit to households and businesses," (Federal Reserve, 2020).[7] In a related set of actions, the Federal Reserve announced a number of other (size limited) measures expanding access to the discount window, intraday credit, bank capital and liquidity buffers, reserve requirements and dollar liquidity swap line arrangements.[8] The package of announcements seem

[6]Haddad et al. (2023) consider the possibility that all policy announcements have a whatever-it-takes element because market participants view policies as state-contingent, expecting more support in bad states. They suggest that large announcement impacts incorporate a "policy put" that reflects the expectation that additional interventions will be made if economic conditions worsen. Our study tests whether policy announcements that are explicitly limited in size differ from those that are perceived as unlimited, and find evidence that the distinction matters, suggesting that the policy put is not fully priced.

[7]https://www.federalreserve.gov/newsevents/pressreleases/monetary20200315a.htm

[8]Countries that relied heavily on dollar funding were especially hard hit by the global fall in dollar liquidity in March 2020. The Federal Reserve responded to this stress in the dollar market by reopening swap lines with an expanded list of countries and establishing the FIMA Repo Facility for countries without access to swap lines. This allowed central banks to obtain dollars by pledging US Treasuries as collateral.

to have been designed to shock-and-awe market participants in order to restore confidence in financial markets as well as provide aggregate demand stimulus by resuming quantitative easing (QE).[9]

Monetary policies, including QE policies, can impact asset prices through at least two channels: by changing expectations through the signaling channel; and through liquidity and portfolio balance effects, in models that allow for financial and goods market frictions.[10] Examples of models in which QE can affect interest rates and exchange rates include Woodford (2012), Farhi and Gabaix (2016), Gourinchas et al. (2022) and Greenwood et al. (2020).[11] In these models, the signaling channel can operate on expected values of forward looking asset prices at the time of a policy announcement. No actual asset purchases are needed in order for changes in expectations to impact market prices. All that is needed is some form of friction that allows the announcement to provide new market-relevant information. In contrast, the liquidity and portfolio balance channels require actual asset purchases. Central banks can reduce liquidity premia on bonds by reducing the risk that bonds will be difficult to sell. Asset purchases can also impact the prices of specific bonds by changing the quantity and composition of private asset holdings. Asset purchase programs tend to reduce exposure to credit risk as central banks exchange safer assets for private sector holdings of riskier assets.

Studies of announcements of QE measures prior to the pandemic find that they are often associated with significant depreciations of the currency of the announcing central bank and declines in bond yields. The first QE announcement by the Federal Reserve on 25 November 2008 led the dollar to depreciate by approximately 4% (Greenwood et al. 2020) and for average declines in yields of around 40 basis points (Gagnon et al. 2011). The European Central Bank's securities market program announcement on 10 May 2010 led to an

Countries with standing swap lines with the US include: Canada, Euro area, Japan, UK and Switzerland. The expanded list of countries that were given access to swap lines included: Australia, Brazil, Korea, Mexico, Singapore, Sweden, Denmark, New Zealand and Norway.

[9] English et al. (2022) note that along with the unprecedented size of many of the pandemic-era asset-purchase programs, the speed at which these purchases were made is also notable. They provide the example of the Bank of England which purchased bonds in 2020 at almost twice the pace as in the initial phase of QE in 2008.

[10] Bhattarai and Neely (2022) provide a comprehensive survey of macro models where QE and other unconventional monetary policies, regardless of size, have no impact, as well as what assumptions are needed for these policies to matter. Likewise, Borio and Zabai (2018) describe the range of unconventional monetary measures that central banks have taken, and what we know about their influence on financial conditions and the macro-economy. These papers, however, do not distinguish whatever-it-takes QE from size-limited QE policies.

[11] In Dedola et al. (2021) expansionary relative QE shocks exacerbate limits to arbitrage in foreign exchange markets by widening CIP deviations.

average decline in yields (across the Eurozone countries) of 190 basis points (Krishnamurthy et al. 2018).[12] The Bank of England's 4 March 2009 QE announcement led to a 100 basis point decline in the 10-year Gilt yield. Few developing countries used QE prior to the pandemic, so we do not have similar estimates for comparison. Rebucci et al. (2022) examine the pandemic-era QE announcements and find that one-day impact effects were larger for emerging market QE announcements than for developed countries. They find a statistically significant overall average one-day decline of 23 basis points on 10-year yields, with the largest impact coming from the Romanian announcement on 20 March 2020 that led to a 150 basis points decline.

Dedola et al. (2021) examine the longer term effects of QE on bilateral exchange rates, emphasizing the need to take into account the relative QE actions of the two relevant central banks. They use the announcements of QE measures as instruments for changes in relative central bank balance sheets and find that a typical QE announcement by either the Federal Reserve or the ECB led to a persistent exchange rate depreciation of around 7%. Importantly, in their approach, the focus is on actual relative changes in central bank balance sheets. Whatever-it-takes announcements that do not result in asset purchases, like the original one by Draghi, cannot be examined in their framework.

The impact of policy changes during the pandemic was also likely to be influenced by Covid-19 fundamentals. Davis and Zlate (2022) find that Covid-19 infection rates—which differed in timing and intensity across countries— affected the sensitivity of exchange rates and capital flows to the global financial cycle[13] and explain a larger share of cross country heterogeneity in the early months of the pandemic than traditional macroeconomic fundamentals. During the pandemic, measures of the global financial cycle fell sharply, most currencies depreciated relative to the U.S. dollar and capital flows fell across the board, but they fell by more for countries and during episodes with larger increases in Covid cases.

Figure 2a plots three trade-weighted dollar exchange rate indices: a broad one based on the dollar exchange rate against all major US trading partners, and then two narrower indices based on subsets of the same currencies, separating advanced economies and emerging markets. Vertical lines denote announcements of unlimited asset purchases made by the Federal Reserve, identified according to our methodology. The plot shows that the dollar

[12]The ECB's first explicit QE program, the Public Sector Purchase Programme (PSPP), was announced on 22 January 2015. Along with the 2010 SMP, in 2009 and 2011 the ECB announced covered bond purchase programmes, and in 2012 it established the Outright Monetary Transactions programme, but none of these were officially described as QE facilities by the ECB.

[13]The global financial cycle is estimated in Miranda-Agrippino and Rey (2020) as a common component in a wide sample of advanced and emerging market asset prices at a monthly frequency.

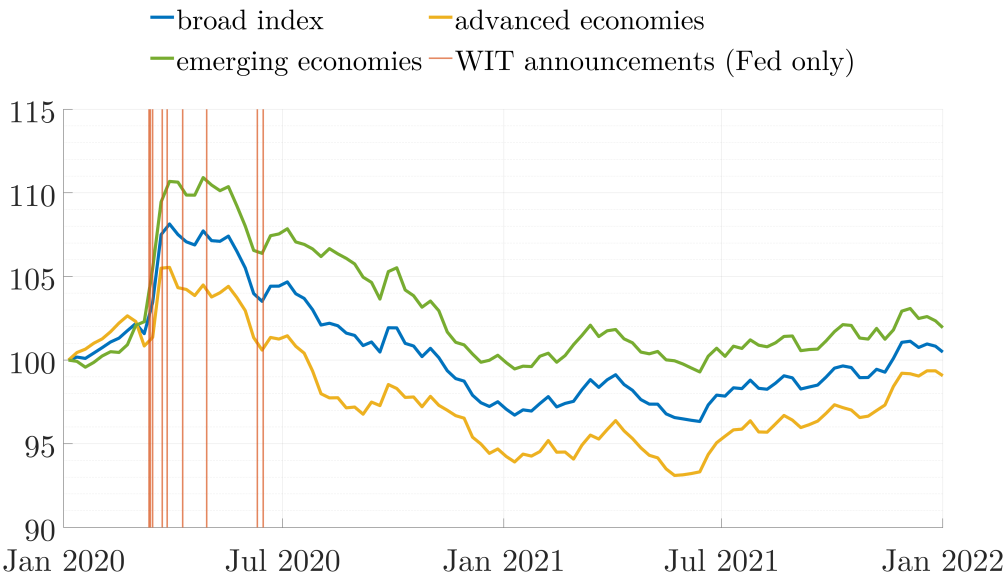
appreciated sharply against all currencies in the early days of the pandemic, but the appreciation was steeper with respect to emerging market currencies. The steepest period of dollar appreciation coincided with the bulk of the Fed's initial whatever-it-takes announcements (along with announcements of a number of other facilities). As investors were dashing for cash, and especially for dollars, in this period, it is hard to disentangle the flight-to-safety dynamics from the concomitant announcement of unlimited asset purchases. It seems likely that the announcements reinforced the dollar's safe status (a point we will come back to later). Subsequent Fed announcements seem to be associated with both appreciations and depreciations.

Figure 2b plots an index capturing the global behavior of 10-year sovereign bond yields. We construct this as an average of the 10-year sovereign bond yields of the countries in our dataset of central bank announcements, weighted by their 2019 PPP GDP.[14] Vertical red lines mark all whatever-it-takes announcements made by central banks around the world, identified according to our methodology. A quick glance at the plot immediately reveals the spike in global yields at the beginning of March 2020, and a clustering of whatever-it-takes announcements crowding the same weeks. Yields peak on 24 March and then start declining, the day after the Fed unleashed its bazooka[15] involving four asset-purchase facilities in what newspapers named "Jerome Powell's whatever-it-takes moment". Notable downward movements in the yield index are punctuated by many other unlimited asset purchases announcements, including another unlimited announcement by the Fed on 29 April, Christine Lagarde's own newspaper-sanctioned whatever-it-takes moment on 6 June, and similar announcements in other countries that came later (for instance, Hungary on 10 October and Australia on 3 November). Of course, it was not just policy that mattered; improvements in the underlying global Covid situation also contributed to lowering yields. Yields later surged again in 2021, driven especially by the yields of advanced economies, as the outlook for recovery improved and inflation expectations rose. Unlimited announcements got sparser during this period and were concentrated in a handful of countries (Australia, Hungary, India, and Japan).

[14] We drop Chile, India, and the Philippines, for which local-currency 10Y yields are not available for this period. For the euro area, we include Austria, Belgium, Germany, Spain, Finland, France, Greece, Ireland, Italy, the Netherlands, Portugal, and Slovakia.

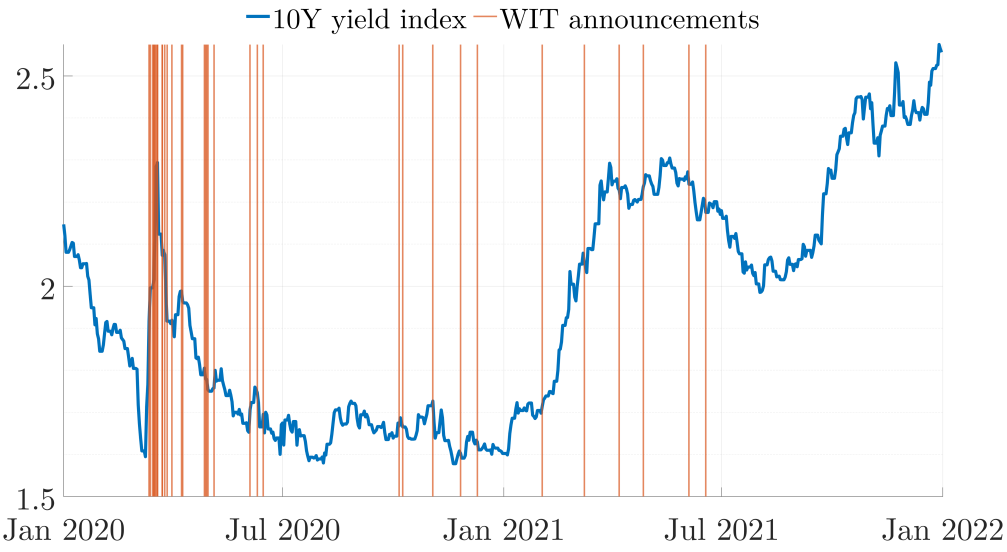
[15] The word is an extension of bazoo, a slang term for "mouth" or "boastful talk" (1877), which is probably from Dutch bazuin "trumpet." The Fed announcement included expanding the QE program to include purchases of commercial MBS, establishing two new facilities (the Primary Market Corporate Credit Facility and the Secondary Market Corporate Credit Facility), reestablishing the Term Asset-Backed Securities Loan Facility (TALF), along with expansions of other facilities.

Figure 2a: USD exchange rate indices



Source: Federal Reserve Bank of St Louis; announcement data from Cantú et al. (2021), classification as whatever-it-takes (WIT) by authors based on central bank press release and subsequent news coverage.

Figure 2b: Global GDP-weighted 10-year yield index



Source: World Bank (GDP); Bloomberg (yields); announcement data from Cantú et al. (2021), classification as whatever-it-takes (WIT) by authors based on central bank press release and subsequent news coverage.

III Categorizing Announcements using Press Releases and Newspaper Reports

The pandemic-era central bank announcements used in our study are collected and described in Cantú et al. (2021). These authors created a database of policy measures together with links to accompanying press statements that provide the timing and details of each announcement. In some cases these press statements are explicit about the size and limited duration of the facility, and in others the language indicates that the central bank is prepared to intervene by as much, and for as long, as needed. The European Central Bank's 18 March 2020 announcement of the Pandemic Emergency Purchase Programme (PEPP) is an interesting example where the size and duration of the program (€750 billion until the end of 2020) is provided, along with the statement, "The Governing Council will do everything necessary within its mandate. The Governing Council is fully prepared to increase the size of its asset purchase programmes and adjust their composition, by as much as necessary and for as long as needed." [16] Likewise, the Federal Reserve FOMC press release on 15 March 2020 states that "it will increase its holdings of Treasury securities by at least $500 billion and its holdings of agency mortgage-backed securities by at least $200 billion." [17] At the press conference directly after the FOMC meeting, Chair Powell clarified that the $500 billion is a floor, but there is no ceiling. This whatever-it-takes clarification was a central feature of the news coverage of the Fed's announcement.

Our study aims to distinguish the impacts of unlimited policies from those with explicit limits; therefore, along with using the information provided by each central bank at the time of an announcement, we also use the Factiva search engine to understand how the financial media describe the announced policies.[18] As was the case with the Federal Reserve and ECB announcements in mid-March, there are cases where the press release suggests a limited policy announcement, but news reports indicate markets consider the policy to be more expansive, often based on subsequent statements made during the post-announcement press conference. It seems likely that central banks purposely invoked constructive ambiguity in some of these cases in order to win over financial markets. This intentional ambiguity

[16] https://www.ecb.europa.eu/press/pr/date/2020/html/ecb.pr200318_1 3949d6f266.en.html

[17] https://www.federalreserve.gov/newsevents/pressreleases/monetary20200315a.htm

[18] We filter the Factiva search on each announcement day to include articles in global and local news sources that include the terms "asset" and "purchas" within 3 words, "monetary policy", "central bank", and the country's name or the central bank's name when it does not contain the country's name (e.g., the Fed or the Riksbank). Our search window goes from the day of the announcement out one week to ensure that all articles reporting on the announcement are included. Central Bank announcement dates are from Cantú et al. (2021).

required us to take a narrative approach that involved reading both the press releases and the accompanying news reports to ultimately code each announcement as limited or unlimited, rather than rely on an algorithmic method or text analysis.

Central banks made 167 asset-purchase announcements during the period from March 2020 to December 2021. Of these announcements, 128 (77%) are coded as limited based on the press release, and 12 of these are re-coded as unlimited based on the subsequent news coverage. Of the 39 unlimited announcements (based on the press release), all but 2 are also coded as unlimited based on news reports. The first unlimited announcement that received skeptical news coverage was made by the ECB on 30 April. More precisely, it can be broken down into two smaller announcements of different facilities made in the same press release. Following the announcement, reports noted that limits for QE were left unchanged, leaving investors unimpressed (by contrast, the press release emphasized that the ECB was prepared to increase the purchases under APP and PEPP by as much as necessary and for as long as needed). The second of these skeptically received unlimited announcements was by the Reserve Bank of Australia on 5 May 2020. In this case, the press release itself is a bit confusing. It states that the RBA "has scaled back the size and frequency of bond purchases, which to date have totaled around $50 billion. The Bank is prepared to scale-up these purchases again and will do whatever is necessary to ensure bond markets remain functional and to achieve the yield target for 3-year AGS [Australian Government Securities]."[19] The news coverage of this announcement emphasizes the fact that purchases were scaled back: the potential for reversing course and do "whatever is necessary", if needed, did not receive attention, as its combination with a reduction in the asset purchasing pace was received as a mixed and conflicting signal.

Table 1 lists the 22 central banks that announced asset-purchasing programs during the pandemic, the date of their first announcement, the total number of announcements made by each central bank, and the percent of these announcements that we code as unlimited in scale. In our empirical work we compare the exchange rate and bond market reactions to the announcements that are explicitly size-limited to those that are introduced as unlimited, or understood to be unlimited based on news coverage.[20] We also group announcements in two additional ways. First, we look at advanced economy announcements separately from those made by emerging market countries. In asset pricing models, only shocks, whether exogenous or the surprise component of policy news, should lead to market reactions. Information that

[19]https://www.rba.gov.au/media-releases/2020/mr-20-13.html

[20]In robustness tests we exclude the 15 announcements that are ambiguous, either because they include limits in the press release, or because the news reports suggest markets are skeptical that the policy is unlimited. Results are qualitatively the same when we exclude these announcements.

Table 1: Central Bank Asset-Purchase Announcements

Country	**Date of First Announcement**	**Number of Announcements**	**% Unlimited**
Canada	3/12/2020	23	17%
Euro Area	3/12/2020	13	31%
United States	3/12/2020	25	44%
Mexico	3/12/2020	2	0%
Japan	3/13/2020	11	45%
Israel	3/15/2020	4	0%
Sweden	3/16/2020	7	14%
Poland	3/16/2020	2	100%
Chile	3/16/2020	9	0%
United Kingdom	3/17/2020	7	29%
India	3/18/2020	6	50%
Australia	3/19/2020	9	56%
Korea	3/19/2020	7	0%
Romania	3/20/2020	1	0%
Thailand	3/22/2020	2	0%
Colombia	3/23/2020	4	50%
New Zealand	3/23/2020	5	0%
Zambia	3/25/2020	1	100%
Turkey	3/31/2020	2	50%
Indonesia	4/1/2020	3	0%
Hungary	4/7/2020	22	23%
Philippines	4/10/2020	1	0%

Source: Announcement data from Cantú et al. (2021), classification as unlimited by authors based on central bank press release and subsequent news coverage.

is expected will already be priced by markets. In the case of advanced economy pandemic-related asset-purchase announcements, some part of the information is likely to have been expected by markets, based on their actions during the 2008 financial crisis and the wide use of QE in the subsequent years. Few central banks in emerging market countries had previously used QE policies, so their pandemic-related asset-purchase announcements were likely to have been more surprising. Second, we look at the first whatever-it-takes announcement separately from subsequent announcements. The first announcement at the start of the pandemic is likely to have more of a surprise-factor than succeeding announcements. Bernanke (2020) and Haddad et al. (2023) also find that the initial announcements of QE

by the Federal Reserve and the ECB had larger effects on asset prices than did succeeding announcements.[21]

Table 2: First Unlimited Asset Purchase Program Announcement Dates by Country

Advanced Economies	**Date**	**Announcement**
Bank of Canada	3/12/2020	Expansion of Bond Buyback Program
Federal Reserve Board	3/15/2020	Asset Purchase Program
Bank of Japan	3/16/2020	Government Bond Purchases
Bank of England	3/17/2020	Covid-19 Corporate Financing Facility (CCFF)
European Central Bank	3/18/2020	Corporate Sector Purchase Program (CSPP)
Reserve Bank of Australia	3/19/2020	Government Bond Purchases
Sveriges Riksbank	11/26/2020	Asset Purchase Program
Emerging Economies		
National Bank of Poland	3/16/2020	Treasury Bond Purchases
Central Bank of Colombia	3/23/2020	Government Bond Purchases
Bank of Zambia	3/25/2020	Government Security Purchases
Central Bank of the Republic of Turkey	3/31/2020	Government Domestic Debt Securities (GDDS)
Hungarian National Bank	4/28/2020	Government Security Purchase Program
Central Bank of India	10/9/2020	State Development Loans (SDLs)

Source: Announcement data from Cantú et al. (2021), classification as unlimited by authors based on central bank press release and subsequent news coverage.

Our empirical analysis uses daily data. We use US dollar exchange rates from the Bank for International Settlements online statistics, which in turn are sourced from the ECB and the Federal Reserve.[22] Exchange rates are measured between 13:15 and 17:00 GMT. For the US, we look at the exchange rate against the euro. All exchange rates are quoted so that an increase corresponds to an appreciation. Local-currency-denominated sovereign bond yields are from Bloomberg, covering maturities between 3 months and 10 years. We focus on results for the 10-year yield in the main text, but results for other maturities are contained in the appendix. Daily Covid-19 cases are from the World Health Organization.[23] The daily

[21] Vissing-Jørgensen (2021) studies the effects of the Federal Reserve March 2020 announcements as well as actual asset purchases on high frequency data from Treasury futures. She finds a causal link from asset purchases, not announcements, to yield declines and suggests that the severe liquidity needs of sectors that were heavy sellers of Treasuries required large actual purchases to stabilize the market. Swanson (2021) also takes a high-frequency (30 min) approach to identify the immediate causal effect of asset-purchase announcements on a broad set of asset prices in the pre-pandemic period and finds impacts that are significant and comparable to those of conventional monetary policy.

[22] https://www.bis.org/statistics/xrusd.htm?m=2675

[23] https://covid19.who.int/data

Economic Policy Uncertainty (EPU) index is computed by Baker et al. (2016).[24] Central bank announcements are from Cantú et al. (2021).[25]

IV Event Study Analysis

During the pandemic, governments and central banks announced policy changes to address the negative impacts of business closures and financial market turmoil.[26] In some cases, the announcements were explicitly unlimited in size. In many other cases, announced new facilities included specific size and time limits. Market reactions to these different types of announcements is likely to differ.

If we start with an initial price of an asset, p_0 at time 0, it should reflect the expected value of the asset in the next period, so that: $p_0 = \mathbb{E}[p_1]$. If a size-limited asset-purchase policy is announced at time 0, this tells the market that the central bank will purchase a quantity Q of the asset by a specific date. To keep things simple, let that policy end-date be time 1 and assume that M is the known price impact of a Q-sized purchase of the asset. This suggests that the post-announcement price of the asset at time 1 is $p_1^A = p_1(1 + MQ)$ and at time 0 it is $p_0^A = \mathbb{E}[p_1](1 + MQ)$.[27] It is straightforward from this to relate the change in the asset price before and after the announcement, $\frac{p_0^A - p_0}{p_0}$, to MQ.

In the case of an unlimited policy announcement where Q is not defined, the post-announcement price will be based on an expectation of Q. It seems reasonable to assume that policymakers decline to explicitly define Q so that this market expectation will exceed the Q that would have been announced in normal times. In Haddad et al. (2023), all announcements are modeled as conditional promises, so that markets expect policymakers to scale-up policy by an additional amount Q^* if economic conditions deteriorate in time 1 (which is equivalent to the asset price falling below a cutoff value p^*). The post-announcement price at time 0 in this setting includes the baseline case with a known Q (and M), and an additional term multiplied by MQ^* that includes the expected probability that $p_1 \leq p^*$:

$$P_0^A = \mathbb{E}[p_1] + \mathbb{E}[p_1]MQ + \mathbb{E}[p_1 \cdot \mathbb{1}_{\{p_1 \leq p^*\}}]MQ^* \ . \tag{1}$$

[24] https://www.policyuncertainty.com/index.html

[25] https://www.bis.org/publ/work934.htm

[26] Bergant and Forbes (2022) examine how countries decide on specific policy packages, looking at a wide array of policies, including fiscal, monetary, foreign exchange intervention and macroprudential regulation. Interestingly, they find that use of one of these types of policies did not affect a country's use of the other policies.

[27] This notation is the similar to what is used in Haddad et al. (2023).

In our setup we assume that some announcements are actually limited in size and scope, so that the post-announcement asset price change should largely be based on the information policymakers provide about Q and views about M. The size of the post-announcement asset price change after whatever-it-takes announcements are less clear-cut, but we can assume that they will exceed the size of the Q-baseline case as long as the unlimited policy is credible. In the case of central bank asset purchases, credibility is likely to be higher than it will be for some other government policies, given that central banks have the unique ability to expand their balance sheets when they choose to do so.[28]

The first step of our analysis is an assessment of the effectiveness of the first whatever-it-takes announcement (we will sometimes abbreviate "whatever it takes" with "WIT" going forward). We do this with an event study framework, and specifically with a two-way fixed effect estimator in a staggered dynamic difference-in-differences specification. The choice to focus only on the first WIT announcement is somewhat determined by the event study setup. On the one hand, this methodology is effective for gauging the effect of a single treatment or event, even if it is staggered. On the other hand, however, the shortcoming of the event study approach via this diff-in-diff specification is that it is more appropriate in settings where each group is treated once, and it is not suitable for a situation with repeated treatments, as we have in our case. Indeed, most central banks made several consecutive announcements, and often they were closely timed to each other. As a result, most countries were treated multiple times, and there was no clear "switching off" of the previous treatment before the next one is introduced, so that they effectively overlapped and cumulated, making estimation difficult. For this reason, we limit our event-study analysis only to the first whatever-it-takes announcement, and we consider this the only treatment experienced by each country. We will expand our analysis to the full set of announcements in the local projections section.

We begin with an examination of the effects of unlimited announcements on our two outcome variables around a narrow time window.[29] We measure the impact of the first whatever-it-takes announcement by the central banks listed in Table 2 on the dollar bilat-

[28]Central banks have the unique ability to create domestic base money, but they cannot create foreign currency legal tender. This means that counties with fixed exchange rates may be subject to greater constraints on their ability to do whatever-it-takes, for fear of triggering a run on the currency. It is also the case that central bank's solvency can be at risk if they suffer substantial losses from intervention-related operations, suggesting that balance sheet exposure and restricted access to fiscal support may also influence the credibility of a whatever-it-takes pronouncement.

[29]Blotevogel et al. (2022) expand the event study specification to include pre-announcement expectations (based on survey data) and post-announcement implementation effects (based on actual asset purchases). In an examination of Euro Area announcements during the pandemic they find large announcement effects, some evidence of pre-announcement expectation effects, and weak implementation effects. These results are in keeping with the larger literature that finds the largest asset pricing effects at the time of announcement.

eral rate for non-US announcements and the euro-USD bilateral rate for Federal Reserve announcements as well as own-country 10-year sovereign yields.[30] Our specification for the exchange rate is as follows:

$$100 \cdot \ln FX_{i,t} = \alpha_i + \alpha_t + \sum_{s=-15}^{-2} \beta_s D_{i,t,s} + \sum_{s=0}^{15} \beta_s D_{i,t,s} + \mathbf{X}_{i,t}\boldsymbol{\gamma} + \varepsilon_{i,t} \ . \tag{2}$$

The specification is similar for the yields, except the left-hand side is not in logs:

$$100 \cdot y_{i,t} = \alpha_i + \alpha_t + \sum_{s=-15}^{-2} \beta_s D_{i,t,s} + \sum_{s=0}^{15} \beta_s D_{i,t,s} + \mathbf{X}_{i,t}\boldsymbol{\gamma} + \varepsilon_{i,t} \ . \tag{3}$$

Here, $D_{i,t,s}$ is a dummy variable, equaling 1 if, in period t, country i is s days away from its first whatever-it-takes announcement, and 0 otherwise. We cumulate lags and leads that are farther than 15 days away from the announcement, so that $D_{i,t,-15}$ and $D_{i,t,15}$ are equal to 1 if observation $\{i,t\}$ is 15 or more days earlier or later than the announcement, respectively. Countries that never made a WIT announcement act as pure controls, providing a counterfactual against which to assess the impact of the policy. Treatment in this context occurs in period 0, and we examine how differences in the outcome variable between treated and untreated countries evolve pre- and post-announcement, relative to their value in the omitted base day, i.e. the day before the announcement. Although in past QE episodes asset prices reacted quickly to central bank announcements, the unusual circumstances of the pandemic may have made it more difficult for markets to process the information revealed in the asset-purchase announcements. This possibility led us to include additional post-announcement days in our estimation window. Importantly, all the 13 first unlimited announcements in our dataset took place in 2020. More specifically, as shown in Table 2, 11 of them occurred between March and April, and only two occurred later (India on 9 October and Sweden on 26 November). As a result, we estimate the regressions using data from 2020 only, so as not to contaminate the control with observations from 2021 that are very distant from the treatment for all countries.

We include country and time-fixed effects as well as a set of control variables $\mathbf{X}_{i,t}$ that are available on a daily basis. Our regression controls capture global, foreign and domestic

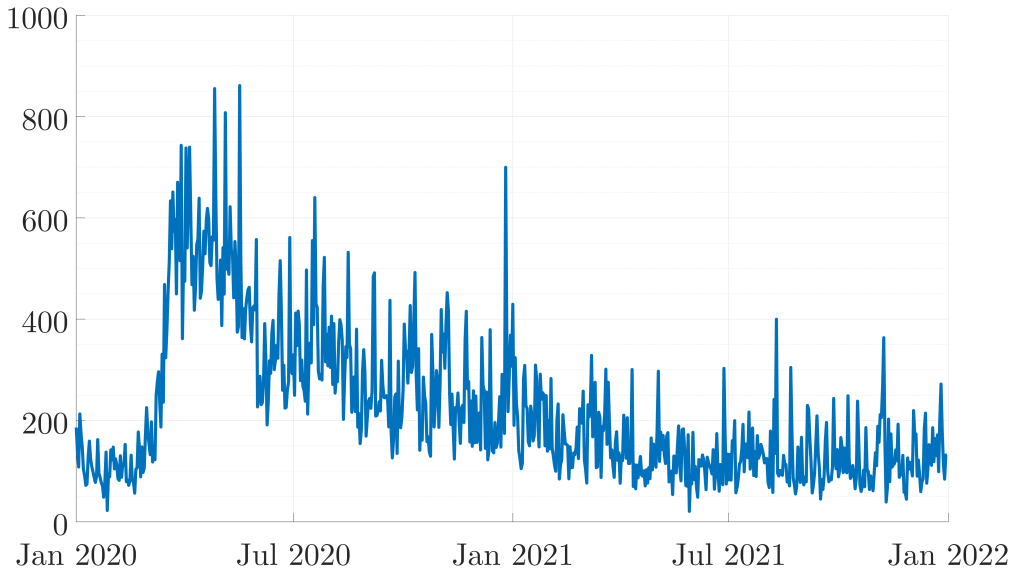
[30]For the exchange rate, the euro area counts as one country. When looking at yields, we look at individual countries within the currency union: Austria, Belgium, Germany, Spain, Finland, France, Greece, Ireland, Italy, the Netherlands, Portugal, and Slovakia. For each of these countries, we therefore have the ECB announcements on the right-hand side, and the country's own yield on the left-hand side. The control variables are similarly aggregated and disaggregated depending on the specification.

factors that may be driving policy announcements. These controls allow us to identify the unpredictable component of the policy announcement. We take into account peer effects by including prior whatever-it-takes announcements made by other central banks. The cumulative number of own-country Covid-19 cases is also included as an important economic barometer during the pandemic, and we separately include the global number of Covid-19 cases (excluding own-country cases) as an indicator of worldwide economic conditions. Finally, we include the number of own-country prior limited-size policy announcements. The larger the number of prior policy announcements, the more likely economic circumstances have continued to deteriorate, leading to more expansive (desperate-times) policy measures.

Figure 3 presents an overview of the control variables. We begin by plotting the economic policy uncertainty (EPU) index introduced in Baker et al. (2016), which is based on counts of news articles that are related to policy uncertainty, and has been found to be a useful daily predictor of macroeconomic conditions. This is a single time series, so it gets absorbed by the time fixed effects when both are included, but we find either of these controls to be important to take account of the high degree of volatility and uncertainty experienced globally during this period. The Covid cases and cumulative announcements variables have a panel structure given that we include the own-country and rest-of-the-world measures separately. In the plots we provide a global aggregate to show their overall behavior during this period. The announcements plot shows the steep increase in the number of unlimited announcements in the early days of the pandemic, which coincides with increases in Covid cases and rising uncertainty. Initially the number of unlimited announcements grew faster than size-limited ones. In the summer of 2020 the pace of unlimited announcements slowed down and eventually plateaued, at the same time the first Covid wave also flattened. Size-limited announcements continued steadily during this period as central banks kept up efforts to sustain the economy. A new wave of unlimited announcements came with the new wave of Covid cases in the fall of 2020. Unlimited announcements ended in the summer of 2021, while size-limited announcements continued through the end of 2021.

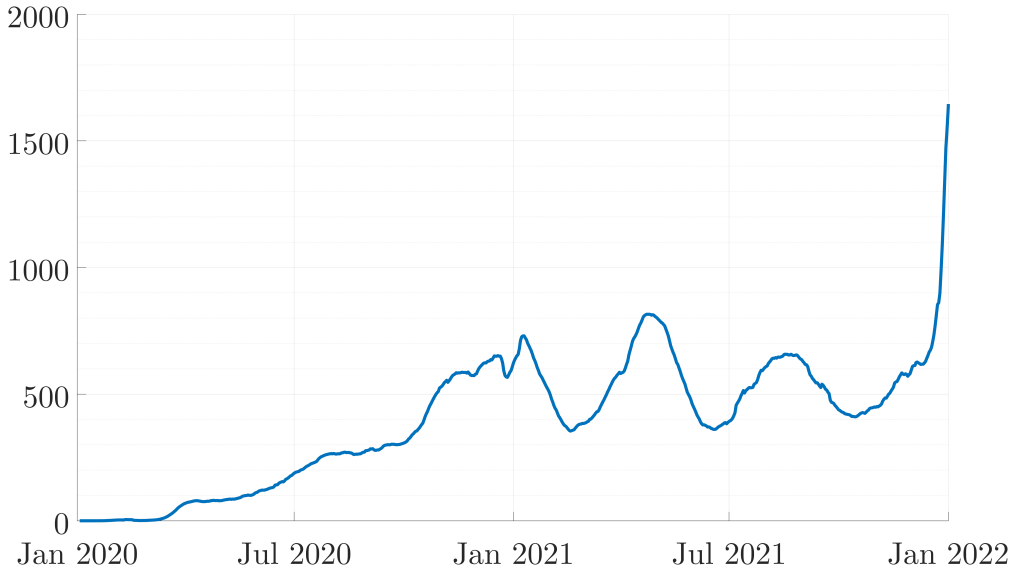
The event study approach focuses on the coefficients that capture the impact of each country's policy announcement on the exchange rate and sovereign yields, relative to the day immediately preceding the announcement. In the figures, the x-axis is measured in event time, so that for each central bank, the announcement of a new policy is aligned at time zero. The underlying assumption is that the time-zero event is the announced policy that changed what otherwise would have happened to the exchange rate or the sovereign yield. The y-axis shows the depreciation of the country's currency value relative to the dollar, or the change in the yield, before and after the announcement.

Figure 3a: Economic Policy Uncertainty Index



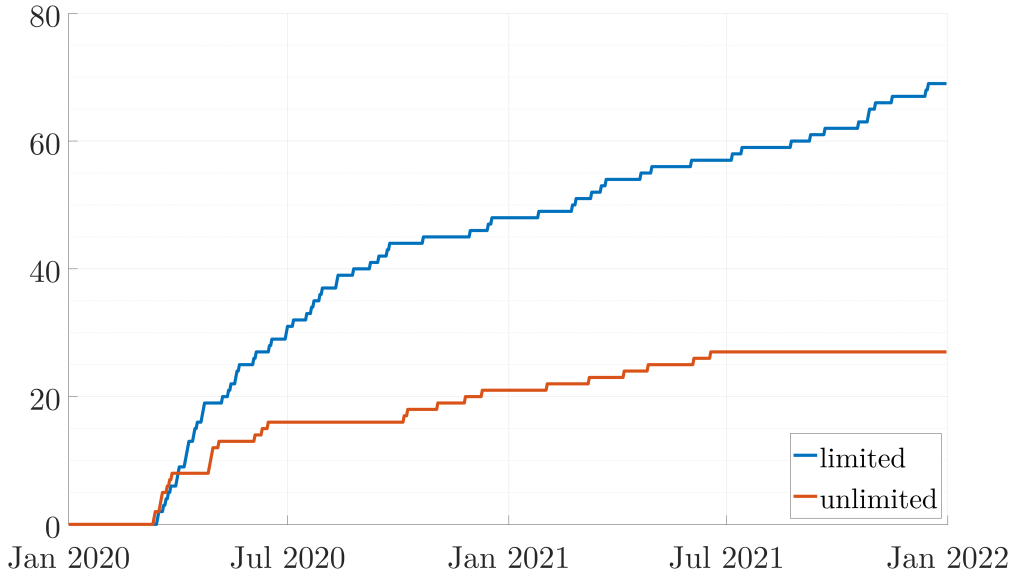
Source: Baker et al. (2016)

Figure 3b: Number of New Covid-19 Cases Globally (thousands), Weekly MA



Source: World Health Organization

Figure 3c: Cumulative Number of Asset Purchases Announcements



Source: Announcement data from Cantú et al. (2021), classification as unlimited by authors based on central bank press release and subsequent news coverage.

Figure 4a shows that unlimited announcements had little impact on the exchange rate, although standard errors become considerably larger after the event. One possibility is that WIT announcements significantly moved exchange rates, but did so in different directions for different countries, so that the point estimates cancel out, but the standard errors get bigger. We will elaborate further on this point in the next section.

The story is different for 10-year yields in Figure 4b, where unlimited announcements appear to have strong and rapid effects leading to a persistent decrease of around 40-50 basis points. No pattern of increasing standard errors appears in this case. Our control variables are generally not statistically significant. The takeaway from the two event study plots seems to be that the first unlimited policy announcement impacted market expectations significantly, but only when it comes to yields, not for the exchange rate. This result, however, might hide some heterogeneity, which we will attempt to uncover in the next section, along with a broader comparison of the effectiveness of different policy announcements.

V Local Projection Analysis

The event study approach can capture the impact of the announcements (or other forms of treatment) relative to appropriate controls, which in our case are countries and days in

Figure 4a: Exchange rate event study

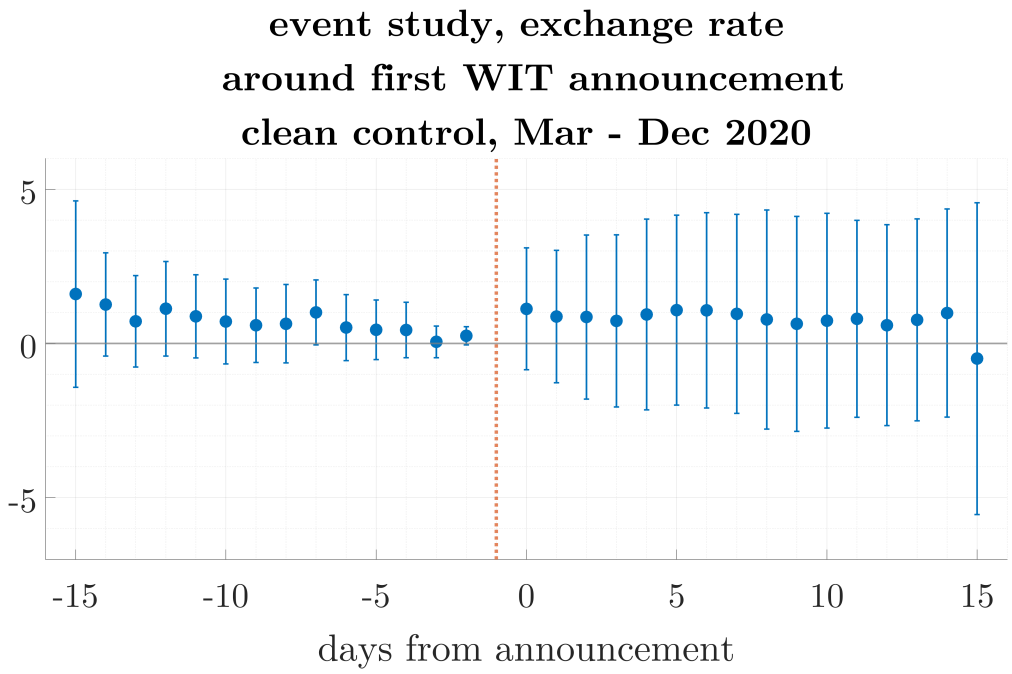
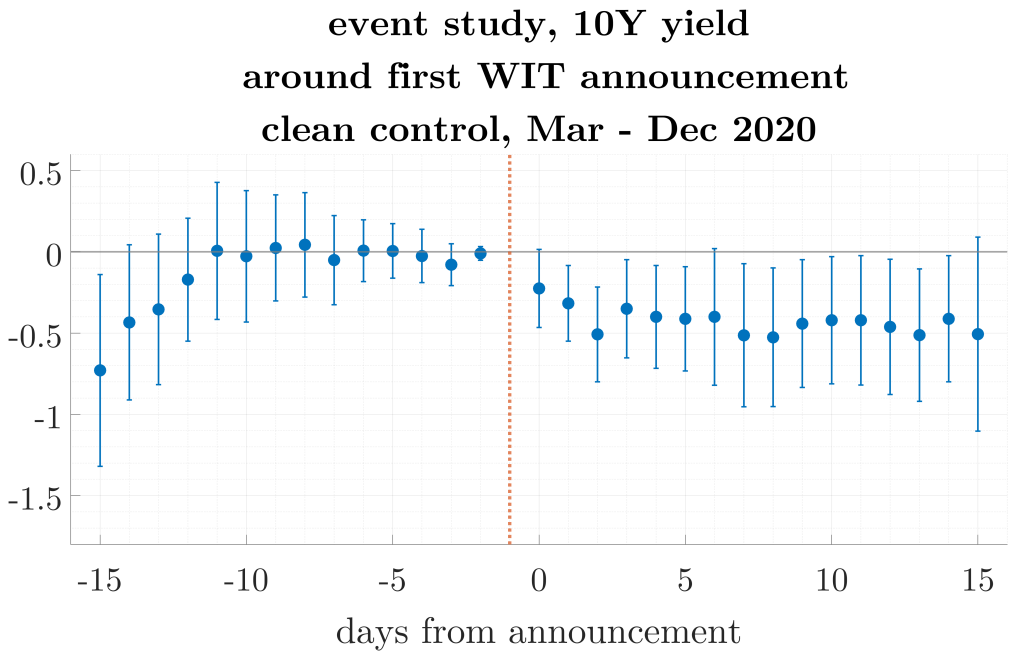


Figure 4b: 10-year yield event study



Notes: Event studies are based on equations 2 and 3. In the charts the x-axis is measured in "event time." The first whatever-it-takes announcement for the countries listed in Table 2 is the "event". The y-axis shows depreciation against the dollar (in Figure 4a) or the change in the 10-year sovereign yield (in Figure 4b) relative to the day before the announcement. Dots indicate the coefficient estimates β_s, bars denote 90% confidence intervals. Regressions include country and time fixed effects and the set of controls $\mathbf{X}_{i,t}$. Standard errors are clustered by country.

which no announcements are made. As long as the announcement is a surprise, and the control days are similar (exhibit parallel trends) to the pre-treatment days, an event study can identify the average announcement effect. In our setting, there are three additional complications: the timing of announcements differs across central banks; there are different types of announcements; and each central bank makes multiple announcements of each type. This suggests that impacts of the announcements may differ due to timing, heterogeneity in underlying policy, and potentially due to gradual learning about the announcements or a cumulation of their effects. In order to take into account these potential staggered, heterogeneous, repeated, and dynamic treatment effects we turn to the local projection methods described in Dube et al. (2023).

A critical issue in our setting is what days can be included in the non-treatment control group. Once a central bank announces a new asset purchasing policy, for how long should we consider the subsequent days to be part of the treatment? Our estimates will potentially be subject to bias if we include control days that are still being affected by an earlier announcement. In the language of event studies, this is described as an 'unclean comparison' and will be a source of negative weights bias in the event estimation. Alternatively, if we exclude all subsequent days after an announcement (the clean control condition), this would force us to exclude any subsequent announcements by the same central bank in the analysis and would result in very few eligible days for the control group. In some settings the control days from a distant time period could be used, but in our context we need days during the pandemic in order to be able to match pre-treatment outcome dynamics.

Our setting is one in which the treatment is not always absorbing, as the same central bank can (and often did) make multiple announcements. We would like to examine these subsequent announcements in our analysis. Our approach is to partially clean our control group by excluding either 15 or 30 days after each announcement.[31] In cases where central banks make subsequent announcements prior to the end of the cleaning period, we include the announcement and start-over with a new cleaning period.

We run the following regression for the exchange rate:

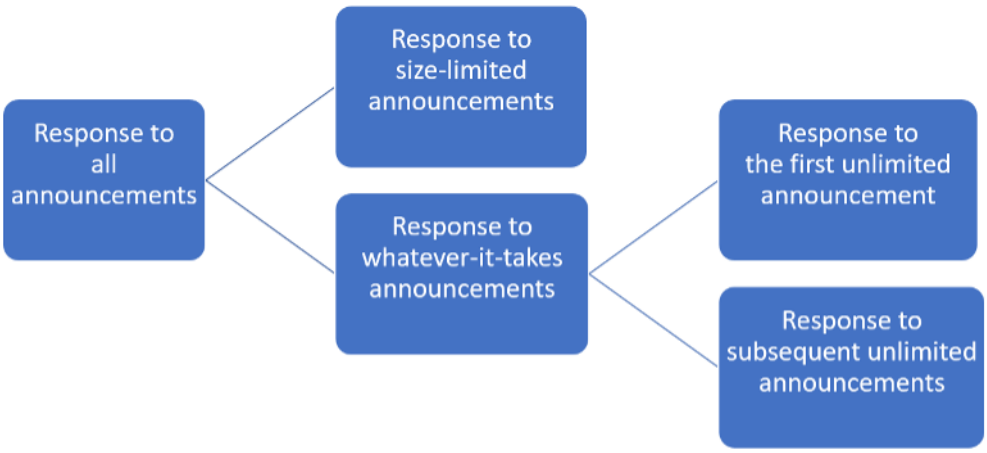
$$100 \cdot \frac{FX_{i,t+h} - FX_{i,t-1}}{FX_{i,t-1}} = \alpha_i + \alpha_t + \beta_h D_{i,t} + \mathbf{X}_{i,t}\boldsymbol{\gamma_h} + \varepsilon_{i,t} \ . \tag{4}$$

[31] Dube et al. (2023) make clear that the only way to rule out negative weights bias is to fully clean controls (in our context exclude all days after an announcement), but at the cost of a reduction in the number of observations (in our case a severe reduction) which can reduce statistical power. They suggest a number of possible modifications of the clean control condition, including a version of the approach we take by limiting the horizon of treatment.

We run a similar regression for yields, using differences instead of cumulative percentage changes:

$$100 \cdot (y_{i,t+h} - y_{i,t-1}) = \alpha_i + \alpha_t + \beta_h D_{i,t} + \mathbf{X}_{i,t}\boldsymbol{\gamma_h} + \varepsilon_{i,t} \ . \tag{5}$$

We run the regression for $h = 0, 1, \ldots 15$ days. Here, $D_{i,t}$ is a dummy equal to 1 if the central bank of country i makes an announcement on day t, and 0 otherwise. Differently from the diff-in-diff methodology, the local projections approach is specifically designed to estimate impulse responses to a sequence of shocks, and our asset purchasing announcements resemble repeated, narratively-identified monetary policy shocks more than they do a single and isolated event or treatment. Therefore, we use our local projections approach to break down the effects of different types of announcements. Our empirical analysis starts with an initial assessment of market reactions to all 167 announcements. We then split our announcements into those with size-limits and those we classify as whatever-it-takes. Finally, we look at responses to the first unlimited announcement (similar to the event study setup) as well as responses to the subsequent unlimited announcements, as outlined in the diagram below.



In the local projection approach, covariates help to control for variation in treatment assignment (which in our context is the timing of central bank announcements). As was the case in our event study analysis, we include country and time fixed effects as well as the same set of controls $\mathbf{X}_{i,t}$ that help us identify the surprise component of the policy announcement. These controls are generally not statistically significant for short horizons, but are significant and appropriately signed for longer horizons across our local projection specifications, suggesting they may have contributed to driving yields with some lag, and might have influenced central bank decisions to intervene. For robustness, we also verify in

the appendix that results are the same irrespective of whether the controls are included or excluded. Standard errors are clustered by date and plotted confidence intervals are at the 90% level.

In order to interpret our local projection results, it is useful to start with the context in the foreign exchange and bond markets during the period under examination. In early 2020, global asset markets had already started to show signs of concern. The US yield curve inverted in late-February 2020, suggesting that investors had begun to worry about a potential crisis, driving short-term security yields up to compensate for the elevated risk. Connected to this, the U.S. dollar briefly lost value relative to a number of other currencies in late February.[32] As the potential worldwide severity of the pandemic started to be better understood, we saw a global dash for cash, as investor confidence in financial markets plummeted. The flight to safe cash, and especially dollar cash, reversed the earlier dollar slide; the broad U.S. dollar index appreciated by 7.5% between 6 March and the dollar's pandemic peak on 24 March. The combination of Federal Reserve swap line announcements on 15 March and 19 March, which reduced a perceived dollar shortage, together with its asset purchase announcements seem to have largely stabilized dollar bilateral rates through mid-May 2020.

The U.S. financial market and monetary policy context is critical to understanding how non-dollar currencies reacted to the asset purchase announcements made by the Federal Reserve and other central banks. The objectives of central bank policy announcements in the early days of the pandemic were twofold: to calm financial markets and provide aggregate demand stimulus. Policies that successfully calm financial markets should appreciate the domestic currency, while expansionary monetary policy (all else equal) should lead to domestic currency depreciation. Of course, during the pandemic all else was not equal. Central banks across the globe were all announcing similar policies at the same time. This meant that foreign exchange markets were responding to the relative strength of central bank policies and attempting to disentangle the effects of counteracting channels.

In light of these considerations, it is less surprising that exchange rates against the dollar do not seem to respond to asset purchase announcements. This was our finding in the event study section and is confirmed by the local projection analysis, as illustrated by the plots in Figure 5a, which plots the β_h coefficients for the exchange rate regressions. The unresponsiveness of the exchange rate remains even after distinguishing between limited and unlimited announcements. When we further separate the first unlimited announcement

[32]This pattern of yield inversion and currency depreciation as a crisis materializes is described in Farhi and Gabaix (2016).

from the following ones, there is a significant, positive response (i.e. an appreciation) on impact, but it dies out immediately. This lack of response can be attributed to the conflicting mechanisms through which asset purchases likely impacted exchange rates in this period. On the one hand, quantitative easing and asset purchasing policies have typically been found to lead to a depreciation of the exchange rate, due to their negative effect on the country's returns, which make the currency less attractive to investors. On the other hand, during the Covid period, the strong flight to safety dynamics likely kept exchange rates of safer countries strong. In this context, asset purchasing policies might actually have a positive effect on the exchange rate, due to their ability to enhance the perceived safety of the country as the central bank commits to doing whatever-it-takes to support its economy.[33]

This dual channel suggests distinguishing between advanced and emerging economies: dominance of one channel over the other is likely to differ between these groups. In emerging economies, which do not enjoy a safety status, the traditional channel should be at work, so that asset purchases lead to a depreciation. In advanced economies, by contrast, asset purchases might have boosted their perceived safety relative to other countries, thus making their assets more attractive for investors looking for safety in the midst of a risk-off period.

Figure 5b confirms that splitting our sample to examine advanced and emerging countries separately is important. It shows that unlimited asset purchasing announcements lead to no response, or a small appreciation, in advanced economies, but lead to a significant depreciation against the dollar in emerging economies. Pooling all the countries together masked this heterogeneity.

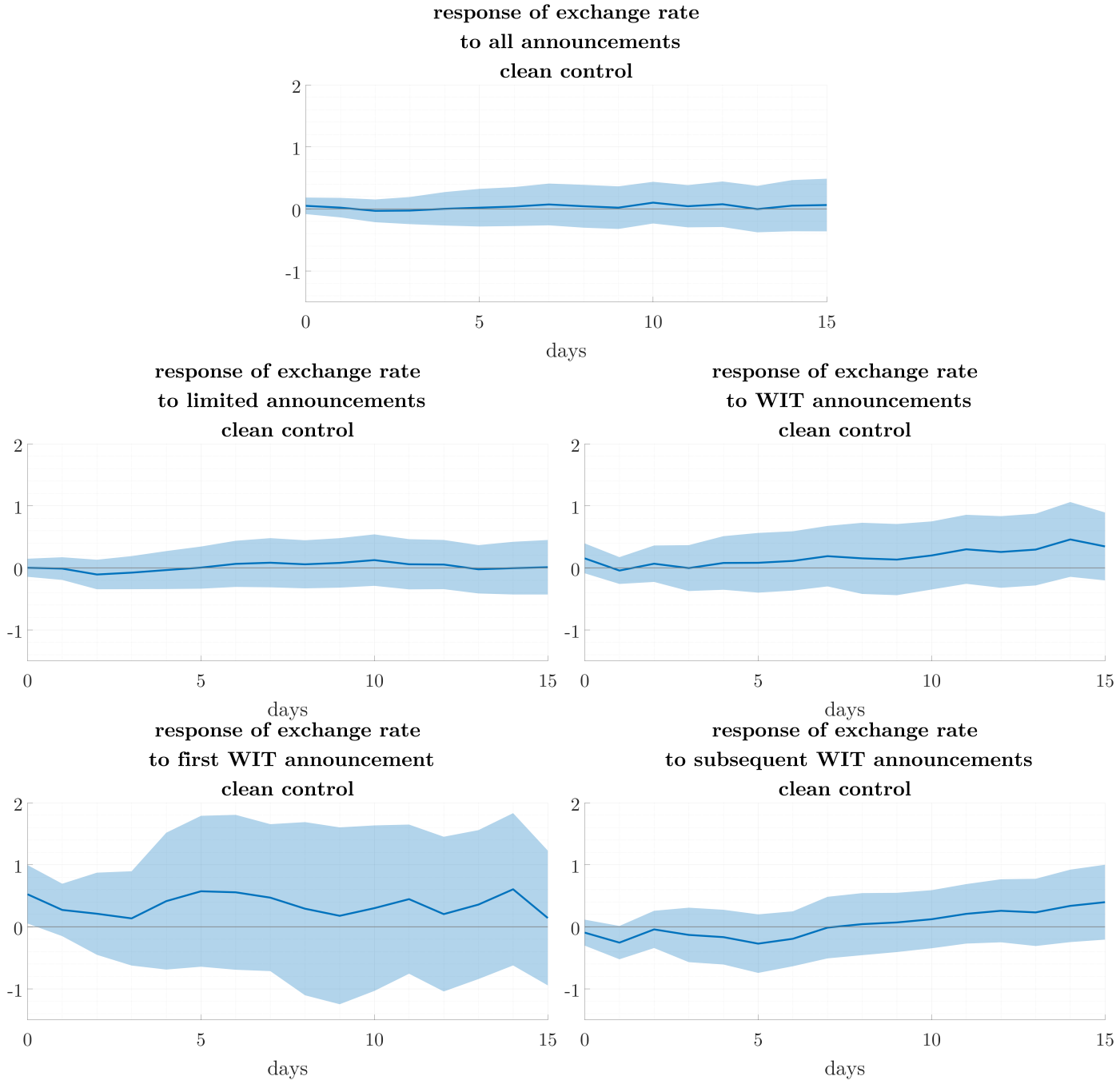
Table 3: Local Projection Coefficients ($h = 1, 2$) for 10-Year Yields

Announcement	**1-day after:** $100 \cdot (y_{i,t+1} - y_{t-1})$		**2-days after:** $100 \cdot (y_{i,t+2} - y_{t-1})$	
All	-0.030	(0.019)	-0.047^{***}	(0.022)
Limited	-0.001	(0.017)	-0.012	(0.017)
Unlimited	-0.081^{***}	(0.040)	-0.150^{***}	(0.055)
1st Unlimited	-0.202^{***}	(0.078)	-0.382^{***}	(0.106)
Later Unlimited	-0.005	(0.023)	-0.005	(0.027)

*Notes: The table shows the estimated coefficients β_h on central bank asset-purchase announcements for each of the five classifications of announcements (all, limited, unlimited, 1st unlimited, and subsequent unlimited) over 1-day and 2-days for the 10-year yield local projection regression (equation 5). The regressions include country and time fixed effects and the set of controls $\mathbf{X}_{i,t}$. Standard errors are clustered by date and shown in parentheses. *, **,*** indicate significance at 10%, 5% and 1%, respectively*

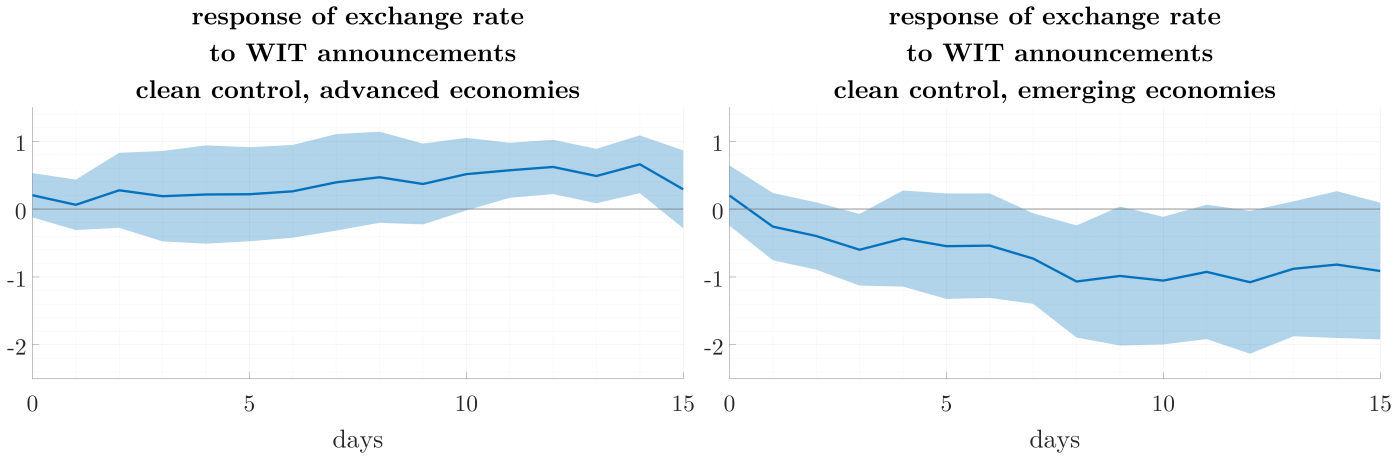
[33]Foschi (2023) provides an examination of flights to safety that explains how perceived safety can change over time.

Figure 5a: Response of Exchange Rate to Asset Purchases Announcements



Notes: Local projections are based on equation 4 for each of the five classifications of central bank asset purchase announcements (all, limited, unlimited, 1st unlimited, and subsequent unlimited). In the charts the x-axis shows the days after the announcement and the y-axis shows depreciation against the dollar relative to the day before the announcement. Our clean control approach excludes 30 days after each announcement. Solid blue lines are the coefficient estimates β_h, shaded areas are 90% confidence intervals. Regressions include country and time fixed effects and the set of controls $\mathbf{X}_{i,t}$. Standard errors are clustered by date.

Figure 5b: Response of Exchange Rate to Unlimited Asset Purchases Announcements, Differentiating Between Advanced and Emerging Economies



Notes: Local projections are based on equation 4 for unlimited central bank asset purchase announcements. The sample is split between advanced and emerging economies. In the charts the x-axis shows the days after the announcement and the y-axis shows depreciation against the dollar relative to the day before the announcement. Our clean control approach excludes 30 days after each announcement. Solid blue lines are the coefficient estimates β_h, shaded areas are 90% confidence intervals. Regressions include country and time fixed effects and the set of controls $\mathbf{X}_{i,t}$. Standard errors are clustered by date.

We find yields to be more responsive to announcements than exchange rates. Figure 6 shows the response of 10-year yields to all announcements, and then breaks it down between limited and unlimited, and between the first and the subsequent unlimited announcements. Results for the first two days following the announcements are also reported in Table 3. Our estimates suggest that asset purchase announcements change expectations and therefore prices, though the effect is modest, hovering between 5 and 10 basis points over the week following the announcement. Breaking this down shows that there is an underlying heterogeneity in the effectiveness of different announcements: while size-limited announcements have, essentially, no effect, unlimited announcements push yields down by 15 basis points in the first two days and up to 20 basis points after a week. Among unlimited announcements there is also heterogeneity: it is the very first whatever-it-takes moment that is most effective, lowering yields by 40 basis points, which roughly matches our estimate from the event study section; conversely subsequent unlimited announcements have no impact. Consistent with what theory and intuition suggests, the real power of whatever-it-takes policy lies largely in its shock-and-awe effect when it is first announced. After the first unlimited announcement, market participants update their expectations, and subsequent announcements seem to only reinforce the original commitment to do whatever is necessary. This may itself be important,

as markets might otherwise react negatively if no further announcements are made.

It is possible that the importance of timing holds more generally for announcements. Our next set of local projections asks whether asset purchase announcements were particularly effective in the early weeks and months of Covid, when there was a widespread sense of panic and central banks seem to have been almost racing to intervene. Figure 7 suggests that was the case: all kinds of announcements were effective in moving prices during the early Covid period, between March and July 2020; in the period that followed, however, none of announcements significantly affect yields.

Finally, as we did for the exchange rate, we split the sample between advanced and emerging economies. The results are shown in figure 8a. In keeping with our prior results, all kinds of announcements are found to be considerably more effective in emerging markets, where they are likely to have been more surprising than in advanced economies. In particular, limited announcements do not affect prices in advanced economies, while whatever-it-takes announcements do, though the effect appears small, at around 5 basis points. In emerging economies, limited announcements appear similarly ineffective, though the point estimates are large in magnitude. Whatever-it-takes announcements, however, appear particularly powerful, lowering yields by up to 40 basis points. The results we found for whatever-it-takes announcements in Figure 6, therefore, appear to be driven by emerging market countries rather than advanced economies. Importantly, this sizable discrepancy in magnitudes between advanced and emerging economies remains even if the dependent variable is standardized by country using its volatility over this period, as shown in Figure 8b for unlimited announcements, so the results do not appear to be due simply to the larger volatility of yields in emerging markets.

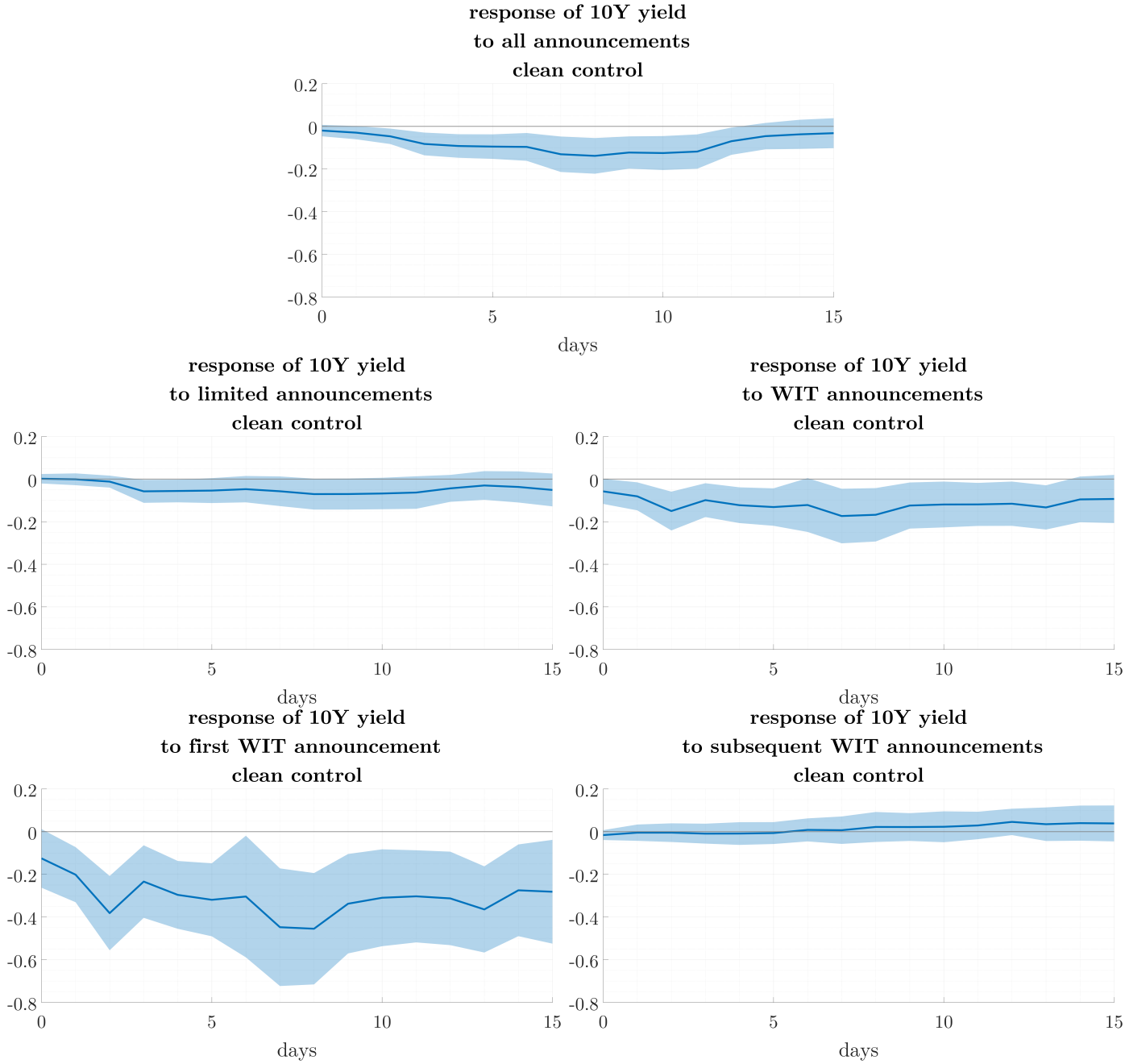
VI Conclusion

Central banks across the globe took aggressive action during the pandemic to restore confidence in financial markets and support economies. They both actively intervened and communicated their intervention to markets ex ante using announcements. This use of policy announcements to signal resolve and restore confidence was also used by many central banks during the 2008 crisis, and stands in marked contrast to the pre-1990s secrets-of-the-temple approach to monetary policy.[34]

In this paper we ask whether a subgroup of these monetary policy announcements,

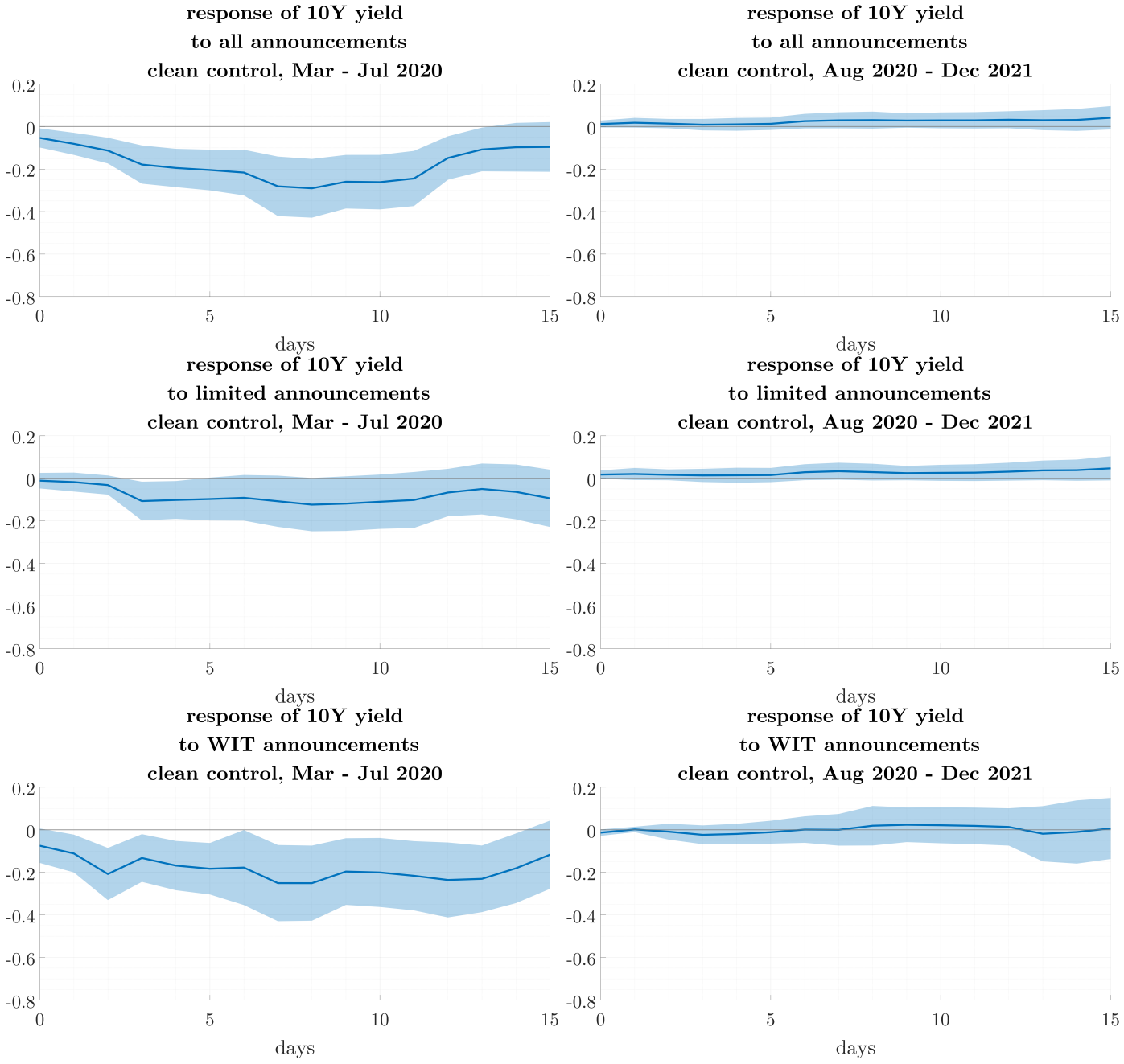
[34]Geraats (2002) and Blinder et al. (2008) provide excellent discussions of the costs and benefits of central bank transparency.

Figure 6: Response of 10-Year Yield to Asset Purchases Announcements



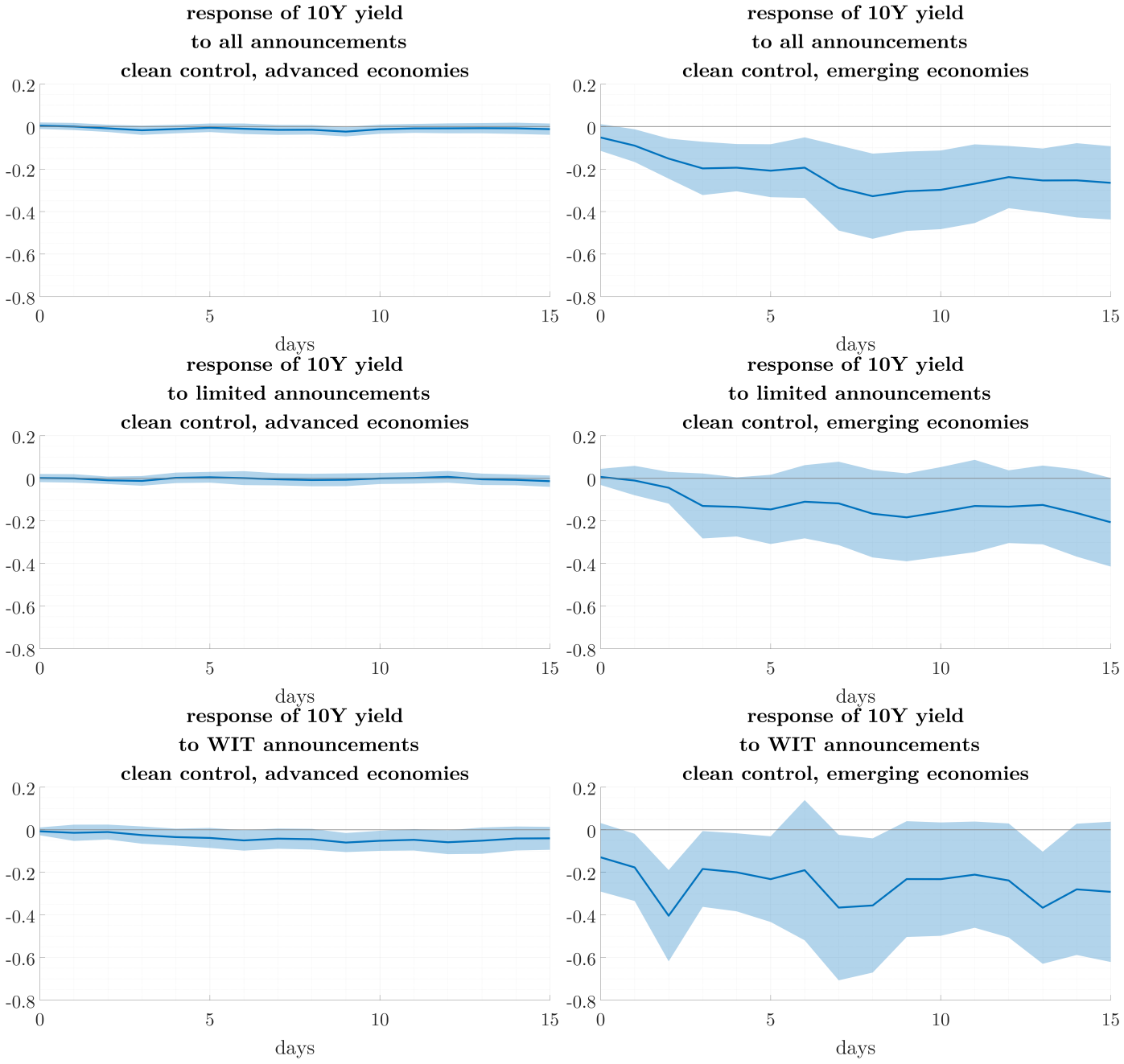
Notes: Local projections are based on equation 5 for each of the five classifications of central bank asset purchase announcements (all, limited, unlimited, 1st unlimited, and subsequent unlimited). In the charts the x-axis shows the days after the announcement and the y-axis shows the change in the 10-year yield relative to the day before the announcement. Our clean control approach excludes 30 days after each announcement. Solid blue lines are the coefficient estimates β_h, shaded areas are 90% confidence intervals. Regressions include country and time fixed effects and the set of controls $\mathbf{X}_{i,t}$. Standard errors are clustered by date.

Figure 7: Response of 10-Year Yield to Asset Purchases Announcements, Differentiating Between Earlier and Later Parts of the Sample



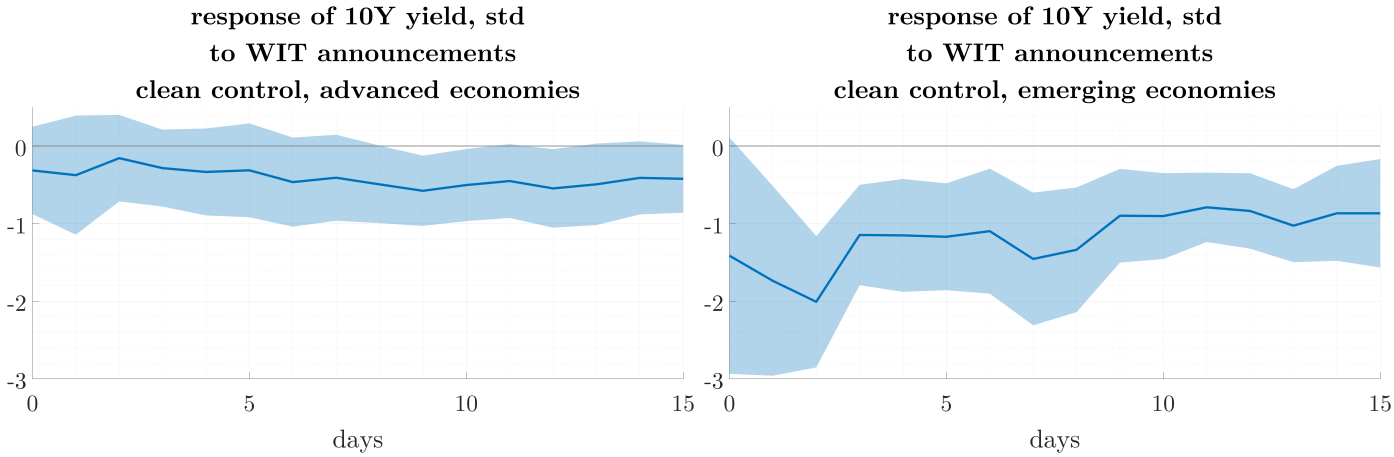
Notes: Local projections are based on equation 5 for each of the five classifications of central bank asset purchase announcements (all, limited, unlimited, 1st unlimited, and subsequent unlimited). The sample is split between March-July 2020 and August 2020-December 2021. In the charts the x-axis shows the days after the announcement and the y-axis shows the change in the 10-year yield relative to the day before the announcement. Our clean control approach excludes 30 days after each announcement. Solid blue lines are the coefficient estimates β_h, shaded areas are 90% confidence intervals. Regressions include country and time fixed effects and the set of controls $\mathbf{X}_{i,t}$. Standard errors are clustered by date.

Figure 8a: Response of 10-Year Yield to Asset Purchases Announcements, Differentiating Between Advanced and Emerging Economies



Notes: Local projections are based on equation 5 for each of the five classifications of central bank asset purchase announcements (all, limited, unlimited, 1st unlimited, and subsequent unlimited). The sample is split between advanced and emerging economies. In the charts the x-axis shows the days after the announcement and the y-axis shows the change in the 10-year yield relative to the day before the announcement. Our clean control approach excludes 30 days after each announcement. Solid blue lines are the coefficient estimates β_h, shaded areas are 90% confidence intervals. Regressions include country and time fixed effects and the set of controls $\mathbf{X}_{i,t}$. Standard errors are clustered by date.

Figure 8b: Response of 10-Year Yield to Unlimited Asset Purchases Announcements, Differentiating Between Advanced and Emerging Economies, Standardized LHS



Notes: Local projections are based on equation 5 for unlimited central bank asset purchase announcements. The sample is split between advanced and emerging economies. The dependent variable is standardized by country. In the charts the x-axis shows the days after the announcement and the y-axis shows the change in the 10-year yield relative to the day before the announcement. Our clean control approach excludes 30 days after each announcement. Solid blue lines are the coefficient estimates β_h, shaded areas are 90% confidence intervals. Regressions include country and time fixed effects and the set of controls $\mathbf{X}_{i,t}$. Standard errors are clustered by date.

those that include a promise to intervene at a whatever-it-takes scale, are more effective than announcements that include size-limits. It is important to note that whatever-it-takes statements embody constructive ambiguity: they are inherently less transparent than announcements with explicit size and duration information. This form of purposeful policy vagueness allows for the possibility that no policy interventions will be taken if the announcement itself is all that it takes. It is also noteworthy that central banks rarely describe the criteria they will use to determine when their whatever-it-takes policy interventions will have accomplished their objective.

Along with the reduced transparency of unlimited operations, there are other downsides to whatever-it-takes policymaking. After a whatever-it-takes announcement is made, it may be harder to impress the market again. Our estimates indicate that subsequent unlimited announcements have less impact on asset prices. Whatever-it-takes announcements set a high bar, potentially leading to ever escalating market expectations for large-scale intervention. These types of announcements will also be counter-productive if they inadvertently heighten investors' fears that economic circumstances are even worse than was thought, or that more standard (size limited) policies are not up to the task. Markets may also worry that if central

banks go 'too big,' they will have limited their options to address the next shock (Bergant and Forbes, 2023). Finally, whatever-it-takes policies are likely to increase moral hazard. Large-scale asset purchases will inevitably increase incentives for risk taking by financial institutions that hold a high share of eligible securities.[35]

Peer pressure was likely a factor in the decisions of some central banks to announce whatever-it-takes policies. If other central banks are successfully restoring orderly financial market function with the use of whatever-it-takes policy, it would be difficult not to follow suit. It may also be the case that cross-country spillovers are likely to be less problematic if policy responses are synchronized. The global scope of the crisis also lessened the worry for central banks that markets would interpret their own aggressive actions as a sign that their economy was facing unusual difficulty.

The empirical analysis in this paper underscores the benefits of whatever-it-takes policies. Markets responded positively to these announcements during the pandemic, and this was especially the case for emerging economy central banks. Impacts on exchange rates and yields indicate that these announcements were successful in restoring confidence in financial markets and in reducing uncertainty and financial stress. In the early days of the pandemic there was a risk that the financial market turmoil would intensify, which would have led economies into much deeper recessions. It does not follow that central banks can rely on whatever-it-takes policy in future crises, but it is useful to understand the preemptive role they played in the pandemic.

[35]Acharya et al. (2019) describe the misallocation of credit that resulted from the announcement impacts of the ECB's OMT on weak European banks.

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Appendix

Table A1: Asset Purchase Announcements by Central Bank and Date

Central Bank	Date	Type of Asset Purchase	Size
Reserve Bank of Australia	19/03/20	Government bond purchases	Unlimited
	05/05/20	Bond Purchases	Unlimited
	03/11/20	Government bond purchases	Unlimited
	03/11/20	Government securities purchases	Unlimited
	02/02/21	Government bond purchases	Unlimited
	06/07/21	Government bond purchases	4 billion weekly until at least mid-November
	06/07/21	Government bond purchases	4 billion weekly until at least 02/2022
	02/11/21	Discontinument of Government bond purchases	NA
Bank of Canada	12/03/20	Expansion of Bond Buyback Program	500 million
	13/03/20	Bankers' Acceptance Purchase Facility (BAPF)	Value of 1-month Bankers' Acceptance weekly
	16/03/20	Canada Mortgage Bond Purchase	500 billion weekly
	24/03/20	Provincial Money Market Purchase Program (PMMP)	40-percent purchase limit
	27/03/20	Commercial Paper Purchase Progeam (CPPP)	Unlimited
	27/03/20	Government securities purchases	Unlimited
	15/04/20	Provincial Bond Purchase Program (PBPP)	Up to 50 billion
	15/04/20	Corporate Bond Purchase Program (CBPP)	Up to 10 billion
	15/04/20	Treasury Purchases	40-percent purchase limit
	20/05/20	Government securities purchases	Up to 100 million
	03/06/20	Bankers' Acceptance Purchase Facility (BAPF)	Value of 1-month Bankers' Acceptance bi-weekly
	21/07/20	PMMP Securities Purchase	20-percent purchase limit
	21/07/20	Treasury Purchases	20-percent purchase limit
	15/09/20	Provincial Money Market Purchase Program (PMMP)	10-percent purchase limit
	15/09/20	Treasury Purchases	10-percent purchase limit
	23/03/21	Commercial Paper Purchase Progeam (CPPP)	NA
	23/03/21	Provincial Bond Purchase Program (PBPP)	NA
	23/03/21	Corporate Bond Purchase Program (CBPP)	NA
	21/04/21	Government bond purchases	3 billion
	30/04/21	Securities Repo Operations (SROs)	4,000 million
	14/07/21	Bank Quantitative Easing Program (QE)	2 billion weekly
	27/10/21	Bank Quantitative Easing Program (QE)	NA
European Central Bank	12/03/20	Asset Purchase Program (APP)	120 billion
	18/03/20	Corporate Sector Purchase Program (CSPP)	Unlimited
	18/03/20	Pandemic Emergency Purchase Program (PEPP)	Unlimited
	30/04/20	Asset Purchase Program	Unlimited
	30/04/20	Pandemic Emergency Purchase Program (PEPP)	Unlimited
	04/06/20	Pandemic Emergency Purchase Program (PEPP)	600 billion
	22/09/20	Sustainability-linked bonds Purchases	NA
	10/12/20	Pandemic Emergency Purchase Program (PEPP)	500 billion
	11/03/21	Pandemic Emergency Purchase Program (PEPP)	NA
	09/09/21	Pandemic Emergency Purchase Program (PEPP)	NA
	28/10/21	Pandemic Emergency Purchase Program (PEPP)	NA
	16/12/21	Pandemic Emergency Purchase Program (PEPP)	NA

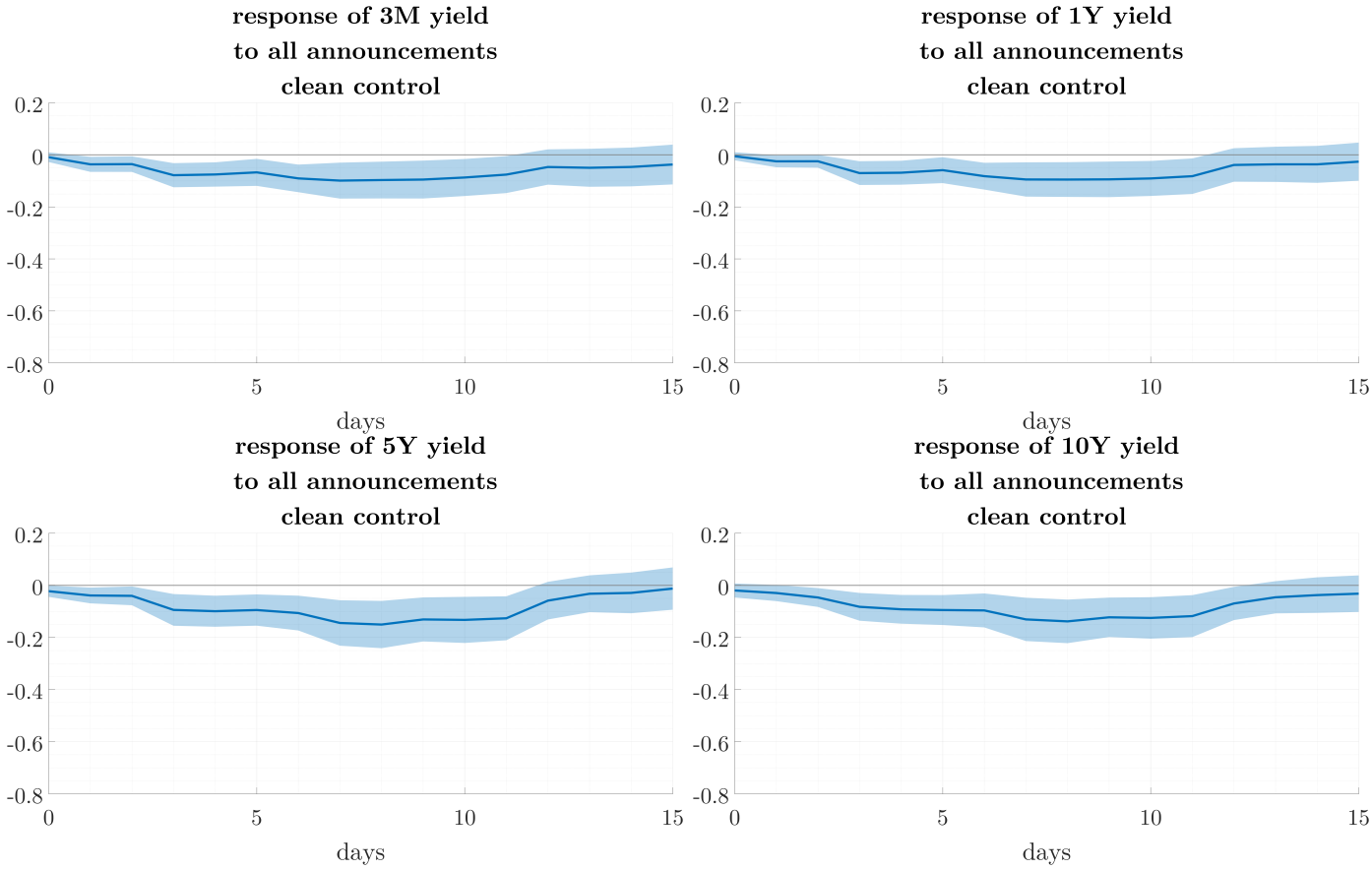
Bank of England	17/03/20	Covid Corporate Financing Facility (CCFF)	Unlimited
	19/03/20	Government Bond Purchases	200 billion
	02/04/20	Corporate Bond Purchases	>10 billion
	19/05/20	Covid Corporate Financing Facility (CCFF)	NA
	05/06/20	Corporate Bond Purchase Scheme (CBPS)	NA
	18/06/20	Government Bond Purchases	100 billion
	18/06/20	Asset Purchase Facility: Gilt Purchases	NA
Sveriges Riksbank	16/03/20	Government Bond Purchases	300 billion
	20/03/20	Covered Bonds Purchase	10 billion
	26/03/20	Commercial Paper Purchase	4 billion
	22/04/20	Bond-purchasing Program	15 billion
	08/05/20	Commercial Paper Purchase	32 billion
	01/07/20	Bond-purchasing Program	200 billion
	26/11/20	Asset Purchase Program	Unlimited
Federal Reserve Board	12/03/20	Treasury Bills Purchase	60 billion
	13/03/20	Treasury Security Purchases	80 billion
	15/03/20	Purchase of Securities	Unlimited
	17/03/20	Commercial Paper Funding Facility (CPFF)	10 billion
	23/03/20	Purchase of Securities	Unlimited
	23/03/20	Commercial Paper Funding Facility (CPFF)	Unlimited
	23/03/20	Primary Market Corporate Credit Facility (PMCCF)	Unlimited
	23/03/20	Secondary Market Corporate Credit Facility (SMCCF)	Unlimited
	09/04/20	Primary Market Corporate Credit Facility (PMCCF)	Unlimited
	09/04/20	Secondary Market Corporate Credit Facility (SMCCF)	Unlimited
	09/04/20	Municipal Liquidity Facility (MLF)	Unlimited
	27/04/20	Municipal Liquidity Facility (MLF)	NA
	29/04/20	Purchase of Securities	Unlimited
	03/06/20	Municipal Liquidity Facility (MLF)	NA
	10/06/20	Purchase of Securities	Unlimited
	15/06/20	Secondary Market Corporate Credit Facility (SMCCF)	Unlimited
	23/07/20	Emergency Lending Facilities	NA
	28/07/20	Extension of Lending Facilities	NA
	11/08/20	Municipal Liquidity Facility (MLF)	NA
	03/11/20	Purchase of Securities	15 billion
	30/11/20	Extension of Lending Facilities	NA
	15/12/20	Purchase of Securities	30 billion
	02/06/21	Secondary Market Corporate Credit Facility (SMCCF)	NA
Bank of Japan	13/03/20	Government Bond Purchases	NA
	16/03/20	Government Bond Purchases	NA
	16/03/20	Corporate Bond Purchases	<2 trillion yen
	16/03/20	Stock Purchases	<12 trillion yen
	27/04/20	Government Bond Purchases	Unlimited
	27/04/20	Corporate Bond Purchases	Unlimited
	22/05/20	Corporate Bond Purchases	NA
	18/12/20	Corporate Bond Purchases	<20 trillion yen
	19/03/21	Stock Purchases	<12 trillion yen
	19/03/21	Government Bond Purchases	NA
	18/06/21	Corporate Bond Purchases	Unlimited

Hungarian National Bank	07/04/20	Government Security Purchase Program	NA
	07/04/20	Mortgage Bond Purchase Program	NA
	07/04/20	Bond Funding for Growth Scheme (BGS)	50 billion
	28/04/20	Government Security Purchase Program	Unlimited
	28/04/20	Mortgage Bond Purchase Program	Unlimited
	30/04/20	Government Security Purchase Program	NA
	30/04/20	Bond Funding for Growth Scheme (BGS)	NA
	21/07/20	Government Security Purchase Program	NA
	25/08/20	Government Security Purchase Program	NA
	22/09/20	Bond Funding for Growth Scheme (BGS)	NA
	06/10/20	Government Security Purchase Program	Unlimited
	26/01/21	Bond Funding for Growth Scheme (BGS)	NA
	26/01/21	Government Security Purchase Program	NA
	23/02/21	Government Security Purchase Program	NA
	09/03/21	Government Security Purchase Program	Unlimited
	27/04/21	Government Security Purchase Program	Unlimited
	24/08/21	Government Security Purchase Program	50 billion weekly
	21/09/21	Government Security Purchase Program	40 billion weekly
	19/10/21	Government Security Purchase Program	NA
	16/11/21	Government Security Purchase Program	NA
	14/12/21	Bond Funding for Growth Scheme (BGS)	NA
	14/12/21	Government Security Purchase Program	NA
Bank of Israel	15/03/20	Government Bond Purchases	NA
	23/03/20	Government Bond Purchases	50 billion
	06/07/20	Corporate Bond Purchase Program	15 billion
	22/10/20	Government Bond Purchases	35 billion
National Bank of Poland	16/03/20	Treasury Bond Purchases	Unlimited
	08/04/20	Government Securities Purchase	Unlimited
Central Bank of Turkey	31/03/20	Government Domestic Debt Securities (GDDS) Sale	Unlimited
	17/04/20	Government Domestic Debt Securities (GDDS) Sale	NA
Bank of Zambia	25/03/20	Government Security Purchases	Unlimited
Central Bank of Chile	16/03/20	Bond Purchase Program	US$4 billion
	19/03/20	Bank Purchase Program	NA
	31/03/20	Bank Purchase Program	US$5.5 billion
	08/04/20	Bank Purchase Program	US$8 billion
	16/06/20	Asset Purchase Program	US$8 billion
	30/07/20	Cash Purchase Operations Program	US$10 billion
	30/07/20	Bank Deposit Purchase Program	US$8 billion
	24/09/20	Bank Deposit Purchase Program	US$6 billion
	24/09/20	Asset Purchase Program	NA
Central Bank of Colombia	23/03/20	Government Bond Purchases	Up to 2 trillion
	23/03/20	Purchase of Private Titles of Credit Establishments	10 trillion
	14/04/20	Government Bond Purchases	Up to 2 trillion
	15/05/20	Public Debt Swap	1,766 billion
Bank Indonesia	01/04/20	Government Security Purchase	NA
	18/06/20	Government Security Purchase	NA
	06/07/20	Government Security Purchase	40 billion

Central Bank of India	18/03/20	Government Security Purchases	10,000 crores
	20/03/20	Government Security Purchases	30,000 crores
	23/04/20	Government Security Sales	10,000 crores
	09/10/20	State Development Loans (SDLs)	NA
	07/04/21	Government Security Purchases	1 trillion crores
	04/06/21	Government Security Purchases	Unlimited
Bank of Korea	19/03/20	Treasury Bond Purchases	1.5 trillion
	09/04/20	Government Bond Purchases	1.5 trillion
	20/05/20	Commercial Paper Purchase Program	10 trillion
	30/06/20	Government Bond Purchases	1.5 trillion
	17/07/20	Corporate Bond Purchases	8 trillion
	08/09/20	Government Bond Purchases	5 trillion
	26/02/21	Government Bond Purchases	7 trillion
Bank of Mexico	12/03/20	Government Bond Swaps	40,000 million
	21/04/20	Government Security Swaps	100 billion
Reserve Bank of New Zealand	23/03/20	Large Scale Asset Purchase Program (LSAP)	30 billion
	07/04/20	Large Scale Asset Purchase Program (LSAP)	3 billion
	13/05/20	Large Scale Asset Purchase Program (LSAP)	60 billion
	12/08/20	Large Scale Asset Purchase Program (LSAP)	100 billion
	14/07/21	Large Scale Asset Purchase Program (LSAP)	NA
Bangko Sentral ng Pilipinas	10/04/20	Government Securities Purchase	1-hour daily unlimited limit
National Bank of Romania	20/03/20	Government Securities Purchase	NA
Central Bank of Thailand	22/03/20	Government Bond Purchase Program	>100 billion
	07/04/20	Corporate Bond Stabilization Fund	NA

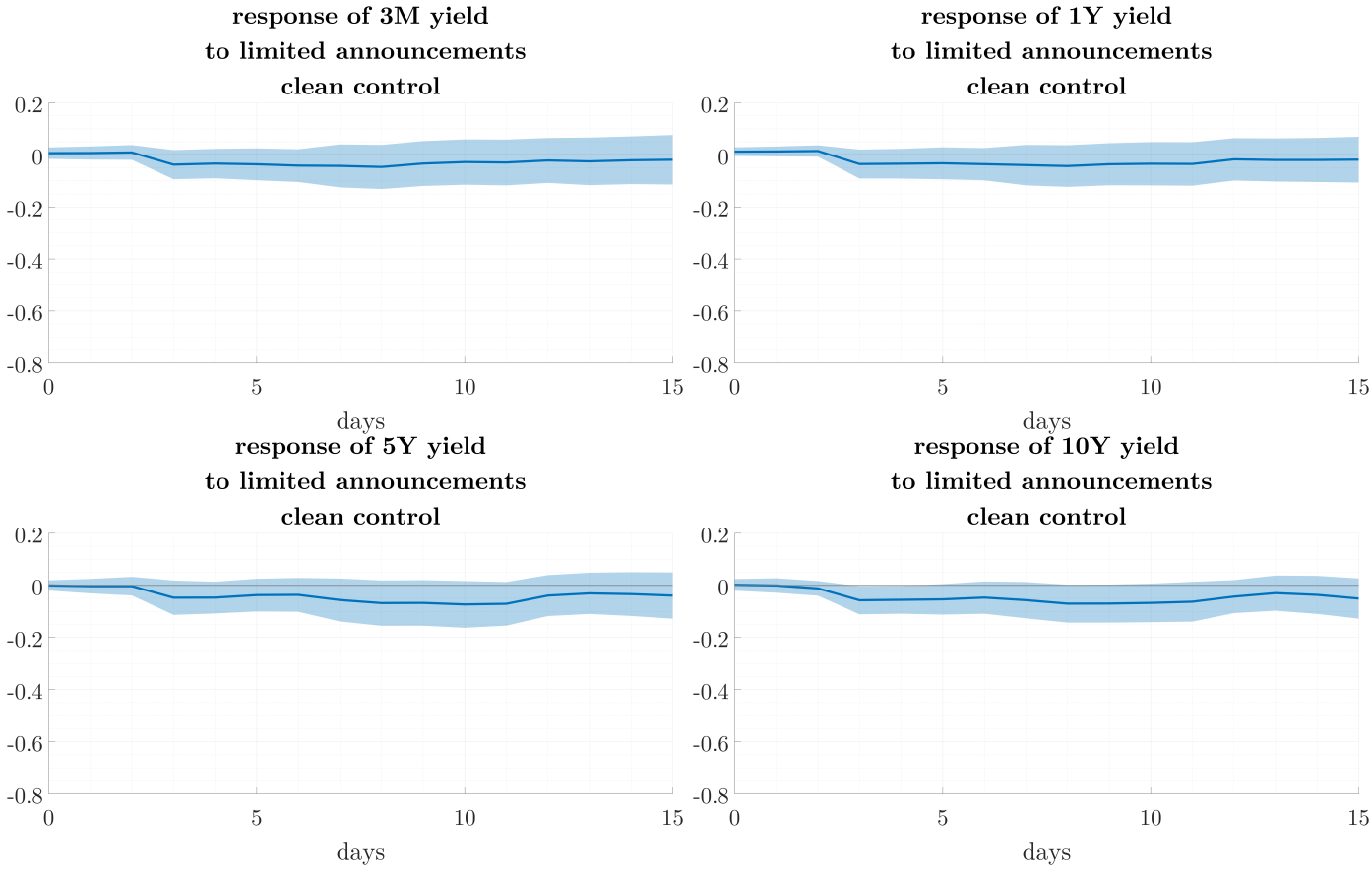
Source: Announcement data from Cantú et al. (2021), classification as unlimited by authors based on central bank press release and subsequent news coverage.

Figure A1a: Response of Yields to All Asset Purchases Announcements, Across Different Maturities



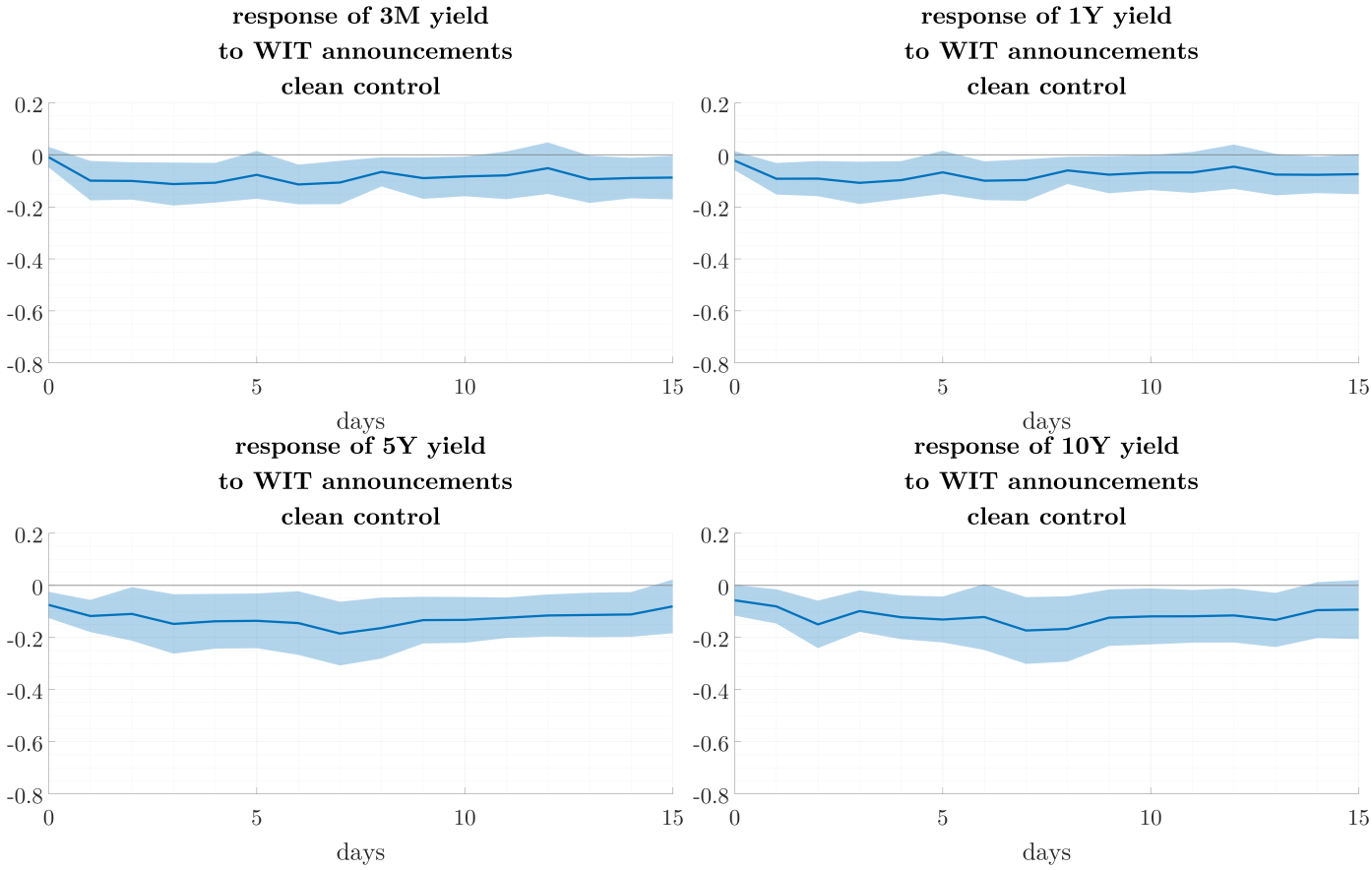
Notes: Local projections are based on equation 5 for all central bank asset purchase announcements. The dependent variables are yields for different sovereign debt maturities. In the charts the x-axis shows the days after the announcement and the y-axis shows the change in the yield relative to the day before the announcement. Our clean control approach excludes 30 days after each announcement. Solid blue lines are the coefficient estimates β_h, shaded areas are 90% confidence intervals. Regressions include country and time fixed effects and the set of controls $\mathbf{X}_{i,t}$. Standard errors are clustered by date.

Figure A1b: Response of Yields to Limited Asset Purchases Announcements, Across Different Maturities



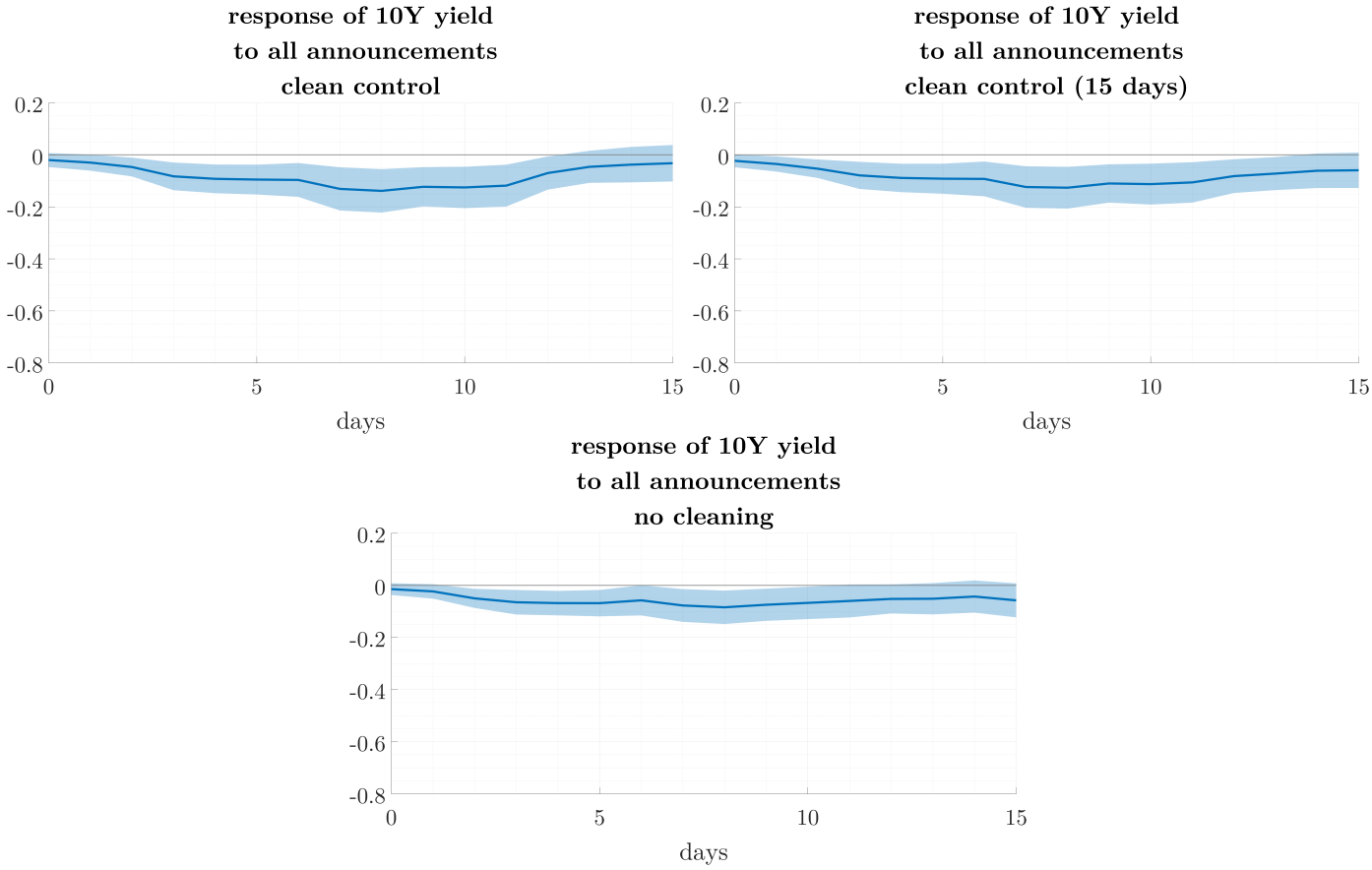
Notes: Local projections are based on equation 5 for limited central bank asset purchase announcements. The dependent variables are yields for different sovereign debt maturities. In the charts the x-axis shows the days after the announcement and the y-axis shows the change in the yield relative to the day before the announcement. Our clean control approach excludes 30 days after each announcement. Solid blue lines are the coefficient estimates β_h, shaded areas are 90% confidence intervals. Regressions include country and time fixed effects and the set of controls $\mathbf{X}_{i,t}$. Standard errors are clustered by date.

Figure A1c: Response of Yields to Unlimited Asset Purchases Announcements, Across Different Maturities



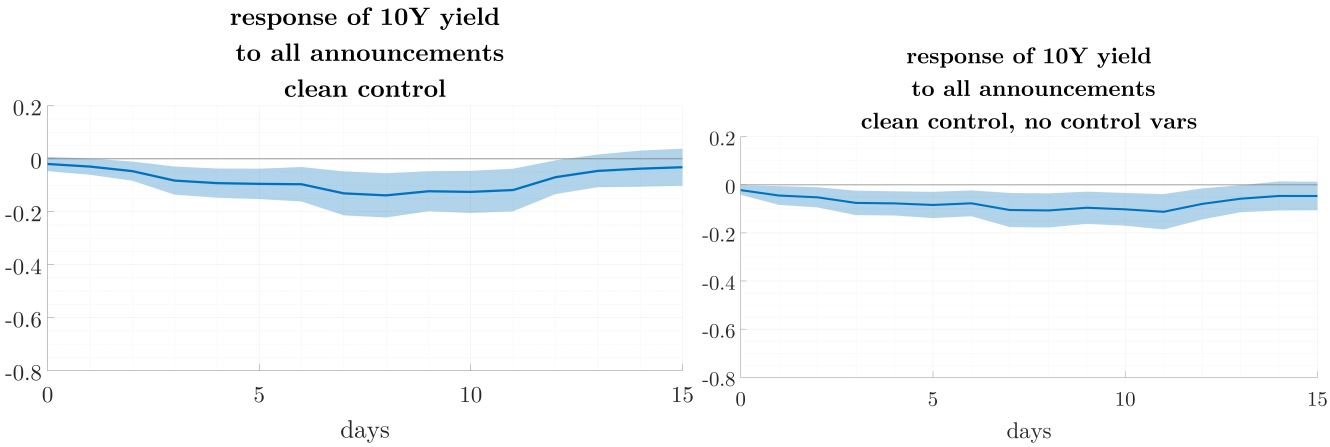
Notes: Local projections are based on equation 5 for unlimited central bank asset purchase announcements. The dependent variables are yields for different sovereign debt maturities. In the charts the x-axis shows the days after the announcement and the y-axis shows the change in the yield relative to the day before the announcement. Our clean control approach excludes 30 days after each announcement. Solid blue lines are the coefficient estimates β_h, shaded areas are 90% confidence intervals. Regressions include country and time fixed effects and the set of controls $\mathbf{X}_{i,t}$. Standard errors are clustered by date.

Figure A2: Robustness Check – Clean Control Sample (30 days), Clean Control Sample (15 days), and No Cleaning



Notes: Local projections are based on equation 5 for all central bank asset purchase announcements. In the charts the x-axis shows the days after the announcement and the y-axis shows the change in the 10-year yield relative to the day before the announcement. Our clean control approach excludes 30 days after each announcement; our alternative clean control approach approach excludes 15 days after each announcement; the approach with no cleaning excludes no observations. Solid blue lines are the coefficient estimates β_h, shaded areas are 90% confidence intervals. Regressions include country and time fixed effects and the set of controls $\mathbf{X}_{i,t}$. Standard errors are clustered by date.

Figure A3: Robustness Check – Including Control Variables, Excluding Control Variables



Notes: Local projections are based on equation 5 for all central bank asset purchase announcements. In the charts the x-axis shows the days after the announcement and the y-axis shows the change in the 10-year yield relative to the day before the announcement. Our clean control approach excludes 30 days after each announcement. Solid blue lines are the coefficient estimates β_h, shaded areas are 90% confidence intervals. Regressions include country and time fixed effects; one specification includes the set of controls $\mathbf{X}_{i,t}$, and the other specification does not. Standard errors are clustered by date.