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Initial Monetary Policy Response to the COVID-19 Pandemic in Inflation Targeting Economies

Abstract: The monetary policy response to COVID-19 in various economies around the world was in many ways exceptional. This paper investigates several aspects of this response among 28 inflation targeters by looking at actions undertaken by selected monetary authorities at the outset of the pandemic-induced crisis. Evidently, the reviewed central banks assessed the pandemic to be a clear-cut case for loosening monetary policy. They promptly announced expansionary decisions, often at extraordinary meetings, using a possibly broad set of measures, with not much hesitation before reaching for unconventional ones. One of the key aspects of the response was how quickly the authorities reacted to the shock. It turned out that, on average, advanced economies announced their initial policy actions within a month, whereas emerging market economies were twice as fast. As shown by a simple econometric exercise, this difference can to a great extent be explained by the time when the first COVID-19 cases were recorded in a country, the stringency of the adopted pandemic restrictions, and the need for liquidity provisions in economies with less deep financial systems. Of relevance were also variables related to having room for manoeuvre with respect to nonstandard measures and the deviation of inflation from the target.

Keywords: policy design, monetary policy, central banking

JEL classification codes: E52, E58, E61

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Reakcja polityki pieniężnej na wybuch pandemii COVID-19 w krajach stosujących strategię celu inflacyjnego

Streszczenie: Reakcja polityki pieniężnej na wybuch pandemii COVID-19 była pod wieloma względami wyjątkowa. Niniejszy artykuł bada kilka aspektów tej wyjątkowości wśród 28 banków centralnych stosujących strategię celu inflacyjnego, biorąc pod uwagę działania podejmowane przez wybrane władze monetarne na początku kryzysu związanego z pandemią. Analizowane banki centralne jednoznacznie uznały, że pandemia wymaga wyraźnego złagodzenia warunków monetarnych, co zaowocowało szybkim ogłoszeniem decyzji zwiększających ekspansywność polityki pieniężnej, podejmowanych często na nadzwyczajnych posiedzeniach i wykorzystujących możliwie szeroki zestaw instrumentów – bez nadmiernego wahania co do zastosowania również narzędzi niestandardowych. Jednym z kluczowych aspektów odpowiedzi banków centralnych na kryzys była również szybkość reakcji na szok. Okazało się, że średnio w gospodarkach rozwiniętych pierwsze decyzje łagodzące politykę pieniężną ogłoszono w ciągu miesiąca od wybuchu pandemii, podczas gdy w gospodarkach rozwijających się reakcja była dwukrotnie szybsza. Jak pokazało proste ćwiczenie ekonometryczne, różnica ta może być jednak w dużym stopniu wyjaśniona przez moment wykrycia pierwszych przypadków COVID-19 w danym kraju, rygorystycznością przyjętych ograniczeń antypandemicznych oraz potrzebą wsparcia płynnościowego gospodarek z mniej głębokim systemem finansowym. Znaczenie miały także zmienne dotyczące przestrzeni do wykorzystania niekonwencyjnych działań oraz odchylenie inflacji od celu inflacyjnego.

Słowa kluczowe: proces decyzyjny, polityka pieniężna, banki centralne

Kody klasyfikacji JEL: E52, E58, E61

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Introduction

The outbreak of the COVID-19 pandemic in early 2020 and the related lockdowns resulted in a decline of economic activity throughout the world. This, in turn, prompted authorities to undertake exceptional measures aimed at mitigating the negative shock. Apart from providing unprecedented fiscal support, at least by peacetime standards, monetary policy makers reacted decisively. There was clearly only one direction considered – loosening.

The actions of central banks were in many respects extraordinary, as evidenced by their timing and scope. The intensity with which new measures were announced and those already introduced extended was outstanding. Also notable was the wide acceptance of a much broader policy toolkit in countries that previously followed rather conventional monetary policy. This indicates that, for the foreseeable future, the distinction between conventional and unconventional measures has become largely irrelevant.

Given the uniqueness of the situation, it is worth reviewing in more detail the initial monetary policy response to COVID-19. In particular, the aim of

this paper is to look at selected aspects of central bank decisions taken in the first half of 2020, including their sequence and drivers.

A total of 28 inflation targeting countries were chosen for the analysis, 14 advanced economies and 14 emerging market economies, making up for a relatively large and heterogenous group to look at. Moreover, such a selection offers the advantage of reviewing economies that pursue the same monetary policy strategy. This allows for a fair comparison of their reactions. The distinction between advanced economy inflation targeters and emerging market economy inflation targeters has been helpful in detecting some similarities and differences in the responses of central banks to COVID-19.

The period investigated begins around the outbreak of the pandemic and ends in June 2020. Thus, all the monetary policy decisions related to COVID-19 that took place in the first half of 2020 are taken into account.

At the same time, apart from distinguishing between advanced and emerging market economies, another possibly important dividing line was introduced. Namely, depending on the timing when the first infections were reported in a given country (January, February or March 2020), the analysed economies were put into three subgroups based on the month in which the pandemic hit them. The resulting pandemic waves also proved useful in the analysis.[1]

All information on monetary policy actions was collected from the central banks' websites (only official announcements were considered), whereas the data used in the estimations were mainly taken from the publicly accessible databases of the International Monetary Fund and the World Bank. The institutional arrangements of the central banks were assessed using indices proposed in Niedźwiedzińska [2020] and based on a unique dataset constructed by this author.[2] For each country, the dataset featured around 60 aspects referring to the main elements of the inflation targeting strategy as pursued in a country, e.g. legal provisions governing a given central bank, together with the key characteristics of its decision-making process, the analytical framework, and communication policy. Capital account openness was proxied by updated measures constructed by Fernández et al. [2016] and Chinn and Ito [2006] and indices taken from the International Monetary Fund, whereas anti-pandemic restrictions were assessed by looking at the Oxford COVID-19 Government Response Tracker [Hale et al., 2021]. The collected indicators were used to construct simple cross-country regressions in an attempt to identify factors affecting the timing of the initial responses of the central banks to COVID-19.

A number of recent papers and publications touch on these issues. Much relevant information and some takeaways from reviewing the experiences of selected central banks in coping with the pandemic can be found, for example,

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1 The term "pandemic wave" is used here to indicate a group of countries hit by COVID-19 in the same month, so its meaning is different than in discussing the evolution of the pandemic (i.e. subsequent episodes of surging infections).

2 The dataset on institutional arrangements will be published in a forthcoming monograph by this author [Niedźwiedzińska, 2022].

in the IMF Policy Tracker, Arslan, Drehmann and Hofmann [2020], Cavallino and De Fiore [2020], Galí [2020], Grostal [2020], Hartley and Rebucci [2020], Lane [2020], Lu [2020], and Mühleisen et al. [2020]. In particular, some observations on monetary policy reactions to COVID-19 in advanced economies were presented in Cavallino and De Fiore [2020], whereas findings on emerging market economies were reported in Mühleisen et al. [2020] and in Hartley and Rebucci [2020].

To the author's knowledge, this paper is one of the first attempts to look at the problem by comparing the initial response of monetary policy to the pandemic across a wide range of jurisdictions, including both advanced and emerging market economies. Interestingly, several researchers who dealt explicitly with actions undertaken by the central banks of emerging market economies argued that those monetary authorities had somewhat limited room for manoeuvre given their dependence on external financing (Benigno et al., [2020], García-Herrero, Ribakova [2020]). Gelos et al. [2020] also pointed to the quality of institutional frameworks and inflation levels as factors influencing policy space. At the same time, some authors acknowledged that the monetary policy response of many emerging market economies was as decisive as that of advanced economies (Mühleisen et al. [2020] and Hartley, Rebucci [2020]). It is therefore interesting to analyse more closely the comparison and empirically investigate factors affecting the way central banks addressed the crisis at its initial stage, with inflation targeters chosen as a relevant group to look at.

The paper has the following structure. First, several topics stemming from more theoretical considerations are noted that may affect the timing of the monetary policy response. Second, some indicative evidence on the exceptionality of central bank reactions is presented. Third, the scope and sequence of the adopted measures are discussed, with this part completed with a simple ranking of first movers. Next, the timing of policy response announcements is analysed in more detail. Finally, simple regressions are constructed to show which factors could influence the difference in the speed of inflation targeters' reactions to COVID-19. The main findings are reported in the concluding part.

Some theory behind the timing of monetary policy response

When investigating the monetary policy of any central bank, it is necessary to be aware of the time lags associated with it. In economics, this topic is predominantly linked to issues concerning the transmission mechanism[3] and the related lags with which monetary policy decisions are reflected in macroeconomic variables.[4]

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3 The monetary transmission mechanism is described in more detail, for example, in Bank of England [1999], and Mishkin [2012].

4 Another central topic related to the timing of the monetary policy response is the considerable degree of policy inertia in the reaction of central banks to shocks, as evidenced in a number of empirical studies [Bernanke, 2004]. In times when interest rates were the main instrument used

Generally, when analysing monetary policy transmission lags, attention is paid in the first place to the relationships between the operational targets of the monetary authorities, some market indicators (e.g. deposit and credit rates offered by commercial banks to their clients) and the decisions of households, firms and the government (e.g. on spending and saving). However, even though the time necessary for those interdependencies to work their way through the economy is most likely responsible for the bulk of the overall delayed reactions, it is not the sole source of the monetary policy lag. Another one, more relevant for this analysis, is an inside lag in reaction to shocks, which comprises an information lag, a recognition lag and a decision lag (Bofinger [2001: 74], Willes [1967]).

The reasons for a delay in arriving at monetary policy action are due to various factors. In particular, they are influenced by the availability of incoming data or, more generally, relevant information on the ongoing processes, the necessity to observe and analyse certain developments over a longer period, or simply the frequency of decision-making meetings held in a given central bank. Although, in normal times, much less attention is devoted to these elements compared to the subsequent stages of the transmission process, they may play quite an important role in delaying monetary policy actions and should not be disregarded. Especially in crisis circumstances – if they affect the whole economy, e.g. through the risk of freezing financial markets – postponing a central bank's reaction even by a few days may result in deepening the economic downturn.

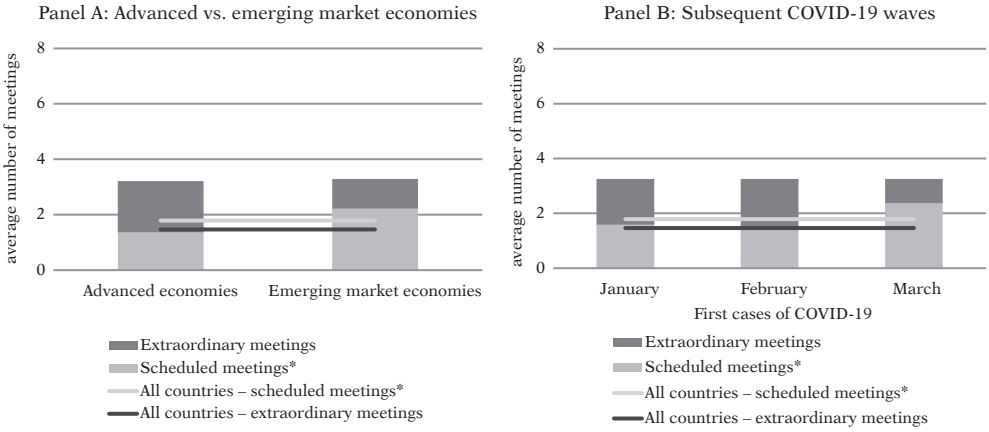
Extraordinary scope of monetary policy response

The number of decision-making meetings held during the first few months of 2020 can be seen as the first proof that the monetary policy reaction to the COVID-19 pandemic was extraordinary (Figure 1).[5] Although in recent decades it has become standard practice for inflation targeters to announce the schedule of their decision-making meetings, usually eight to 12 a year, well in advance [Niedźwiedzińska, 2018], in early 2020 monetary policy meetings were often far more frequent, with around half of them held on an ad hoc basis.

by monetary authorities, this phenomenon was also called interest rate smoothing [Coibion, Gorodnichenko, 2012]. Looking at the past policies of inflation targeters, it is clear that for most of the time they favoured smaller or moderate, but more frequent instrument adjustments compared to larger and less frequent policy moves. The intuition behind it is that a more incremental approach allows for more calibrated actions.

5 Only meetings followed by a decision on applying or changing any of the monetary policy measures are considered. Whereas, in normal times, keeping the policy unchanged can also be regarded as an important decision, the approach adopted here is justified by the fact that the focus of the analysis is on the monetary policy response to the pandemic shock which required action.

Figure 1. Monetary policy initial response to COVID-19 announced after scheduled and extraordinary decision-making meetings



Note: For each central bank the number of extraordinary meetings and the number of scheduled meetings are counted. Based on individual country data the averages for all the indicated groups of economies are calculated. * including rescheduled meetings if announced with prior notice.

Source: Author's own compilation based on information from central banks' websites.

The need to call extraordinary meetings was somewhat more apparent in advanced economies, and in countries where coronavirus hit first. The first observation can be explained by the fact that advanced economies in principle held fewer meetings prior to the pandemic. The second finding may follow from an initial uncertainty about how quickly COVID-19 would spread, and in effect how strongly the pandemic would affect economies.

Importantly, not all the monetary policy moves were introduced after decision-making meetings. Many liquidity providing measures (repo, swaps, etc.) and operational aspects[6] or extensions of previously proposed instruments (their timing, size, targeted asset classes, collateral requirements etc.) were announced in the form of press releases without any formal meetings. It seems that the urgency of the situation required decisive moves that could be agreed without prior extensive discussions, or simply set at an operational level.

However, if we look only at the initial monetary policy response, i.e. the very first announcement of any monetary loosening justified by the pandemic, we will see that it most often took place after a decision-making meeting. This shows a clear preference for introducing the first policy actions after a formal discussion. In 20 of the 28 analysed central banks such a response followed a decision-making meeting, with 50% of those meetings not planned in advance.

The scope of the monetary policy measures that were introduced during the first few months of 2020 can be seen as further proof of the central banks' unprecedented reaction to the pandemic (Table 1).

6 This review includes announcements of new measures and extensions of previously introduced instruments. Subsequent press releases on operational details are not counted.

Table 1. Overview of monetary policy measures used in Q1-Q2 2020 in response to COVID-19

Country	First cases of COVID-19	First monetary policy response*	First response at extraordinary meeting	Cuts in interest rates	New asset purchase programmes (+ extensions)	New credit easing schemes (+ extensions)	Liquidity providing measures	Additional measures**
AU	25–01–2020	3–03–2020		yes	yes	yes	yes	yes
BR	26–02–2020	6–03–2020		yes			yes	
CA	26–01–2020	4–03–2020		yes	yes (+yes)	yes	yes	
CL	4–03–2020	12–03–2020		yes	yes (+yes)	yes	yes	
CZ	2–03–2020	16–03–2020	yes	yes			yes	yes
EA	25–01–2020	12–03–2020			yes (+yes)	(yes)	yes	
HU	5–03–2020	17–03–2020		yes	yes	yes	yes	
IS	29–02–2020	10–03–2020		yes	yes		yes	yes
IN	30–01–2020	12–03–2020		yes	yes	yes	yes	yes
ID	2–03–2020	20–02–2020		yes	yes		yes	yes
IL	24–02–2020	15–03–2020	yes	yes	yes	yes	yes	
JP	15–01–2020	16–03–2020			(yes)	yes	yes	
KR	20–01–2020	12–03–2020		yes	yes	(yes)	yes	yes
MX	29–02–2020	20–03–2020	yes	yes		yes	yes	yes
NZ	28–02–2020	16–03–2020	yes	yes	yes (+yes)	yes	yes	
NO	27–02–2020	12–03–2020	yes	yes			yes	yes
PH	30–01–2020	6–02–2020		yes	yes	yes	yes	yes
PL	4–03–2020	16–03–2020		yes	yes	yes	yes	
RO	27–02–2020	20–03–2020	yes	yes	yes		yes	
RU	1–02–2020	9–03–2020		yes		yes	yes	yes
ZA	6–03–2020	19–03–2020		yes	yes		yes	yes
SE	1–02–2020	12–03–2020	yes		(+yes)	yes (+yes)	yes	
CH	26–02–2020	19–03–2020				yes (+yes)	yes	yes
TH	13–01–2020	5–02–2020		yes	yes	yes	yes	
TR	12–03–2020	17–03–2020	yes	yes	(yes)	yes	yes	
UA	4–03–2020	10–03–2020		yes			yes	yes
GB	31–01–2020	11–03–2020	yes	yes	yes	yes (+yes)	yes	yes
US	21–01–2020	3–03–2020	yes	yes	yes (+yes)	yes (+yes)	yes	

Note: Countries ordered alphabetically based on the full name of the country in English. * Announcement dates. ** Mainly FX interventions and direct financing of government.

Source: Author's own compilation based on information from central banks' websites.

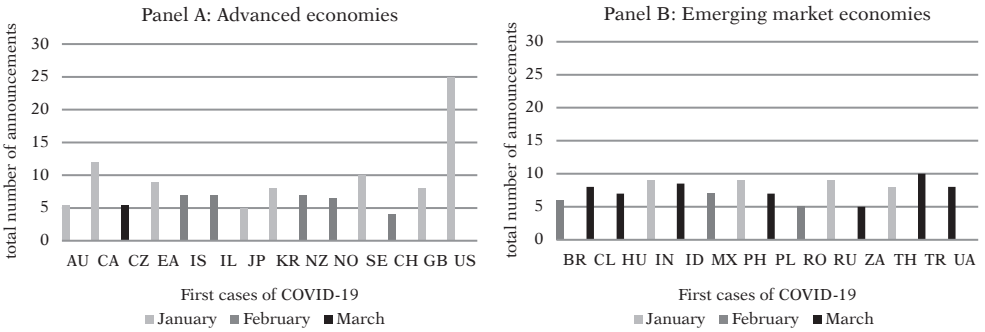
Considering the experience of dealing with past crises, i.e. the global financial crisis and the European sovereign debt crisis, inflation targeters, especially in emerging market economies, this time turned out to be far more

eager to reach for instruments regarded as unconventional, at least by pre-2008 standards.

This is no surprise given the fact that even prior to COVID-19 many central banks conducted loose monetary policies, with limited or almost non-existent room for additional interest rate cuts in several jurisdictions. Under such circumstances, in order to make monetary conditions more accommodative, which was the only considered direction of monetary response to the pandemic[7], the use of other measures was necessary. Having said that, whoever could lower interest rates did so (and those who did not, already had them at zero or in negative territory).

Most of the analysed central banks used as broad a policy toolkit as possible. Only a few of them applied just one or two additional measures. Liquidity providing operations were a must, with repo transactions and currency swaps among the most popular instruments on offer. Asset purchase programmes and credit easing schemes also became widely applicable, with only a handful of countries not making use of them.[8] Moreover, several central banks decided to reach for less common measures, which generally took the form of FX interventions or direct financing of government (predominantly short-term).

Figure 2. Number of monetary policy announcements related to new measures or their extensions in Q1-Q2 2020 in response to COVID-19



Note: Countries ordered alphabetically based on the full name of the country in English. Each announcement counted separately (e.g. each interest rate cut counted separately). Monetary policy announcements considered in the chart are counted starting with the first announcement related to COVID-19 and are added up to end-June 2020. Thus, the timeframe varies from country to country.

Source: Author's own compilation based on information from central banks' websites.

Taking into account that, in many instances, after initial actions, the authorities gradually extended previously introduced measures, the wide scope of

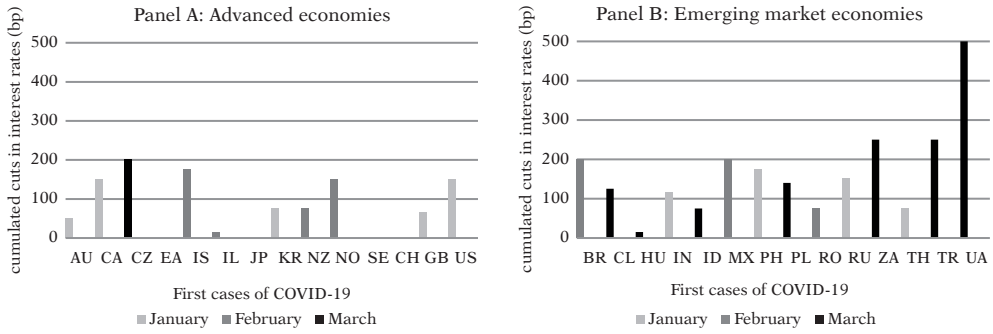
7 The only exception were FX interventions undertaken with a view to safeguarding macroeconomic stability by curbing depreciation pressures.

8 Announcing new asset purchase programmes or credit easing schemes was treated on an equal footing with extending existing programmes.

monetary policy response translated into a large number of overall announcements. Generally, most of the investigated inflation targeters issued between five and 10 policy statements from the start of the pandemic to the end of June 2020 (Figure 2). Interestingly, there were no major differences between advanced and emerging market economies, except in the United States where announcements were visibly more frequent. Nor does the time when the first cases of COVID-19 were recorded seem to matter much with respect to the number of policy announcements.

Applying a purely mechanical approach, this means that loosening measures (the introduction of new instruments or extension of previously proposed moves) were announced every 19 calendar days on average. Again, there were no major differences between advanced and emerging market economies, or between countries hit by COVID-19 in subsequent months.[9] However, the breaks between the announcements were in fact much shorter since the decisions on providing monetary policy stimulus were concentrated in March 2020, when it became apparent that the pandemic would have strongly negative effects on all economies.

Figure 3. Cumulative interest rate cuts in Q1-Q2 2020 in response to COVID-19



Note: Countries ordered alphabetically based on the full name of the country in English. Interest rate cuts considered in the chart are counted starting with the first monetary policy announcement related to COVID-19 and are added up to end-June 2020. Thus, the timeframe varies from country to country.

Source: Author's own compilation based on information from central banks' websites.

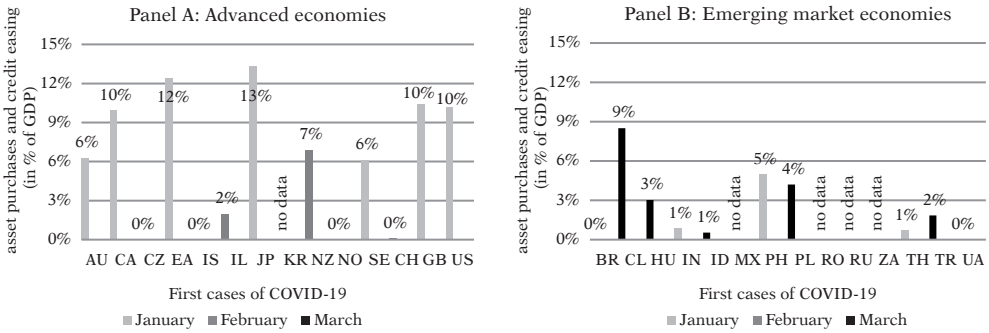
With regard to the magnitude of the applied measures, the scale of cumulative interest rate cuts is the easiest to compare, followed by the size of balance sheet expansion stemming from asset purchases and credit easing.[10]

9 The number of calendar days covered in the analysis (i.e. the number of days between the first COVID-19 cases in a given country until the end of June 2020) was divided by the number of announcements of any monetary policy moves in that country. Calendar days were used instead of working days for simplicity, but such an approach should not affect the results.

10 In the case of asset purchases and credit easing measures the availability of data published by the analysed central banks is quite high although there is no unified way in which data are

Since reducing interest rates and increasing balance sheets can be seen as belonging to two distinct sets of monetary policy measures – i.e. standard vs. unconventional ones, is it worth looking at their usage. It is not surprising to see that the cumulative interest rate cuts were much deeper in emerging market economies, which prior to COVID-19 had much higher level of policy rates, and therefore much more space for lowering them. The average cumulative policy rate reduction in advanced economies was 79 basis points (bp), whereas the value for emerging market economies was twice as high at 168 bp (Figure 3).

Figure 4. Cumulative value of asset purchases and credit easing measures implemented in Q1-Q2 2020 in response to COVID-19



Note: Countries ordered alphabetically based on the full name of the country in English. For countries with no asset purchases and no credit easing measures "0%". For countries where no information on asset purchases nor credit easing measures was available "no data". Values of asset purchases and credit easing measures considered in the chart are counted starting with the first monetary policy announcement related to COVID-19 (or the date closest to the first announcement – depending on data availability) and are added up to end-June 2020. Thus, the timeframe varies from country to country.

Source: Author's own compilation based on information from central banks' websites.

At the same time, the overall size of asset purchases and credit easing was markedly higher in advanced economies, which, on the one hand, had more experience applying those measures in the past[11] and, on the other, faced limited room for reducing policy rates. The average ratio of the cumulative value

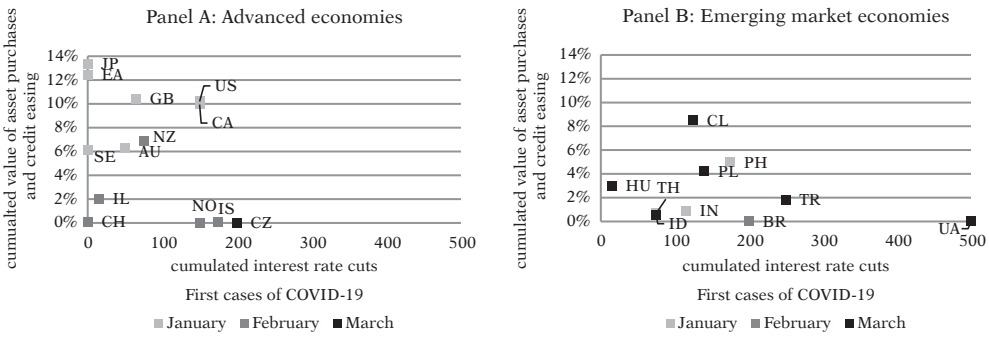
reported. Thus, the two measures are added up and presented jointly. Meanwhile, information on the size of the undertaken FX interventions is much less openly shared by monetary authorities. Regarding liquidity providing, the main difficulty was a broad array of instruments used to provide it. Therefore, to avoid significant discrepancies between different countries that would undermine any comparison, data on those measures were not collected.

11 In several cases asset purchases and credit easing were pursued by the reviewed central banks even before the pandemic shock, so the response of those monetary authorities to COVID-19 can be seen as simply intensifying their use. The size of balance sheet expansion considered here does not, however, distinguish between the "already conducted" asset purchases and credit easing measures and "additional" ones, because it would be highly arbitrary to establish what

of asset purchases and credit easing measures to GDP in advanced economies was 6.0%, whereas the average ratio for emerging market economies was less than half that number at 2.5% (Figure 4).

Certainly, it would be more comprehensive to present a combined measure of additional monetary policy accommodation provided by central banks in response to COVID-19, but considering the wide range of different instruments used, that is not possible without making a number of highly questionable assumptions.[12] However, looking at the two-dimensional comparison, it is evident that most advanced economy inflation targeters moved much more in the direction of balance sheet expansion, while most emerging market economy inflation targeters were more aggressive in cutting rates (Figure 5).

Figure 5. Use of standard vs. nonstandard monetary policy measures in Q1-Q2 2020 in response to COVID-19



Note: See Note to the figure above.

Source: Author's own compilation based on information from central banks' websites.

Sequence of adopting policy measures and first movers

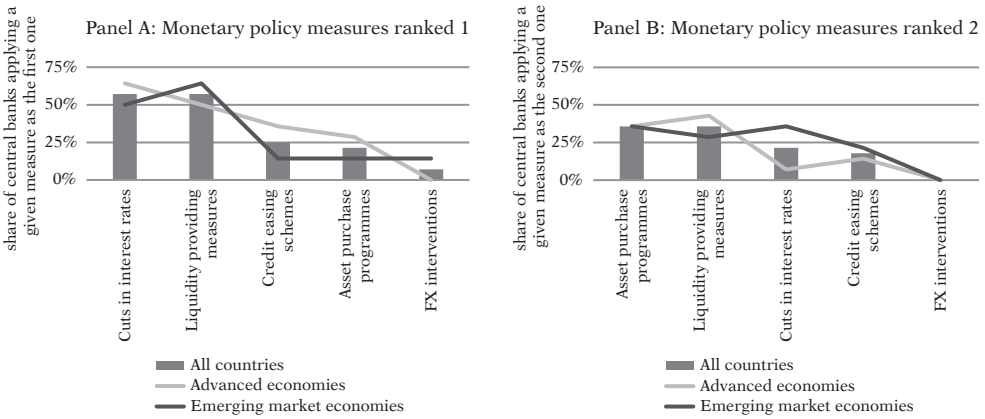
An analysis of the sequence of policy measures adopted in response to a major shock reveals a preference among central banks for using standard rather than nonstandard instruments. However, as already noted, the distinction between the two kinds of measures – given the widespread applicability of asset purchase programmes and credit easing schemes – became largely irrelevant and does not reflect their current status.

would be the scale of unconventional measures in the absence of COVID-19 (e.g. whether any kind of tapering or acceleration of asset purchases would take place in the meantime).

12 Some measures predominantly affect short-term interest rates, while others are in the first place aimed at influencing the longer-term-end of the yield curve. Thus, it is not easy to assess the overall effectiveness of the applied instruments judging by their impact on financial variables characterised by different maturities. This is so even disregarding the simultaneous fiscal expansion, which additionally blurs the picture.

Clearly, cutting interest rates and introducing liquidity providing operations were the first lines of defence for both advanced economy inflation targeters and emerging market economy inflation targeters (Figure 6; Table 2). Asset purchase programmes (new or extended) and credit easing schemes (new or extended) were much less popular at the initial phase of dealing with the economic consequences of COVID-19, especially in emerging market economies. Two countries, Russia and Ukraine, chose FX interventions as the first instrument to use.

Figure 6. Order of adopting certain monetary policy measures in Q1-Q2 2020 in response to COVID-19



Note: Asset purchase programmes – new and extended programmes grouped together. Credit easing schemes – new and extended schemes grouped together. Several instruments could be announced contemporaneously, resulting in an equal rank.

Source: Author's own compilation based on information from central banks' websites.

Table 2. Sequence of adopting monetary policy measures in Q1- Q2 2020 in response to COVID-19

Country	First cases of COVID-19	First monetary policy response*	Sequence of monetary policy measures				
			Cuts in interest rates	New asset purchase programmes (+ extensions)	New credit easing schemes (+ extensions)	Liquidity providing measures	FX interventions
AU	25–01–2020	3–03–2020	1	3	3	2	
BR	26–02–2020	6–03–2020	2			1	
CA	26–01–2020	4–03–2020	1	2	3	2	
CL	4–03–2020	12–03–2020	2	2	2	1	
CZ	2–03–2020	16–03–2020	1			1	
EA	25–01–2020	12–03–2020		1	1	1	
HU	5–03–2020	17–03–2020	2	2	2	1	

Country	First cases of COVID-19	First monetary policy response*	Sequence of monetary policy measures				
			Cuts in interest rates	New asset purchase programmes (+ extensions)	New credit easing schemes (+ extensions)	Liquidity providing measures	FX interventions
IS	29–02–2020	10–03–2020	1	2		1	
IN	30–01–2020	12–03–2020	3	2	3	1	
ID	2–03–2020	20–02–2020	1	3		2	
IL	24–02–2020	15–03–2020	2	1	2	1	
JP	15–01–2020	16–03–2020		1	1	2	
KR	20–01–2020	12–03–2020	1	1	1	1	
MX	29–02–2020	20–03–2020	1		2	1	
NZ	28–02–2020	16–03–2020	1	3	4	2	
NO	27–02–2020	12–03–2020	1			1	
PH	30–01–2020	6–02–2020	1	3	4	2	
PL	4–03–2020	16–03–2020	2	1	1	1	
RO	27–02–2020	20–03–2020	1	1		1	
RU	1–02–2020	9–03–2020	4		3	2	1
ZA	6–03–2020	19–03–2020	1	2		1	
SE	1–02–2020	12–03–2020		2	1	2	
CH	26–02–2020	19–03–2020			2	1	
TH	13–01–2020	5–02–2020	1	3	3	2	
TR	12–03–2020	17–03–2020	1	2	1	1	
UA	4–03–2020	10–03–2020	2			3	1
GB	31–01–2020	11–03–2020	1	2	1	3	
US	21–01–2020	3–03–2020	1	3	4	2	

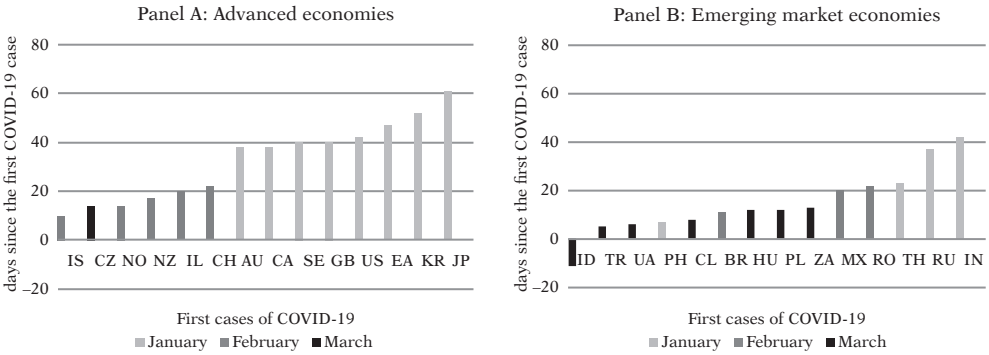
Note: Countries ordered alphabetically based on the full name of the country in English. Numbers indicate the sequence of applying certain instruments. Several instruments could be announced contemporaneously, resulting in an equal rank.* Announcement dates.

Source: Author's own compilation based on information from central banks' websites.

Considering the monetary policy response to the pandemic, one of its key aspects is how promptly monetary authorities recognised the risks and reacted with providing monetary accommodation. One of the possible ways to look at the collected data is to simply rank inflation targeters according to the speed at which they provided monetary stimulus (Figures 7 and 8). Evidently, this does not take into account many of the potentially important issues, but can clearly illustrate the already discussed findings, i.e. the generally quicker reaction of emerging market economies and those from the March group.

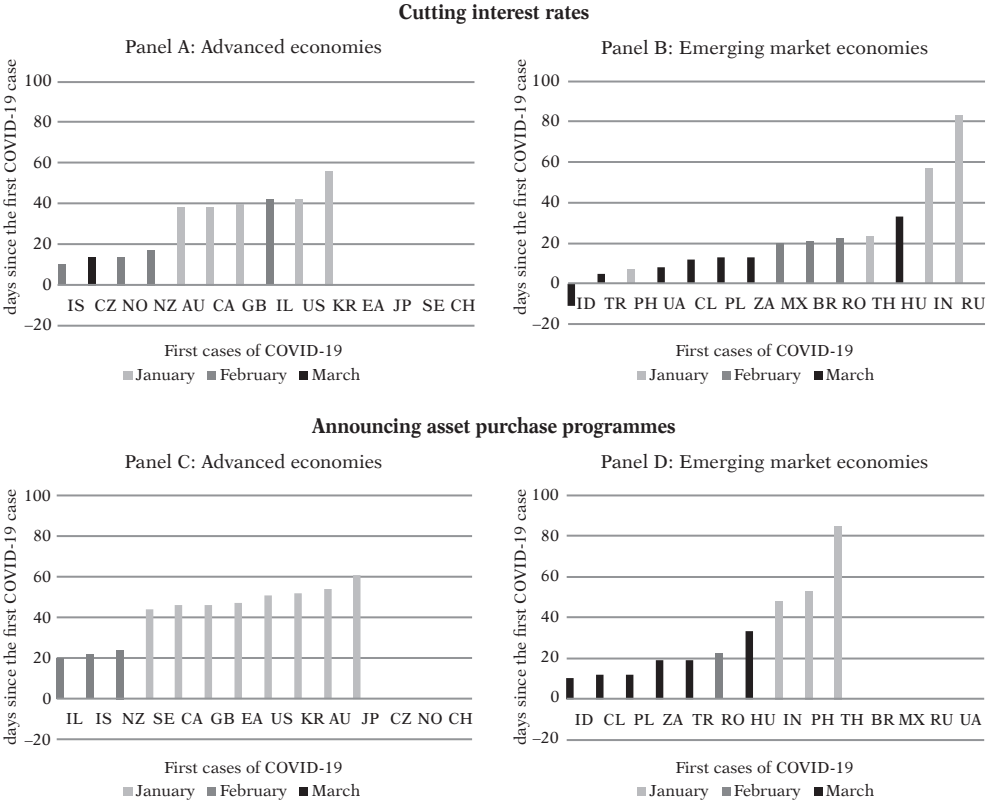
The ranking also indicates countries sticking to more traditional policy measures, such as Brazil, the Czech Republic, Norway and Ukraine, which did not reach for asset purchases or credit easing, at least in their initial response to the pandemic.

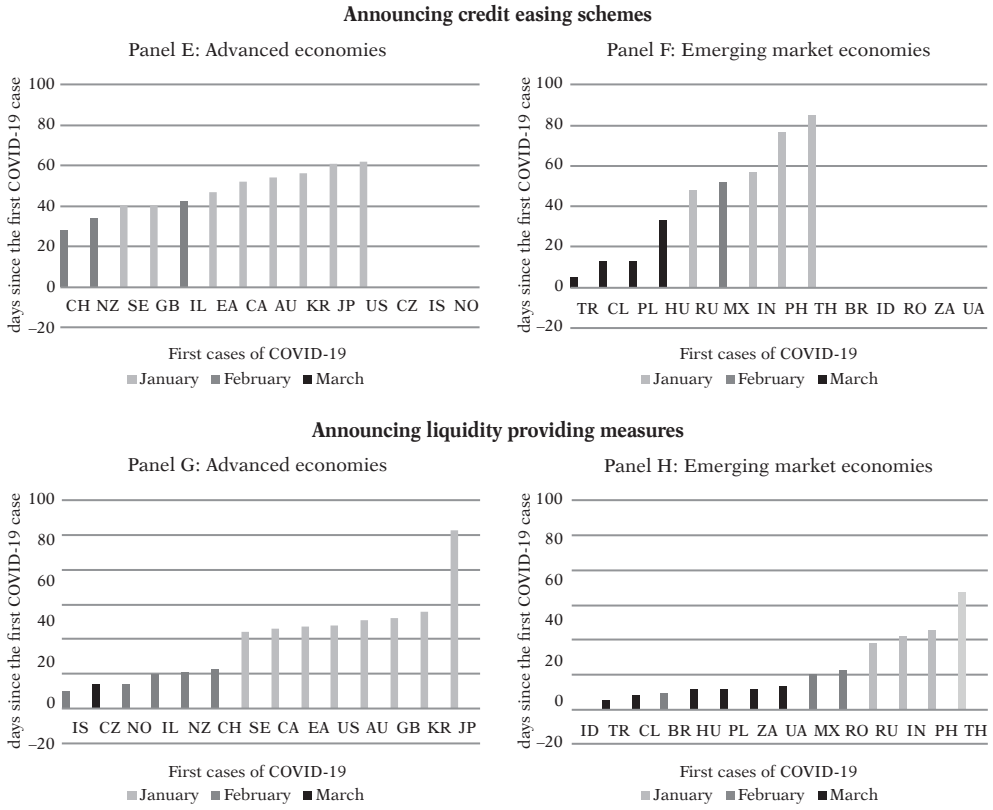
Figure 7. Overall monetary policy response lag to COVID-19 in individual countries



Source: Author's own compilation based on information from central banks' websites.

Figure 8. Monetary policy response lag to COVID-19 in individual countries by type of monetary policy instrument used





Source: Author's own compilation based on information from central banks' websites.

Timing of monetary policy measures

When analysing the timing of monetary policy measures, it is useful to compare the response lags among different country groups. Moreover, when discussing the monetary policy reactions to COVID-19, apart from considering the first announced response, subsequent policy moves are also of importance.

Looking at the overall picture, i.e. taking into account any monetary policy measure used[13], advanced economy inflation targeters announced their initial policy actions within a month on average, whereas emerging market economies were twice as fast.

There may be several ways in which the difference can be explained. First, it can be partly driven by the fact that, among the countries reviewed here, the first waves of COVID-19 were reported predominantly in advanced economies (Table A2 in the Appendix). This means that in advanced economies some

13 As already noted, only monetary policy actions justified explicitly with the need to address the pandemic shock are taken into account.

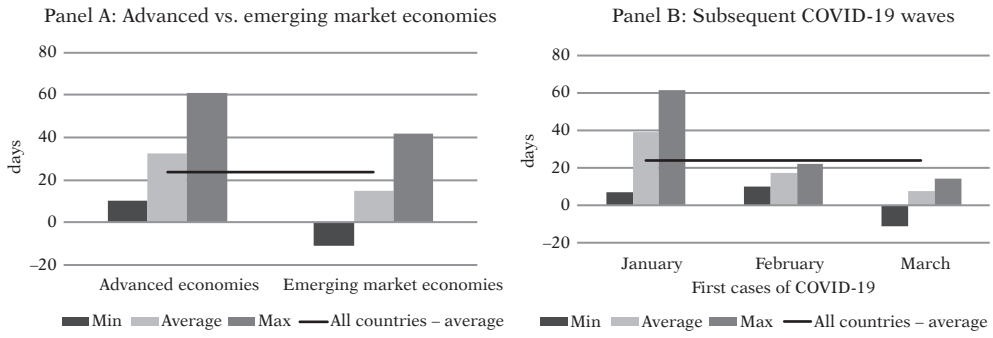
more time elapsed before it became clear that the coronavirus would spread broadly and exert a significantly negative impact on all affected economies, calling for decisive monetary stimulus. A related issue is how stringent the anti-pandemic restrictions were when the pandemic hit, with countries gradually learning the gravity of the situation and accepting more drastic lockdowns to deal with it. The arguments behind this reasoning are presented below.

Another possible explanation why emerging market economies were quicker in responding to the pandemic may be related to their bigger room for manoeuvre than in advanced economies with respect to both conventional interest rate cuts (which could be applied without designing more complex policy measures) and nonstandard measures in relatively simple form. Some tentative indications of such a relationship are also noted later.

Third, since in many instances the initial reaction of central banks took the form of liquidity providing operations, it may be the case that emerging market economies were more in need of urgent access to funds, not least due to the higher role of external financing and FX indebtedness in those economies. The third hypothesis seems plausible given the already discussed sequence of adopting individual measures by the studied countries. Although the difference was not massive, liquidity providing operations evidently ranked first in most of the analysed emerging market economies, whereas they came second among advanced economies.

Lastly, some monetary policy easing may have resulted from spillover effects, especially amid free capital movements in smaller economies. Since the main central banks reacted to COVID-19 by loosening their policy stance, this could have prompted other monetary authorities to act in the same direction.

Figure 9. Monetary policy response lag to COVID-19 in different sub-groups of inflation targeters



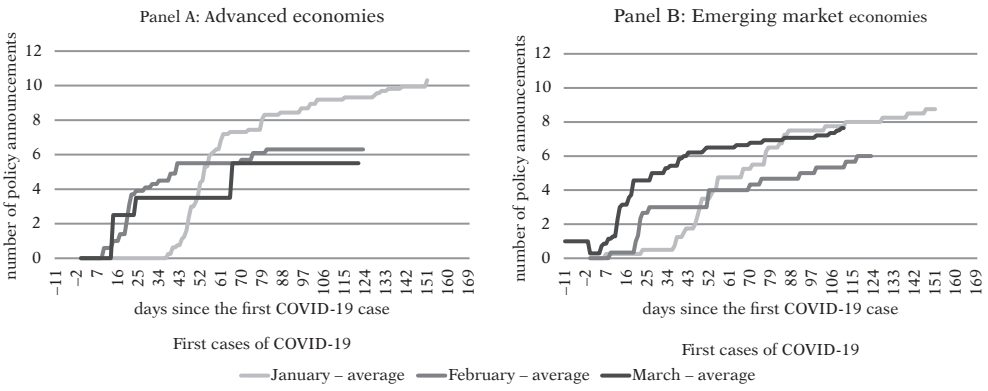
Source: Author's own compilation based on information from central banks' websites.

Moving back to the first hypothesis explaining the difference in the speed of monetary policy actions, some support for the importance of the pandemic waves may be offered by the gradually decreasing time lag between the first infections of COVID-19 reported in a given country and the monetary policy reaction when one compares country groups based on the months when the

pandemic hit them (Figure 9). For countries in the January wave, the average time needed for adopting any decision on loosening monetary policy was close to 40 days, for the February group it stood at around 17 days, and for the March sample it dropped to seven days. Indonesia, where the first COVID-19 cases were reported in March 2020, reacted 11 days before the first registered infections. Although the averages indicate some tendencies, there is a notable dispersion among the studied countries.

As a rule, central banks announced additional monetary policy loosening stepwise (Figure 10). Moreover, in general, the later a country was hit by the COVID-19 pandemic, the more concentrated its response was to the worsened economic prospects. The countries in the January group caught up with adequate monetary policy support once it became clear that the risks to economic stability were extensive.

Figure 10. Number of monetary policy announcements and their timing in response to COVID-19 in different sub-groups of inflation targeters



Source: Author's own compilation based on information from central banks' websites.

The largest number of monetary stimulus decisions was reported in the United States where the Federal Reserve repeatedly extended previously announced measures, e.g. by including new asset classes in purchase programmes or relaxing the terms of certain operations.[14] Other central banks announced significantly fewer policy moves. However, by pre-pandemic standards, the reaction of inflation targeters should be described as vigorous. Most of them increased the accommodativeness of monetary policy by five

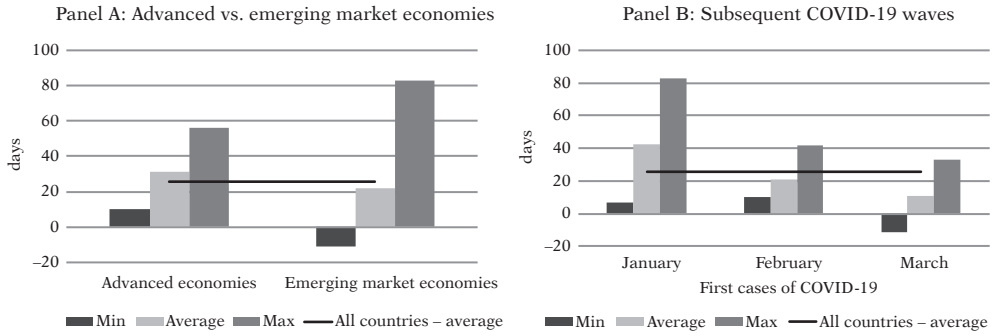
14 Importantly, the number of monetary policy announcements reported for the United States does not include announcements of offering swap lines since swaps were aimed at providing additional US dollar liquidity to countries outside the United States. Thus, swap lines were not treated as loosening monetary conditions domestically in the United States. Meanwhile, for countries benefitting from the Fed's swap lines, this instrument was classified as proving monetary policy accommodation and was taken into account in the analysis.

to 10 times in a relatively short period of time (with around eight decisions by the end of June 2020 on average).[15]

Distinguishing between the individual measures adopted by the analysed central banks reveals that a higher level of economic development and being among the first countries to report COVID-19 cases in principle extended the time lag of the policy response. The dispersion between countries in the investigated groups with respect to the speed of their reaction was, however, high for most of the instruments considered.

In particular, cuts in interest rates were applied somewhat faster in emerging market economies (after around 22 days on average) compared to advanced economies (after around 31 days on average), possibly due to a higher initial level of interest rates in the first group of countries (Figure 11). This speaks in favour of the second hypothesis explaining the swifter reaction of emerging market economy inflation targeters to the pandemic. At the same time, the dispersion in timing among emerging market economies was massive, and there were a few advanced economies, such as Iceland, the Czech Republic and Norway, that cut their interest rates faster than some emerging market economies. Thus, the average lag is clearly not telling the whole story.

Figure 11. Lag in cutting interest rates in response to COVID-19 in different sub-groups of inflation targeters



Source: Author's own compilation based on information from central banks' websites.

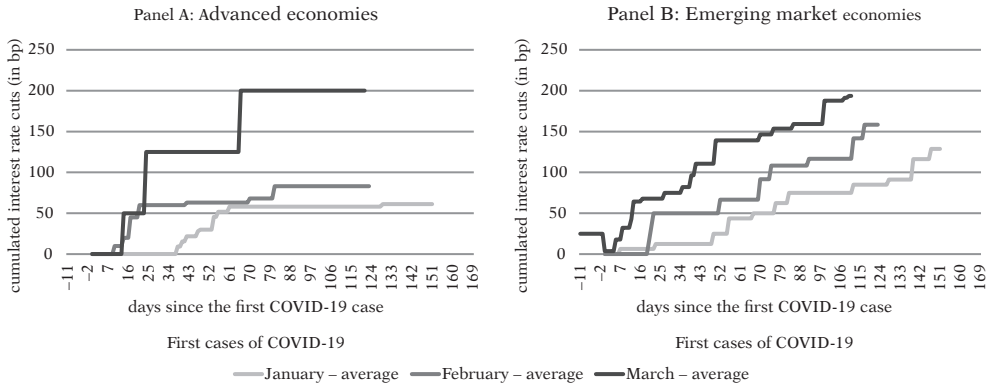
Looking at the waves of the first infections, central banks from the March sample needed much less time to arrive at a decision to lower the rates than countries in the January group (around 11 days vs. 43 days on average).

Moreover, the scale and number of interest rate decreases were much more pronounced in emerging market economies (2.7 cuts by a cumulative 168 basis points on average, compared with 1.7 cuts by a cumulative 79 basis points in advanced economies) and countries in the March group, which lowered

15 As already noted, apart from decisions following formal decision-making meetings, all other announcements of policy actions are counted here. Thus the average numbers reported in Chart 10 are markedly higher than those in Chart 1.

the rates 2.6 times by a cumulative 194 basis points on average (Figure 12). However, this is again simply due to the higher initial level of interest rates in some economies.

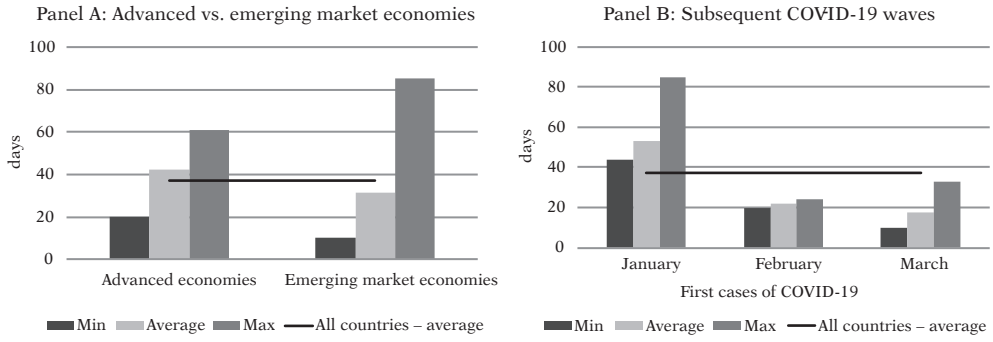
Figure 12. Cumulative interest rate cuts and their timing in response to COVID-19 in different sub-groups of inflation targeters



Source: Author's own compilation based on information from central banks' websites.

Asset purchase programmes were also announced somewhat earlier in emerging market economies (after around 31 days on average, compared to around 43 days for advanced economies). There were exceptions to that rule because the dispersion in timing among emerging market economies was very high. Countries hit by the COVID-19 pandemic later reached for asset purchases far more quickly. The March wave needed around 18 days to announce them on average, compared with around 53 days for the January group (Figure 13).

Figure 13. Lag in announcing asset purchase programmes (new or extended) in response to COVID-19 in different sub-groups of inflation targeters

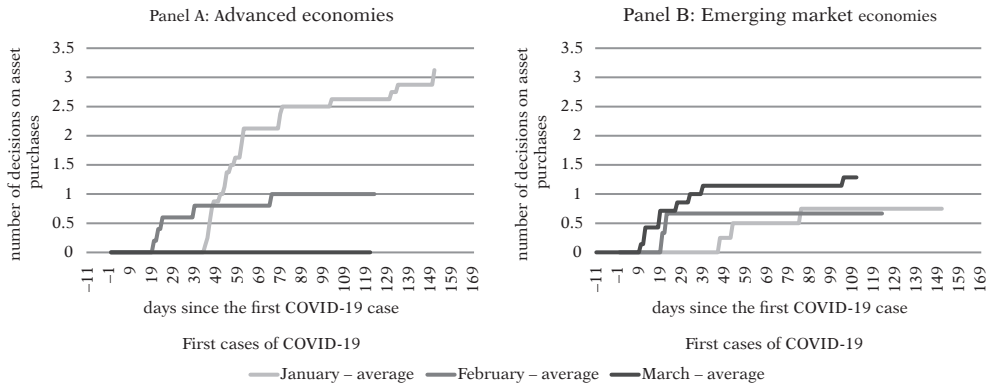


Source: Author's own compilation based on information from central banks' websites.

The significant discrepancy among emerging market economies in announcing asset purchase programmes does not stem from the fact that some of them were more experienced in applying such measures than others. Among the fastest to react by launching asset purchases were Chile, Indonesia and Poland, which had not used such instruments in the past. This points to the importance of having potential policy space. Countries already pursuing purchases needed more time to analyse what asset classes or what envelope value of programmes would offer adequate support for the economy, while the newcomers swiftly decided to target the main market segment, i.e. the government bond market. This, again, offers some support for the second hypothesis explaining the faster reaction to COVID-19 among emerging market economy inflation targeters.

The number of adjustments to asset purchase programmes[16] was much higher in advanced economies, with 2.8 decisions per advanced economy on average vs. 1.3 for emerging market economies (Figure 14). This may be explained by an observation that providing additional accommodation by central banks already present in the main market segments – as in the case for many of the advanced economy inflation targeters – required choosing different asset classes and those decisions were often taken stepwise.

Figure 14. Number of decisions on asset purchase programmes (new and extended) and their timing taken in response to COVID-19 in different sub-groups of inflation targeters



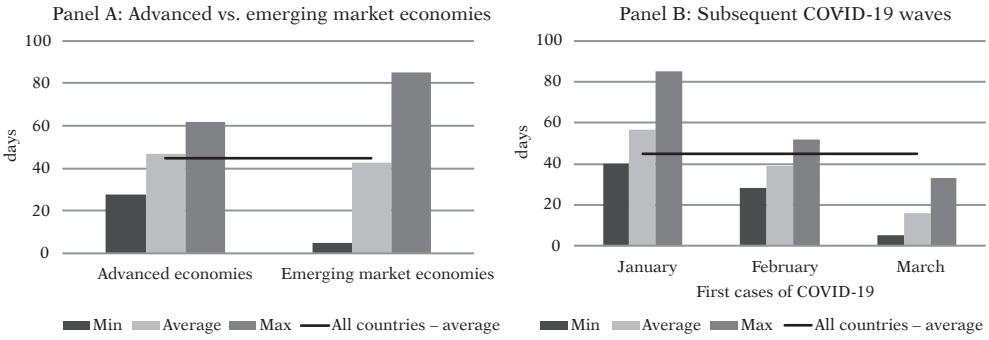
Source: Author's own compilation based on information from central banks' websites.

For credit easing schemes, there was virtually no difference in the time of announcing these between advanced and emerging market economies (47 vs. 43 days on average respectively). Meanwhile, emerging market economies showed a strong dispersion in terms of how quickly they reached for that policy measure (Figure 15). Moreover, like with asset purchase programmes,

16 The number includes announcements of both launching new programmes and extending existing ones, e.g. by including additional asset classes.

those were not necessarily the most experienced inflation targeters to adopt that instrument, with Turkey, Chile and Poland leading the ranking of first movers even though they previously had no credit easing schemes in place.

Figure 15. Lag in announcing credit easing schemes (new or extended) in response to COVID-19 in different sub-groups of inflation targeters

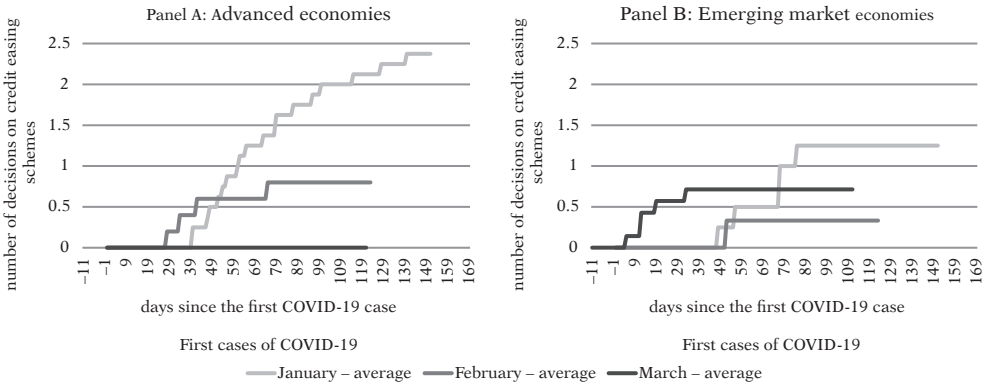


Source: Author's own compilation based on information from central banks' websites.

As with other policy measures, inflation targeters from the March wave outpaced the others. They reached for credit easing schemes after around 16 days on average, vs. 57 days for the January group.

As with asset purchases, advanced economies were more active in announcing changes to their credit easing schemes, with 2.1 decisions per advanced economy vs. 1.2 for emerging market economies on average (Figure 16). The reasoning behind that difference can be similar as in the case of asset purchase programmes.

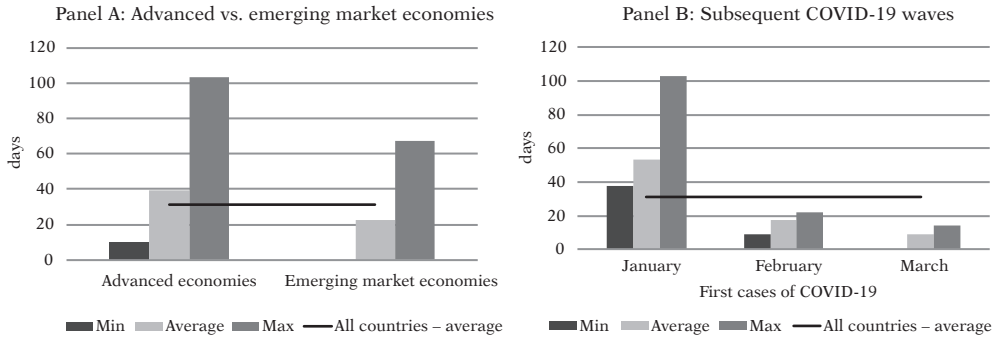
Figure 16. Number of decisions on credit easing schemes (new and extended) and their timing taken in response to COVID-19 in different sub-groups of inflation targeters



Source: Author's own compilation based on information from central banks' websites.

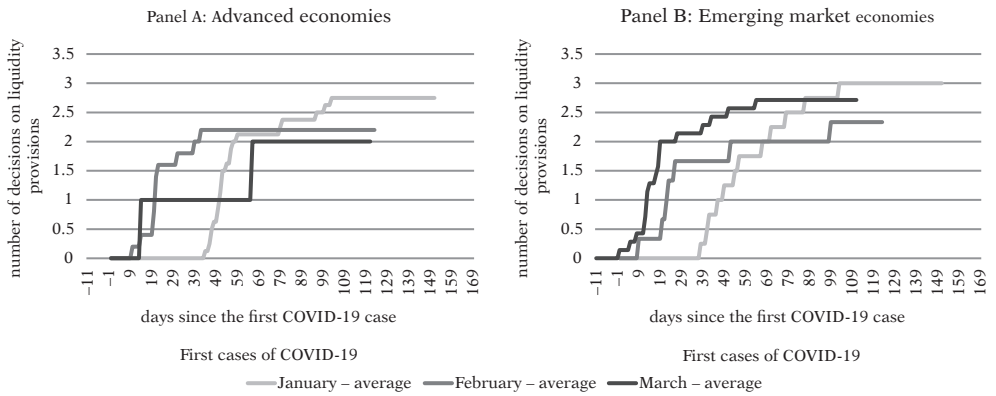
For liquidity providing measures, the general conclusions remain the same as for most other instruments analysed. Emerging market economies were somewhat faster in adopting such measures than the rest of the sample. They needed around 23 days on average to make a decision, while advanced economies needed 39 days. At the same time, countries reporting COVID-19 infections later were much faster than countries hit by the pandemic earlier, with around nine days on average for the March wave vs. 53 days for the January group (Figure 17). One notable feature is a much larger dispersion of the time lag in providing extra liquidity among advanced economy inflation targeters than emerging market economy inflation targeters, but for both groups the dispersion was rather high.

Figure 17. Lag in announcing liquidity providing measures in response to COVID-19 in different sub-groups of inflation targeters



Source: Author's own compilation based on information from central banks' websites.

Figure 18. Number of decisions on liquidity provisions and their timing taken in response to COVID-19 in different sub-groups of inflation targeters



Source: Author's own compilation based on information from central banks' websites.

As already noted, liquidity providing operations were among the first measures to be announced. Like other instruments, such operations were quite frequently modified in order to cope with changes in the market situation. At the same time, the number of announcements of liquidity providing measures was comparable in most of the countries reviewed here, with around 2.6 decisions on average. One prominent exception was the United States where the number was more than three times higher than the overall average (Figure 18).

Importantly, a higher number of monetary policy announcements does not automatically mean looser monetary conditions. Some central banks gradually relaxed the terms of their operations, while others designed their policy measures in a flexible form from the start to eliminate the need of subsequent adjustments.

Factors influencing the timing of monetary policy response

The final part of the analysis aims to formulate simple cross-country regressions trying to capture factors that influence the timing of the monetary policy response to COVID-19. The proposed models are designed to show what kind of variables may have mattered, if any, and in particular, to investigate the reasons behind the difference in the speed of reaction between advanced and emerging market economies. Even though the number of countries included in the review is quite large for the purposes of a descriptive analysis, it must be assessed as limited for quantitative methods. Therefore, given the number of observations, the results should be interpreted as tentative.

The sample includes 28 economies, half of which are advanced economies and the other half emerging market economies (Table A1 in the Appendix). The dependent variable is the number of days between the first COVID-19 cases reported in a given country and the initial announcement by the central bank of any policy measure loosening monetary conditions justified by the pandemic.[17]

Since the main hypotheses explaining the difference between advanced and emerging market economies in how quickly they reacted to the shock refer to: (1) the timing of registering COVID-19 infections and the stringency of the adopted anti-pandemic restrictions, (2) having room for manoeuvre with respect to monetary policy measures, (3) experiencing more or less urgent need of liquidity provisions, and (4) potential spillover effects of monetary policy easing abroad, a number of regressors related to those issues were taken into account. Thus, the explanatory variables, apart from the level of economic

[17] Models explaining the time lags in applying individual measures (e.g. separately interest rate cuts, or asset purchase programmes) were also constructed, but since not all the reviewed countries used all the instruments, the related specifications were based on ever fewer observations, and therefore are not reported. Generally, the instrument-specific versions of the model broadly supported the presented conclusions, even though – due to the smaller number of observations – their specifications did not make it possible to include more than two to three variables at a time.

development (Advanced_economy dummy), include a variable related to the subsequent waves of COVID-19 (Start_of_COVID19 ordinal variable), stringency measures (Stringency_index), indicators characterising the country's past monetary policy (e.g. the level of interest rates, dummies referring to past experience with asset purchases or credit easing), measures of financial depth (e.g. monetary aggregates, market capitalisation), and indicators of capital account openness.

The control variables encompass various sets of indicators: those referring to the current macroeconomic situation of an economy and its medium-term outlook assessed as of late 2019 (e.g. inflation, GDP growth, unemployment, fiscal balance, projected inflation, projected GDP growth), those capturing more structural features of a country (e.g. public debt, trade openness), and those describing the institutional arrangements of the central banks (e.g. indices of central bank independence, transparency, and accountability). The regressors also include a variable considered as potentially key for the analysed problem, i.e. a very simplified proxy for easiness of contagion (measured as the distance between a given capital city and Beijing).

Most indicators, as listed in the Appendix (Table A1 in the Appendix), were collected from the databases of the International Monetary Fund and the World Bank. The institutional characteristics of the central banks were assessed by applying indices proposed in Niedźwiedzińska [2020] and available in Niedźwiedzińska [2022]. The measures of capital account openness were taken from Fernández et al. [2016] and Chinn and Ito [2006], and the anti-pandemic restrictions were assessed by looking at the Oxford COVID-19 Government Response Tracker [Hale et al., 2021].

The regressors used in the exercise in principle covered 2019, though for a few variables some missing observations for 2019 were substituted with 2018 values.[18] The forecasts were supposed to show the medium-term prospects of economies as assessed prior to the pandemic, and were therefore taken from the IMF World Economic Outlook – October 2019. They encompassed both 2020 and 2021, with an emphasis on 2021 as a more relevant horizon for forward-looking monetary policy by inflation targeters.

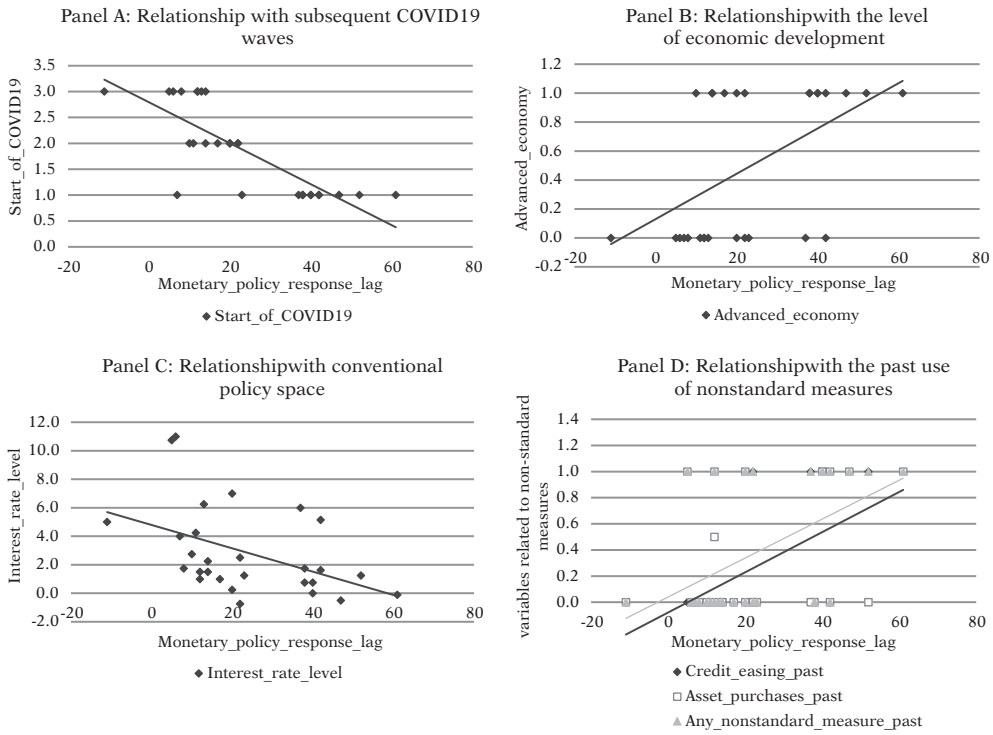
The institutional set-up indices were constructed to capture several potentially important aspects affecting the way monetary policy has been conducted in the analysed economies. The indices were built using a unique database produced by the author. Of interest were around 60 elements related to the institutional arrangements that allowed for a broad and detailed analysis. In particular, it was investigated: (1) how experienced the country had been in pursuing an IT strategy, (2) how much independence had been granted to the central bank, (3) how well-informed decision-makers had been, (4) how understandable the decision-making process had been, (5) how transparent

[18] Substituting missing 2019 values with 2018 data was considered only for slowly moving variables, such as the money to GDP ratio.

monetary policy had been, and (6) how high accountability standards had been employed by the central bank. All these elements were thought to be helpful in evaluating the credibility of the central banks, and translated into a summary index being the average of the individual indices. The indices referred to 2018 (the latest available data), but the institutional arrangements change rather slowly and – especially in a cross-country set-up – considering 2018 numbers should not affect the results in any visible way.

A first look at the data would indeed support the claim that being hit later by the pandemic speeded up the reaction time (Figure 19). Likewise, more policy space measured as the level of interest rates is negatively correlated with the monetary policy response lag, signalling that higher rates prompted central bank decisions. Meanwhile, belonging to the group of advanced economies and having past experience using unconventional instruments, either in the form of asset purchases or credit easing schemes, hampered central bank actions if assessed by analysing correlations only.

Figure 19. Relationship between monetary policy response lag and various regressors



Note: The lines in the charts are trend fitted lines.

Source: Author's own compilation based on data indicated in Table A1 in the Appendix.

When investigating cross-correlations, it turns out that the Advanced_economy dummy is visibly correlated with the interest rate level, and some

measures of financial depth and – less strongly – with the Start_of_COVID19 ordinal variable and dummies providing information on the past use of asset purchase programmes or credit easing schemes. At the same time, Start_of_COVID19 is somewhat correlated with the interest rate level, the past use of credit easing schemes and measures of financial depth. Although these interdependencies are in many instances not very strong, they may influence relationships between variables indicated by simple correlations. Thus, an attempt is undertaken to construct regressions that would capture, even if only tentatively, the directions of the underlying linkages.

Since the number of observations is rather limited, the number of regressors included in any specification is also restricted. For that reason, based on three initial specifications (first, regressions including only a constant and one of the investigated explanatory variables at a time; second, models encompassing a constant, Start_of_COVID19 and one additional regressor; and third, specifications considering a constant, Advanced_economy and one additional regressor), a set of the most relevant explanatory variables was identified.[19] The regressors taken into account at this stage were selected following the findings of the descriptive analysis and looking at correlations. Thus the timing of registering the first COVID-19 cases, the stringency index and the level of financial depth were predominantly found to be relevant factors that affected the speed of central bank responses. Those variables constituted the basis for the main version of the model, which was later extended to include control variables (Table 3).

A simple ordinary least squares procedure was applied.

The baseline model is a regression of the following form: $y_i = \alpha + \beta^T X_i + \varepsilon_i$, where $i = 1, \ldots, N$ corresponds to individual countries included in the analysis, y is the dependent variable, X is a matrix of explanatory variables that are likely to affect the dependent variable, α is a constant, and β is a vector of coefficients.

An overview of the estimation results and some robustness checks are reported in full in Tables 3 and 4, with some additional regression outputs included in the subsequent tables (Tables 5, 6 and 7).

The main findings are as follows.

Clearly, the single most relevant indicator is the variable related to the start of COVID-19 in a country, followed by the stringency index and the level of financial depth measured as the ratio of money to GDP. Those indicators are statistically significant across almost all the considered specifications and contribute to explaining a fair share of the dependent variable variability.

The estimations confirm that being among the countries hit later by the pandemic visibly shortened the reaction time – by around nine to 11 days for every month without COVID-19, depending on the specification.

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[19] Also when controlling for the Bonferroni correction to mitigate the multiple testing problem.

Table 3. Estimation results – overview

Dependent variable – Monetary_policy_response_lag								
Explanatory variables	Main model	+ Var. related to economic development	+ Var. related to monetary policy			+ Var. related to current economic conditions		+ Var. related to institutional set-up
Constant	34.7***	33.85 ***	34.17***	35.62***	32.91***	37.19***	31.38***	30.38
	(4.32)	(4.2)	(3.88)	(4.74)	(4.53)	(4.84)	(3.71)	(1.66)
Start_of_COVID19	–9.94***	–9.32***	–10***	–9.48***	–8.76***	–10.47***	–8.52**	–9.92***
	(–3.76)	(–3.45)	(–3.66)	(–3.82)	(–3.61)	(–4.18)	(–2.84)	(–3.67)
Stringency_index_infection_week_avg	–0.38*	–0.42*	–0.39*	–0.5**	–0.39*	–0.56**	–0.41*	–0.38*
	(–1.79)	(–1.93)	(–1.76)	(–2.41)	(–2.02)	(–2.53)	(–1.87)	(–1.75)
Money_to_GDP	0.13**	0.1*	0.13**	0.1*	0.09**	0.13***	0.14***	0.12**
	(2.69)	(2.03)	(2.48)	(2.04)	(2.09)	(2.99)	(2.88)	(2.52)
Advanced_economy		4.51						
		(1.05)						
Interest_rate_level			0.12					
			(0.17)					
Asset_purchase_past				8.25*				
				(2.01)				
Credit_easing_past					10.54**			
					(2.43)			
CPI_deviation_from _target						2.34*		
						(1.9)		
Unemployment_rate							–0.1	
							(–0.28)	
Fully_fledged_IT								0.66
								(0.26)
No. of observations	25	25	25	24	25	25	25	25
R-squared	0.76	0.77	0.76	0.80	0.82	0.8	0.77	0.76
Adjusted R-squared	0.73	0.73	0.71	0.76	0.78	0.76	0.72	0.72
F-statistic	22.37***	17.13***	16.01***	20.24***	22.18***	19.78***	15.96***	16.05***
Prob (F-statistic)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Significance codes: '***' 0.01, '**' 0.05, '*' 0.1. T-statistics in parenthesis.

Source: Author's own computations based on data collected from sources indicated in Table A1 in the Appendix.

Table 4. Robustness checks – overview

Dependent variable – Monetary_policy_response_lag								
Explanatory variables	Main model	Alternative var. related to start of COVID19			Alternative var. related to stringency measures	Alternative var. related to financial depth		Alternative var. related to monetary policy
Constant	34.7***	28.11 ***	40.04***	6.4	32.11***	48.49***	51.4***	32.05***
	(4.32)	(3.82)	(4.55)	(1.04)	(4.1)	(5.75)	(7.93)	(4.7)
Start_of_COVID19	–9.94***				–13.32***	–12.68***	–12.93***	–8.24***
	(–3.76)				(–5.02)	(–4.52)	(–4.33)	(–3.59)
Start_of_COVID19_ increasing		–5.93***						
		(–3.35)						
Start_of_COVID19_ decreasing			–13.51***					
			(–3.93)					
Start_of_COVID19_ January				20.22***				
				(3.79)				
Start_of_COVID19_ February				3.24				
				(1.36)				
Stringency_index_infection_week_avg	–0.38*	–0.41*	–0.37*	–0.38*		–0.43	–0.47 *	–0.5**
	(–1.79)	(–1.87)	(–1.79)	(–1.75)		(–1.68)	(–1.86)	(–2.74)
Stringency_index_ response_week_avg					0.2*			
					(1.84)			
Money_to_GDP	0.13**	0.14***	0.12**	0.12**	0.12**			0.09**
	(2.69)	(2.9)	(2.52)	(2.44)	(2.56)			(2.21)
Credit_to_GDP						0.04		
						(0.79)		
Market_capitalisation _to_GDP							0.01	
							(0.33)	
Any_nonstandard_measure_past								10.87***
								(3.1)
No. of observations	25	25	25	25	25	26	23	25
R-squared	0.78	0.74	0.77	0.77	0.76	0.7	0.68	0.84
Adjusted R-squared	0.75	0.7	0.74	0.72	0.73	0.66	0.63	0.81
F-statistic	24.59***	19.92***	23.5***	16.79***	22.58***	17.19***	13.52***	26.04***
Prob (F-statistic)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Significance codes: '***' 0.01, '**' 0.05, '*' 0.1. T-statistics in parenthesis.

Source: Author's own computations based on data collected from sources indicated in Table A1 in the Appendix.

Table 5. Additional estimation results – part 1

Dependent variable – Monetary_policy_response_lag								
Explanatory variables	Main model	+ Var. related to contagion easiness	+ Var. related to current and forecasted economic activity					
Constant	34.7***	39.02 ***	32.81***	33.22***	33.08***	37.04***	40.55***	42.03***
	(4.32)	(4.43)	(4.03)	(4.12)	(3.97)	(4.06)	(4)	(4.1)
Start_of_COVID19	–9.94***	–8.24**	–10.43***	–10.83***	–10.42***	–10.3***	–10.8***	–11.07***
	(–3.76)	(–2.74)	(–3.93)	(–3.97)	(–3.82)	(–3.73)	(–3.86)	(–3.94)
Stringency_index_infection_week_avg	–0.38**	–0.53**	–0.47**	–0.46*	–0.44*	–0.32	–0.29	–0.29
	(–1.79)	(–2.14)	(–2.09)	(–2.08)	(–1.95)	(–1.32)	(–1.22)	(–1.26)
Money_to_GDP	0.13**	0.12**	0.14***	0.13**	0.13**	0.12**	0.11**	0.11**
	(2.69)	(2.41)	(2.9)	(2.85)	(2.77)	(2.46)	(2.19)	(2.15)
Distance_from_Beijing		0						
		(–1.15)						
CPI			0.87					
			(1.15)					
CPI_forecast_2020				1.14				
				(1.17)				
CPI_forecast_2021					0.82			
					(0.82)			
GDP_rate						–0.78		
						(–0.57)		
GDP_rate_forecast_2020							–1.4	
							(–0.95)	
GDP_rate_forecast_2021								–1.6
								(–1.14)
No. of observations	25	25	25	25	25	25	25	25
R-squared	0.76	0.78	0.78	0.78	0.77	0.77	0.77	0.78
Adjusted R-squared	0.73	0.73	0.73	0.73	0.72	0.72	0.73	0.73
F-statistic	22.37***	17.37***	17.38***	17.42***	16.69***	16.32***	16.93***	17.34***
Prob (F-statistic)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Significance codes: '***' 0.01, '**' 0.05, '*' 0.1. T-statistics in parenthesis.

Source: Author's own computations based on data collected from sources indicated in Table A1 in the Appendix.

Table 6. Additional estimation results – part 2

Dependent variable – Monetary_policy_response_lag								
Explanatory variables	Main model	+ Var. related to fiscal position		+ Var. related to external position		+ Var. related to capital account openness		
Constant	34.7***	34.44 ***	35.86***	33.04***	34.99***	30.63***	40.81***	36.24***
	(4.32)	(4.19)	(4.41)	(3.75)	(4.22)	(3.56)	(4.62)	(4.46)
Start_of_COVID19	–9.94***	–10.02***	–10.39***	–10.37***	–10.13***	–9.55***	–10.1***	–9.59***
	(–3.76)	(–3.71)	(–3.86)	(–3.67)	(–3.6)	(–3.63)	(–3.92)	(–3.61)
Stringency_index_infection_ week_avg	–0.38*	–0.39*	–0.37	–0.37	–0.38*	–0.39*	–0.38*	–0.41*
	(–1.79)	(–1.77)	(–1.72)	(–1.71)	(–1.74)	(–1.84)	(–1.83)	(–1.9)
Money_to_GDP	0.13**	0.13**	0.08	0.13**	0.13**	0.11**	0.10**	0.12**
	(2.69)	(2.6)	(1.24)	(2.67)	(2.64)	(2.34)	(2.11)	(2.54)
Fiscal_balance_to_GDP		–0.26						
		(–0.44)						
Public_debt_to_GDP			0.06					
			(0.96)					
Trade_to_GDP				0.03				
				(0.51)				
Current_account_balance_ to_GDP					–0.15			
					(–0.24)			
Capital_account_openness_ Chinn_Ito						6.7		
						(1.22)		
Capital_account_restrictions_ FKRSU							–9.26	
							(–1.48)	
Capital_transactions_restrictions_ AREAER								–4.26
								(–1.08)
No. of observations	25	25	25	24	25	25	25	25
R-squared	0.76	0.76	0.77	0.76	0.76	0.78	0.79	0.77
Adjusted R-squared	0.73	0.72	0.73	0.72	0.71	0.73	0.74	0.73
F-statistic	22.37***	16.18***	16.95***	16.25***	16.04***	17.54***	18.29***	17.21***
Prob (F-statistic)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Significance codes: '***' 0.01, '**' 0.05, '*' 0.1. T-statistics in parenthesis.

Source: Author's own computations based on data collected from sources indicated in Table A1 in the Appendix.

Table 7. Additional estimation results – part 3

Dependent variable – Monetary_policy_response_lag								
Explanatory variables	Main model	+ Var. related to institutional set-up						
Constant	34.7***	32.83 **	25.31**	46.64**	33.62**	24.6**	44.69***	30.38
	(4.32)	(2.62)	(2.12)	(2.83)	(2.75)	(2.09)	(3.51)	(1.66)
Start_of_COVID19	–9.94***	–9.91***	–9.69***	–10.41***	–9.99***	–10.43***	–9.98***	–9.92***
	(–3.76)	(–3.66)	(–3.66)	(–3.82)	(–3.65)	(–3.93)	(–3.78)	(–3.67)
Stringency_index_infection_week_avg	–0.38*	–0.38*	–0.46*	–0.43*	–0.37	–0.33	–0.3	–0.38*
	(–1.79)	(–1.74)	(–2.05)	(–1.93)	(–1.61)	(–1.55)	(–1.32)	(–1.75)
Money_to_GDP	0.13**	0.13**	0.14***	0.13**	0.12**	0.1*	0.14***	0.12**
	(2.69)	(2.57)	(2.89)	(2.66)	(2.44)	(2.06)	(2.86)	(2.52)
Mature_IT		0.26						
		(0.2)						
Independent_IT			1.47					
			(1.06)					
Informed_IT				–1.41				
				(–0.83)				
Explicatory_IT					0.22			
					(0.12)			
Transparent_IT						1.67		
						(1.16)		
Accountable_IT							–1.65	
							(–1.01)	
Fully_fledged_IT								0.66
								(0.26)
No. of observations	25	25	25	25	25	25	25	25
R-squared	0.76	0.76	0.77	0.77	0.76	0.78	0.77	0.76
Adjusted R-squared	0.73	0.71	0.73	0.72	0.71	0.73	0.73	0.72
F-statistic	22.37***	16.02***	17.16***	16.7***	16***	17.4***	17.05***	16.05***
Prob (F-statistic)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Significance codes: '***' 0.01, '**' 0.05, '*' 0.1. T-statistics in parenthesis.

Source: Author's own computations based on data collected from sources indicated in Table A1 in the Appendix.

Meanwhile, more stringent ani-pandemic restrictions translated into only a minor decrease in the monetary policy decision lag – by around half a day for every 1-point increase in the stringency index. Looking at the extreme cases, i.e. countries which adopted the most drastic and most relaxed restrictions, the difference in timing stemming from this factor alone could be around six days. Lastly, a deeper financial system, measured by looking at the ratio of the broad monetary aggregate to GDP, may have decreased the urgency of policy actions by 0.1 days, i.e. by a few hours, for each percentage point difference in the considered ratio. At the same time, taking into account the fact that the sample includes countries characterised by wide-ranging values of the money to GDP indicator, the difference in the time lag needed to arrive at any decision between economies with the deepest and shallowest financial systems rises to around 22 days.

The findings also held when a number of robustness checks were conducted. First of all, considering various modifications of the Start_of_COVID19 indicator (by assuming increasing or decreasing importance of belonging to different waves of infected countries or by substituting the ordinal variable with two dummies) did not affect the estimates of other coefficients in any visible way. The results of the estimation did not change significantly in regressions that used the average Stringency_index computed for the week when the first monetary response was announced – instead of the average Stringency_index for the week when the first infections were reported. In turn, allowing for alternative measures of financial depth was neither helpful nor harmful for the estimation results. The credit-to-GDP and market capitalisation-to-GDP (with fewer observations) ratios performed similarly though somewhat more poorly in terms of coefficient significance than the money-to-GDP indicator, while the relevance of other variables included in the respective models was not affected.

Considering control variables, they did not significantly affect the results or change the main conclusions. In particular, the Advanced_economy dummy was not found to be significant in the model if account was taken of the factors discussed above. The same was true when the Advanced_economy dummy was replaced with GDP per capita when conducting robustness checks.

The first set of additional regressors was comprised of variables related to monetary policy instruments, both conventional and nonstandard ones. The level of interest rates was not significant, whereas the past use of asset purchases and credit easing postponed monetary policy decisions by around eight and 11 days respectively, possibly signalling the need to design more extensive measures than those already applied. That observation may imply that what really mattered was room for policy manoeuvre, understood as the possibility to apply simple nonstandard measures.[20]

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20 An alternative interpretation of the positive sign of those coefficients could be that some of the economies classified as having past experience using unconventional measures were, in fact, still making use of them when hit by the pandemic. This, in turn, could indicate that those central banks could be seeing those instruments as already working, thus not necessitating any

Analysing variables describing the current macroeconomic condition of a given country and their outlook as evaluated prior to the pandemic suggests that those indicators have no significance. The only exception is the deviation of inflation from the target. In the case of inflation targeters, the deviation from the target should indeed be of relevance and it seems that the higher the deviation the more reluctant were central banks to resort to loosening. For each percentage point of excessive inflation, the decision lag lengthened by around 2.3 days.

None of the considered structural indicators proved useful in explaining differences in the central banks' response lag, since neither the variables referring to the fiscal situation nor the indicators of trade openness or capital account openness were found to be relevant. This last observation is worth noting since it does not support the notion of spillover effects.

Finally, the quality of institutional set-ups did not have much impact because the indices of the central banks' institutional arrangements proved to be insignificant. It seems that being a more experienced inflation targeter, enjoying more independence, setting store in informed decisions, putting an emphasis on a comprehensive explanation of actions undertaken, and praising the transparency of the conducted policy was not helpful in quickly responding to the pandemic.

Conclusions

The monetary policy response to COVID-19 by central banks in various countries was in many ways exceptional. This paper investigated some of the aspects of this exceptional action in a more systematic way, allowing for the formulation of several observations.

The number of decision-making meetings held during the first few months of 2020 can be seen as the first proof that the monetary policy reaction to the pandemic was extraordinary. While not all monetary policy measures were introduced after decision-making meetings, central banks preferred introducing initial monetary policy actions after a formal discussion at decision-making meetings. Fifty percent of those meetings were held on an ad hoc basis. At the same time, many liquidity providing operations or extensions of previously announced instruments were announced in the form of press releases without any meeting.

The wide scope of monetary policy measures introduced during the first half of 2020 can be seen as further evidence of an unprecedented central bank reaction to the pandemic. This time, unlike during the global financial crisis and the European sovereign debt crisis, almost all inflation targeters turned

extensions. However, after including a variable explicitly capturing those cases, i.e. indicating central banks that were active in applying asset purchases and credit easing, such an interpretation had to be dropped.

out to be ready to reach for instruments regarded as unconventional in the past. Moreover, given the fact that the authorities often gradually extended previously introduced measures, most of the analysed central banks issued between five and 10 policy statements on monetary stimulus from the start of the pandemic to the end of June 2020. This means that their reactions can be described as vigorous.

An investigation of the sequence of policy measures revealed a preference among central banks for using standard measures as the first line of defence. However, given the widespread applicability of asset purchase programmes and credit easing schemes, calling them unconventional does not seem to reflect their current status. Considering the magnitude of the applied measures, the cumulative interest rate cuts were much deeper in emerging market economies, while the overall size of asset purchases and credit easing was markedly higher in advanced economies.

Clearly, one of the key aspects of the monetary policy response to the COVID-19 pandemic is how quickly monetary authorities reacted to the shock. Looking at the overall picture, advanced economy inflation targeters announced their initial policy actions within a month on average, while emerging market economies were twice as fast. Moreover, being among the first countries to report COVID-19 cases in principle extended the time lag of the policy response. The ranking of first movers among inflation targeters provides clear evidence for those findings.

Considering the results of simple cross-country regressions, several factors turned out to be significant in explaining differences in the speed with which monetary policy stimulus was provided, though the results should be treated as tentative. Evidently, the best-performing indicator referred to the waves of the COVID-19 pandemic. The importance of belonging to a group of countries hit later by the coronavirus possibly stems from the advantage of already being aware of the gravity of the situation. In this context, the significance of the stringency of the adopted anti-pandemic restrictions should not be surprising. Some evidence was also found for the relevance of having policy space with respect to nonstandard measures, which allowed for a swift adoption of relatively simple unconventional instruments. On the other hand, among factors delaying the monetary response were measures of financial depth, signalling less urgency for adopting liquidity providing operations in countries with deeper financial systems and a greater deviation of inflation from the target. After controlling for those factors, the level of economic development, captured by either the Advanced_economy dummy or the GDP per capita indicator, was not found to be significant. The findings are fully in line with intuition, and although they seem quite obvious, it is interesting to see that, under crisis circumstances, monetary authorities are able to act irrespective of the structural characteristics of their economies or institutional set-ups under which they operate.

This analysis constitutes a review of initial central bank responses to the pandemic – their timing, sequence and scope. Its major advantage is its wide

range of countries that follow the same monetary policy strategy, making it fair to compare their reactions. When thinking about monetary policy in the context of COVID-19, it would be interesting to analyse the magnitude of the response in greater detail and to investigate its effectiveness. The problem with the magnitude of the response is that it is difficult to quantify the overall strength of the provided accommodation given the wide range of instruments used. The problem with the effectiveness of the response is that it is difficult to disentangle the effects of monetary policy loosening from the massive fiscal expansion applied in many countries at almost the same time. These topics are therefore not covered in this paper.

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Appendix

Table A1. Overview of data analysed

Variable	Description	Source
Monetary_policy_ response_ lag	days between the first COVID-19 case reported in a country and the first announcement of monetary policy measures (any) by a given central bank	own calculation based on information from central banks' websites
Lag_in_cutting_interest_ rates	days between the first COVID-19 case reported in a country and the first announcement of a respective monetary policy measure by a given central bank	
Lag_in_announcing_asset_ purchase_programmes		
Lag_in_announcing_ credit_easing_schemes		
Lag_in_announcing_ liquidity_providing_ measures		
Start_of_COVID19	ordinal variable: 1 for countries where the first COVID-19 cases were reported in January, 2 – for February, 3 – for March	own calculation based on information from https://covid.ourworldindata.org/data/owid-covid-data.csv
Start_of_COVID19_ January	dummy variable: 1 for countries where the first COVID-19 cases were reported in January, 0 – otherwise	
Start_of_COVID19_ February	dummy variable: 1 for countries where the first COVID-19 cases were reported in February, 0 – otherwise	
Start_of_COVID19_ increasing	ordinal variable: 1 for countries where the first COVID-19 cases were reported in January, 2 – for February, 4 – for March	
Start_of_COVID19_ decreasing	ordinal variable: 1 for countries where the first COVID-19 cases were reported in January, 2 – for February, 2.5 – for March	
Advanced_economy	dummy variable: 1 for countries classified as advanced economies by the IMF, 0 – otherwise	own calculation based on IMF classification
GDP_per_capita_PPP	GDP per capita, PPP (current international dollars)	World Bank, World Development Indicators
Distance_from_Beijing	distance between Beijing and the capital of a given country (for the euro area distance to Brussels)	https://www.google.com/maps

Variable	Description	Source
Interest_rate_level	main policy interest rates	information from central banks' websites
Asset_purchases_past	dummy variable: 1 for central banks using asset purchases in the past, 0 – otherwise	
Credit_easing_past	dummy variable: 1 for central banks using credit easing in the past, 0 – otherwise	
Any_nonstandard_measure_past	dummy variable: 1 for central banks conducting asset purchases or credit easing in the past, 0 – otherwise	
CPI	average annual consumer price inflation	IMF WEO, April 2020
CPI_end	end-of-year consumer price inflation	IMF WEO, April 2020
CPI_forecast_2020	average annual consumer price inflation forecast for 2020	IMF WEO, October 2019
CPI_forecast_2021	average annual consumer price inflation forecast for 2021	IMF WEO, October 2019
CPI_deviation_from_target	difference between end-of-year consumer price inflation and inflation target (midpoint)	own calculation based on IMF data and information from central banks' websites
GDP_rate	annual GDP growth rate	IMF WEO, April 2020
GDP_rate_forecast_2020	annual GDP growth rate forecast for 2020	IMF WEO, October 2019
GDP_rate_forecast_2021	annual GDP growth rate forecast for 2021	IMF WEO, October 2019
Unemployment_rate	unemployment (% of total labour force)	IMF WEO, April 2020
Unemployment_rate_forecast_2020	unemployment rate forecast for 2020	IMF WEO, October 2019
Unemployment_rate_forecast_2021	unemployment rate forecast for 2021	IMF WEO, October 2019
Fiscal_balance_to_GDP	general government overall balance (% of GDP)	IMF, Fiscal Monitor Database
Public_debt_to_GDP	general government gross debt (% of GDP)	IMF, Fiscal Monitor Database
Trade_to_GDP	trade (% of GDP)	World Bank, World Development Indicators
Current_account_balance_to_GDP	current account balance (% of GDP)	IMF WEO, April 2020
Money_to_GDP	broad money (% of GDP)	IMF WEO, April 2020
Credit_to_GDP	domestic credit to private sector (% of GDP)	World Bank, World Development Indicators
Market_capitalisation_to_GDP	market capitalisation of listed domestic companies (% of GDP)	World Bank, World Development Indicators

Variable	Description	Source
Mature_IT	index describing how mature an IT strategy is	Niedźwiedzińska [2022]
Independent_IT	index describing how independent a central bank is	
Informed_IT	index describing how well informed monetary policy decisions are	
Explicatory_IT	index describing how transparent a monetary policy decision-making process is	
Transparent_IT	index describing how transparent a central bank is	
Accountable_IT	index describing how accountable a central bank is	
Fully_fledged_IT	index summarising all institutional features of an IT strategy	
Capital_account_ openness_ Chinn_Ito	indicator of capital account openness	Chinn and Ito [2006] – updated
Capital_account_ restrictions_FKRSU	indicator of restrictions on capital account	Fernández *et al.* [2016] – updated
Capital_transactions_ restrictions_AREAER	indicator of restrictions on capital transactions	IMF [2020]
Stringency_index_ infection_day	stringency index on the day when the first COVID-19 case was reported in a country	Hale *et al.* [2021]
Stringency_index_ infection_week_avg	average stringency index in the week following the first COVID-19 case in a country	
Stringency_index_ response_day	stringency index on the day of the first announcement of monetary policy measures (any) by a given central bank	
Stringency_index_ response_week_avg	average stringency index in the week prior to the first announcement of monetary policy measures (any) by a given central bank	

Note: For variables for which data on the euro area were not available, data on Germany were considered.

Source: Author's own compilation.

Table A2. Overview of countries analysed

First cases of COVID-19 reported in:								
January*			February			March		
Economy	Country	Country code	Economy	Country	Country code	Economy	Country	Country code
A	Australia	AU	E	Brazil	BR	E	Chile	CL
A	Canada	CA	A	Iceland	IS	A	Czech Republic	CZ
A	Euro Area	EA	A	Israel	IL	E	Hungary	HU
E	India	IN	E	Mexico	MX	E	Indonesia	ID
A	Japan	JP	A	New Zealand	NZ	E	Poland	PL
A	Korea	KR	A	Norway	NO	E	South Africa	ZA
E	Philippines	PH	E	Romania	RO	E	Turkey	TR
E	Russia	RU	A	Switzerland	CH	E	Ukraine	UA
A	Sweden	SE	No. of cases		8	No. of cases		8
E	Thailand	TH	No. of advanced economies		5	No. of advanced economies		1
A	United Kingdom	GB	No. of emerging market economies		3	No. of emerging market economies		7
A	United States	US						
No. of cases		12						
No. of advanced economies		8						
No. of emerging market economies		4						

Note: * Russia and Sweden were included in the January group (the first cases of COVID-19 in those two countries were reported on 1 February 2020, while for other countries included in the February group the first cases of COVID-19 were reported in late February). A denotes advanced economies, while E denotes emerging market economies.

Source: Author's own compilation.