CHAPTER 4

ONLINE ANNEX

This Annex provides further detail on the methods, data sources, robustness exercises and extensions applicable to Chapter 4 of the April 2021 World Econoimc Outlook, which is entitled "Shifting Gears: Monetary Policy Spillovers During the Recovery from COVID-19."[1] It is designed to be read jointly with the main text, so it does not repeat information from there. The Annex is structured into two parts. The first part describes the event study analysis and the second describes the determinants of monetary policy actions in EMs.[2]

Annex 4.1. Event Study Analysis

Methods

The chapter estimates the following model of the effects of monetary policy surprises, real news and vaccine news s_t on financial conditions in EMs:

$$y_{c,t+1} - y_{c,t-1} = \alpha_c + \zeta s_t + \theta \tau_t + \gamma x_{c,t} + \mu \tau_t s_t + \eta s_t x_{c,t} + v_{c,t+1}$$

where the dependent variable $y_{c,t}$ represents various financial indicators on day t in EM c, including government bond yields at various maturities, exchange rates, total stock returns, portfolio flows, term premiums and expectations of future short-term monetary policy rates. For models where s_t represents vaccine news, an additional s_t^2 term is included on the right-hand side to capture non-linearities, and the results report the combined effects of a unit increase in both terms. The variable τ_t allows to capture low-frequency time variation in the sensitivity, using linear time trends or indicator variables for sub-periods. The variables $x_{c,t}$ are measures of heterogeneity across EMs in the previous year that could be related to the strength of the spillovers as defined below. Finally, $v_{c,t}$ is an error term. In addition to the model above for financial conditions in EMs, a simplified time series version

$$y_{t+1} - y_{t-1} = \delta + \beta s_t + u_{t+1}$$

is used to model the effects of monetary policy surprises, real news and vaccine news (s_t) on global and US financial indicators (y_t), including US Treasury yields, US expected future policy rates and term premiums, the US dollar nominal effective (trade-weighted) exchange rate and the US stock market volatility index (VIX).

Estimation of parameters $\zeta, \theta, \gamma, \mu, \eta$ uses the within-groups estimator, and given the long time dimension, standard errors that allow for spatial and temporal dependence are used following Driscoll and Kraay (1998). When estimating the average sensitivity (ζ) to monetary surprises or economic/vaccine news (Figures 4.6, 4.7, 4.12 and 4.13 in the main text), time and cross-section effects are dropped before estimation ($\theta, \gamma, \mu, \eta = 0$). When estimating time variation (μ; Figure 4.8 in the main text), cross-section heterogeneity is dropped before estimation ($\gamma, \eta = 0$), and when estimating cross-section heterogeneity (η), time effects are dropped before estimation ($\theta, \mu = 0$; Figure 4.9 in the main text). Parameters δ, β are estimated by least squares with standard errors that allow for heteroskedasticity and autocorrelation as described by Newey and West (1987).

[1] This annex, and the chapter it supplements, is authored by Philipp Engler, Roberto Piazza and Galen Sher.
[2] In this Annex, like in the main text, AE denotes advanced economy, EM denotes emerging market economy and LIC denotes low-income developing country, according to World Economic Outlook classifications.

The effects of monetary policy surprises, news about US economic activity, and news about COVID-19 vaccines are estimated on monetary policy announcement days, days of publication of headline US economic indicators and days with news about COVID-19 vaccines, respectively.

In order not to cut off some of the transmission channels of monetary policy and real economic news, the analysis does not control for other factors, which should be uncorrelated with the well-identified monetary policy surprises and real news measures used here.[3]

Data Sources

The following measures are used for news about monetary policy, the real economy or vaccines (s_t):

a. *Monetary policy surprises.* Data on US monetary policy surprises come from the change in Treasury yields on days of FOMC announcements, and these days were provided by the Federal Reserve. The ECB monetary policy surprises are as published by the ECB and as described in Altavilla and others (2019). The bond yield surprises are averaged across Germany, France, Italy and Spain using ECB capital keys as weights. These data end in April 2020, so were expanded to include the changes in bond yields on the later announcement days of July 16, September 10 and October 29. However, weighted average eurozone bond yields often abstract from important spreads between yields in eurozone economies that are also arguably a target of euro area monetary policy.[4] Thus, one extension below uses spreads between yields on Italian and German government bonds as a monetary policy instrument, following Rogers and others (2014).

b. *Economic news.* Data on US economic news is the difference between the value of headline US macroeconomic indicators on their publication days and the median market survey expectation just before, as in Gürkaynak and others (2020). The chapter focuses on non-farm payrolls, because they have the largest effects, but GDP, retail sales, durable goods orders and consumer and producer price inflation are also analyzed. As a cross-check, A Bloomberg time series of US non-farm payroll surprises is used, which scales the surprises (in numbers of jobs) by the dispersion of survey responses. As an extension, the US economic surprise index published by Citigroup is also used, from Bloomberg. This index measures the extent to which economic indicators exceed market expectations, weighted according to their effects on exchange rates.[5]

c. *Vaccine news.* The daily stock returns of Moderna and BioNTech, two firms leading the race to develop vaccines against COVID-19, were sensitive to news about the development of vaccines. For example, on July 2, 2020, Moderna's stock fell by 5 percent after a report indicated that the company's stage-3 clinical trial could be delayed by a few weeks, and on November 9, 2020, BioNTech's stocks surged 14 percent after the company and its partner Pfizer announced that, based on preliminary data, their vaccine was a 90 percent effective in preventing infections.[6] Large movements in the stock prices of these two firms were also unlikely to have

[3] Indeed, changes in global factors (log VIX, log commodity prices, and the log total return index on US stocks) and EM monetary policy rates absorb some of the measured monetary policy spillovers, but the results here remain statistically significant.
[4] Weighted average eurozone yields and Italy-Germany spreads move in the same direction on about half of all ECB monetary policy announcement days in the sample.
[5] The interpretation of this index is challenging, because it seems that not all its components and weights are public.
[6] On both these days, the MSCI USA Healthcare Index did not change much.

been driven by other aspects of their business because these firms are not large or diversified multinationals. To remove the influence of other economic developments on their stock returns, the residuals are obtained in a regression of these returns on the those of the MSCI USA Healthcare Index. For each of the two firms, the residuals are coded as -1 or 1 if they fall in the bottom or top 10th percentiles of their historical distributions and zero otherwise. The vaccine news index is then computed as the sum of these two coded variables, which means the index takes on integer values between -2 to 2.[7] An interpretation of a unit increase in the index is if one of the two vaccines in development experiences a one-in-ten positive event. Many vaccines were in development in 2020, but their chances of success were correlated due to commonalities in technology.

The sample of 60 EMs is constructed from the IMF's list of 97 EMs by dropping offshore financial centers, countries without their own currency, countries undergoing hyperinflation or crises, countries on the IMF's list of fragile states, countries with population of less than 1 million persons and countries with GDP less than US$ 10 billion in 2019. The resulting economies are Albania, Algeria, Angola, Argentina, Armenia, Azerbaijan, Bahrain, Belarus, Bolivia, Bosnia & Herzegovina, Botswana, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Croatia, Dominican Republic, Egypt, Equatorial Guinea, Gabon, Georgia, Guatemala, Hungary, India, Indonesia, Iran, Jamaica, Jordan, Kazakhstan, Kuwait, Macedonia, Malaysia, Mauritius, Mexico, Mongolia, Morocco, Namibia, Oman, Pakistan, Paraguay, Peru, Philippines, Poland, Qatar, Romania, Russia, Saudi Arabia, Serbia, South Africa, Sri Lanka, Thailand, Trinidad & Tobago, Tunisia, Turkey, Turkmenistan, Ukraine, United Arab Emirates and Uruguay. A similar approach leads to a sample of 23 LICs, containing Bangladesh, Benin, Burkina Faso, Cambodia, Cameroon, Ethiopia, Ghana, Honduras, Kenya, Laos, Moldova, Mozambique, Nepal, Nicaragua, Niger, Nigeria, Rwanda, Senegal, Tanzania, Uganda, Uzbekistan, Vietnam and Zambia.

Data for nominal, local-currency government bond yields are obtained from Haver. These come first from official sources if available, otherwise from Tullett Prebon, and otherwise from Reuters. Government bond total return indices and EMBI spreads are from JP Morgan Markets.[8] MSCI total stock return indices and BNP Paribas 5-year EM term premiums (following the method of Adrian and others (2013)) are from Bloomberg. Exchange rates against the US dollar and nominal effective (trade-weighted) exchange rates are from the IMF's Global Data Source database if available, otherwise from offical sources through Haver. The US term premiums and expected future short-term interest rates are as published by the Federal Reserve Bank of New York, also following the method of Adrian and others (2013). Daily portfolio flows are from the Institute of International Finance. Monetary policy rates are from the Bank for International Settlements.

The following measures of heterogeneity in the previous year ($x_{c,t}$) are used:

a. *Credit rating.* An economy is classified as investment grade if its sovereign rating from Moody's was at least Baa3 in the previous year, otherwise it is speculative grade.

[7] However, consistent with analyses of monetary policy surprises and real economic news, models for vaccine news are estimated only on days with vaccine news, so values of zero in the vaccine index are dropped from the sample. There are 62 vaccine news days, with -2 and 2 each occurring on about 10 percent of them, and with -1 and 1 each occurring on about 40 percent of them.

[8] For many economies, data on government bond yields with a 10-year constant maturity are also available from Bloomberg. The results in the main text are robust to using this alternative data source for 10-year yields.

b. *External debt share*. Data on external debt are difficult to obtain across countries. Therefore, the chapter uses the ratio of external debt owed by official sources to government debt, both from the IMF's WEO database.[9]

c. *Currency volatility*. This is the average, across months in the preceding calendar year, of the standard deviation of daily changes in the logarithm of the nominal effective (trade-weighted) exchange rate.

d. *Bond substitutability*. The correlation between the total returns of local currency government bonds is a measure of substitutability from the investor's perspective (Neely 2015). Results are similar whether such returns are expressed in local currency or in US dollars.

e. *Financial openness*. The index of capital account openness used is that of Chinn and Ito (2008).

f. *Financial ties to the US*. Overall financial ties are measured as the simple average of banking, direct investment and portfolio investment ties in the previous calendar year, each of which is measured as total assets and liabilities against the US in percent of the GDP of the given emerging economy. Banking ties are as reported by the US in the BIS' Locational Banking Statistics. Direct and Portfolio investment ties are from the IMF's Coordinated Portfolio and Direct Investment Surveys.

Table A.4.1.1. Interaction Terms (η) for Effects on EM 10-Year Bond Yields and EMBI Spreads of Surprises to US Non-Farm Payrolls and US Monetary Policy.

	Non-farm payrolls			Monetary policy	
	EM 10Y	EMBI	Exch. Rate	EM 5Y	EM 10Y
Fiscal capacity:					
• investment grade *(indicator)*	24	14	10	-42*	-27
• fiscal rule exists *(indicator)*	38**	-2	22	21	15
Risk channel measures:					
• government debt *(percent of GDP)*	-1**	-0.4	1	-0.3	-0.5
• government debt *(log[1+debt/GDP])*	-19*	-7	16	1	-8
• external debt share *(log[1+x])*	7	-0.5	7	17*	17*
• NEER volatility *(percent per day)*	-7	-42**	2	38	80*
Trade channel measures:					
• trade ties to the US *(percent of GDP)*	-1	-1*	-4	0.2	1
Portfolio balance channel measures:					
• substitutability in local currency	-3	81	97	-142	-64
• substitutability in US$	-18	52	507	-38	-22
• financial ties to the US *(percent of GDP)*	-1	1	-256	-2	1
• capital account openness *(index)*	-1	-1	-19*	-2	-2

Notes: Stars denote statistical significance: **=1 percent, *=5 percent, .=10 percent. 2Y, 5Y and 10Y denote the 2-, 5- and 10-year local currency government bond yields respectively. NEER denotes the nominal effective (trade-weighted) exchange rate. Exch. rate denotes the EM's bilateral exchange rate in local currency per US dollar. Non-farm payroll surprises are in millions of jobs and monetary policy surprises are in percentage points (i.e. per 100 basis points change in US2Y). EM10Y and EMBI spreads are in basis points. Substitutability is the correlation in total returns on government bonds between the given economy and the US, and it is constant across time. EM government bond yields are from Haver.

[9] This is a proxy, and may in principle exceed 100 percent.

Further Detail on Interaction Terms

Table A.4.1.1 shows how the effects of US monetary policy and employment surprises vary across EMs (parameter η), according to EMs' fiscal capacity, riskiness, and trade and financial links to the US. The table confirms that there is some evidence that US monetary policy and employment surprises have stronger financial effects on EMs that are *ex ante* riskier, which suggests that US monetary and employment conditions transmit internationally by affecting investors' perceptions of risks or their risk aversion (a "risk channel"). However, this evidence is only suggestive because not all the tabulated sensitivity parameters are precisely estimated.

By contrast, the evidence does not support the existence of a portfolio balance channel, in that spillovers are no stronger for economies with *ex ante* more open capital accounts, deeper financial ties to the US, or bonds that are more substitutable with US bonds. For monetary policy spillovers, the portfolio balance channel suffers a lack of evidence, but for employment spillovers, the evidence points against the channel. After a surprise rise in non-farm payrolls, EMBI spreads seem to fall slightly less, and domestic currencies seem to depreciate by less, in EMs with deeper financial ties to the US than in other EMs (p-value of 10 percent). Similarly, under a portfolio balance channel, domestic currencies should depreciate by more in EMs with more open capital accounts, but Table A.4.1.1 shows that they in fact depreciate by less.

Table A.4.1.2. Robustness of the Effects of Monetary Policy Surprises.

	Alternative approach			
Finding	Control variables	Huber M-estimation	ZLB period (10-year yield changes)	non-ZLB period (Fed Funds Futures / EONIA)
Positive US monetary policy surprises:				
• appreciate the USD	n.a.	yes	yes	no effect
• do not affect the US VIX	n.a.	yes	yes	yes
• lift EM interest rates	yes	yes	yes	yes
• lift EM term premiums	yes	yes	yes	yes
• depreciate EM currencies against the USD	no effect	yes	yes	no effect
Positive EA monetary policy surprises:				
• lift EM interest rates at some maturities	yes	yes	yes	yes, lifts 6M, but lowers 2Y
• lift EM interest rates less than US surprises	yes, but only at shorter maturities; at longer maturities the effects are similar	yes, but only at longer maturities; at shorter maturities, the effects are similar	yes, but only at shorter maturities; EM10Y reacts more to EA10Y than to	yes

Notes: Huber M-estimation uses bisquare weights. The zero lower bound (ZLB) period for the US is between Nov. 30, 2008 and Sep. 30, 2016 and between Mar. 15, 2020 and Nov. 9, 2020 (the end of the sample). The ZLB period for the euro area is between Jul. 1, 2009 and Jun. 30, 2010 and between Jan. 1, 2012 and Nov. 9, 2020. In the non-ZLB period, the US monetary policy instrument is the 3-month interest rate on federal funds futures. and the euro area instrument is the euro overnight index average (EONIA). 6M and 2Y denote 6-month and 2-year government bond yields.

Robustness Exercises and Extensions

Table A.4.1.2 summarizes the effects of different analytical approaches on the chapter's main findings about the spillovers of monetary policy surprises. The first column shows that, by re-estimating the model using Huber robust regression (like Rogers and others (2014)), the main findings about spillovers from monetary policy surprises are not driven by outliers. Similarly, the main findings barely change when estimated on the zero lower bound period with 10-year government bond yields as the monetary policy instrument. The rightmost column shows the effects of estimating on the period when short-term interest rates were not at the zero-lower bound, with federal funds futures and the euro overnight index average (EONIA) as policy rates. During this non-zero lower bound period, US monetary policy surprises continued to have significant effects on EM interest rates and term premiums but did not have detectable effects on the US dollar or EM exchange rates against the dollar. Also, during the non-zero lower bound period, EONIA surprises lift yields on EM government bonds with 6-month maturity.

The spreads between Italian and German bond yields are informative about risks of fragmentation in the eurozone, which would have significant effects on EM trading partners. Therefore, monetary policy announcements that affect these spreads are significantly associated with measures of risk in EMs, like term premiums, spreads on dollar-denominated debt and stock prices (Figure A.4.1.1). Increases in the Italy—Germany spread seem to drive portfolio flows out of EMs (in the amount of 0.8 basis points of annual GDP, over 2 days, for each 100 bp tightening). Effects on longer-term local currency bond yields are marginally significant.

Table A.4.1.3 summarizes the effects of different analytical approaches on the chapter's main findings about the spillovers of news about the US economy. It shows that, when non-farm payroll surprises beat expectations, this tends to lift US interest rates, lower the US VIX, appreciate the US dollar and lift EM interest rates, and these findings are not driven by outliers (the first column of Table A.4.1.3) or the definition of non-farm payroll surprises (the second column). Two other findings are not as clear-cut. The depreciation of EM currencies

Table A.4.1.3. Robustness of the Effects of US Economic News.

	Control variables	Huber M-estimation	Bloomberg non-farm payrolls
Positive non-farm payroll surprises:			
• lift longer-term US interest rates	n.a.	yes	yes
• lower the US VIX	n.a.	yes	yes
• appreciate the US dollar	n.a.	yes	yes
• lift EM interest rates	yes	yes	yes
• lift EM expected future short-term interest rates		no effect	no effect
• depreciate EM currencies against the USD	yes	no effect	yes
• lower EMBI spreads	yes	yes	no effect
Positive inflation surprises:			
• have 'essentially' no effect on EM interest rates /1	yes	some effects emerge, but they are sensitive to the weighting function	n.a.
• do not change EM exchange rates against the USD	yes	yes	n.a.

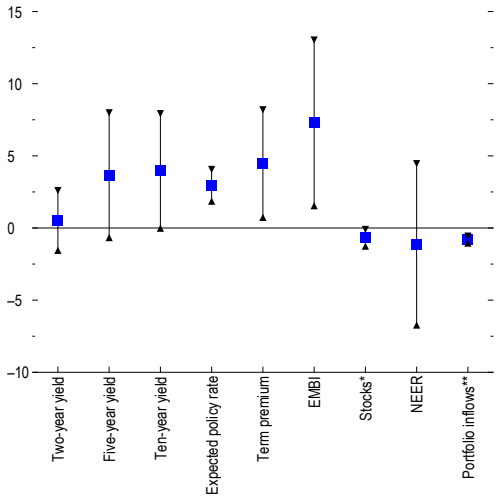
Notes: The results in the main text use a within-groups estimator without control variables and with non-farm payroll surprises from Gurkaynak and others (2020). The first column shows the effect of adding control variables, the second of using Huber M-estimation, and the right column shows the effects of using scaled non-farm payroll surprises (NFP) from Bloomberg. 1/ "Essentially no effect" here means that there may be a statistically significant effect at at most one maturity. We see effects at the 6-month maturity in the baseline specification, but it may be driven by low country coverage and is not confirmed by any effects at nearby maturities.

after a positive non-farm payroll surprise could be driven by outliers, and lower EMBI spreads after a positive non-farm payroll surprise could be driven by the definition of such surprises.

The main text concludes that US inflation surprises have very limited effects on EM financial conditions. This finding is based on the within-groups estimator and applies equally to US core CPI and core PPI inflation. While some statistical significance can be found when using a Huber M-estimator with Tukey bisquare weighting (following Rogers and others, 2014), this disappears if the tuning parameter is increased slightly above its conventional level of 4.685 and also disappears if alternative weighting schemes are used (not shown).

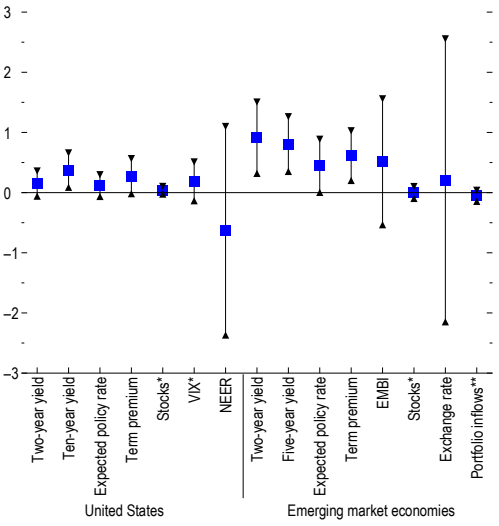
Figure A.4.1.2 shows the effects of US economic news as measured by the Citigroup economic surprise index. Such news tends to lift only longer-term US interest rates and does not clearly affect the US VIX or the value of the US dollar. This index of US news also lifts EM interest rates, but by small amounts.[10] Rising EM interest rates are nearly evenly split between expected future policy rate and term premium components, and the former suggests some expected policy reaction to inflationary pressures from increased US demand. This "trade channel" is similar to the one described in the main text.

Annex Figure 4.1.1. Effects of Increases in the Spread Between Italian and German Yields
*(Basis points; * = percentage points; ** = basis points of annual GDP)*



Source: IMF staff calculations.
Notes: The squares show estimates of the effect of a two standard deviation surprise in the spread between 10-year yields on Italian and German government bonds. The whiskers show 90 percent confidence intervals. The expected future short-term interest rate and term premia, are at the 10-year maturity for the United States and at the 5-year maturity for Emerging market economies. The emerging market nominal effective exchange rate (NEER) is trade-weighted and increases denote appreciations. EMBI = J.P. Morgan Emerging Market Bond Index; VIX = Chicago Board Options Exchange Volatility Index.

Annex Figure 4.1.2. Effects of Positive News about US Economic Activity: Citi Index
*(Basis points; * = percentage points; ** = basis points of annual GDP)*



Source: IMF staff calculations.
Note: The squares show estimates of the effect of a two standard deviation surprise in US economic activity. The whiskers show 90 percent confidence intervals. The expected future short-term interest rate and term premia, are at the 10-year maturity for the United States and at the 5-year maturity for Emerging market economies. Exchange rate increases denote appreciations. The United States nominal effective exchange rate (NEER) is trade-weighted, while the emerging market exchange rate is against the US dollar. EMBI = J.P. Morgan Emerging Market Bond Index; VIX = Chicago Board Options Exchange Volatility Index.

Annex 4.2. Determinants of APP Choice and Policy Rate Cuts

Specification: APPs

This section explains the empirical strategy behind the discussion of the drivers of APP choice and the size of the policy rate cuts among emerging market economies during the Covid-19 crisis in the second part of the main text.

Whether a country used APPs is indicated by a binary dummy variable y that is equal to 1 for countries that used APPs between March and August 2020 and zero otherwise. Vector x contains the drivers explaining the probability p of launching an APP. The relationship between x and p is described by the logit model

[10] A 2-standard deviation increase in the Citi index of US economic news on a given day lifts EM interest rates of different maturities by between ½ and 1 bp.

$$\mathrm{p} = \Pr[y = 1|x] = \frac{\exp(x'\beta)}{1 + \exp(x'\beta)}$$

where the term on the right is the logistic cumulative distribution function.[11] The marginal effect of a specific variable x_i on the probability p is equal to

$$\frac{\partial \mathrm{p}_i}{\partial \mathrm{x}_i} = \frac{\exp(x'\beta)}{[1 + \exp(x'\beta)]^2}\beta_i$$

The columns denoted with "APP dummy" in Tables A.4.2.2-A.4.2.5 below show the estimated coefficients β for the various drivers. The parameters β are estimated via maximum likelihood on the cross-section of countries, using the method proposed by Firth (1993) to correct small sample biases.[12] The bars in the charts of the main text show the marginal effects, evaluated at the means of the variables in x.

Specification: Policy Rate Cuts

The determinants of the interest rate cuts are estimated using linear regression models with cross sectional data. To reduce the role of outliers, the chapter uses robust regression which drops or downweighs observations with large residuals.

Estimation Results

All logistic or linear regressions reported in the chapter control for GDP per capita. Moreover, with only three exceptions, all the other regressions also control for the presence of a floating or freely floating exchange rate.

The only three exceptions are the regressions based on the "Inflation Targeting" regressor and on the "CB Transparency" regressor shown in Figure 4.14 in the text of the chapter, and on the regression with "FXI" and "Policy rate cut" regressors whose results are displayed in Figure 4.16 in the main text. In all three cases, the exchange rate regime dummy was not used as a control because

Table A.4.2.1 Pairwise Correlations

Variables	APP dummy	Floating and free floating dummy	Inflation targeting dummy	CB transpa-rency	Number of numerical fiscal rules	FXI	Percent policy rate cut during Covid-19
APP dummy	1.00						
Floating and free floating dummy	0.51	1.00					
Inflation targeting dummy	0.49	0.72	1.00				
CB transparency	0.46	0.60	0.70	1.00			
Number of numerical fiscal rules	0.22	-0.15	0.02	0.15	1.00		
FXI	0.28	0.48	0.47	0.30	-0.03	1.00	
Percent policy rate cut during COVID-19	0.30	0.24	0.31	0.25	0.30	0.22	1.00

[11] See Cameron and Trivedi (2019) for details.

[12] Since the number of observations is relatively small, collinearities make it difficult to estimate models containing many drivers jointly. But even with separate logistic regressions for individual explanatory variables, maximum likelihood estimates are known to be biased due to a small sample size. This chapter therefore employs the method of Firth (1993) to reduce this bias. The method works by introducing a penalty term in the likelihood that shrinks the parameters toward zero. Without the penalty, traditional maximum likelihood parameters would be biased away from zero.

of its naturally high correlation with the regressors (see Table A.4.2.1; the reason why the FXI indicator is highly correlated with the exchange rate regime is discussed in a footnote in the relevant section of the chapter).

Columns (1)-(3) in Table A.4.2.2 show the APP logit models and columns (4)-(6) the interest rate regressions for the group of *policy framework* variables.[13] The number of fiscal rules here counts budget balance, debt, expenditure and revenue rules, at the national and supranational level. Note that, since the number of fiscal rules that a country has in place is not very correlated with the flexible exchange rate dummy (Table A.4.2.1), both variables are used contemporaneously in the regression. The coefficients on GDP per capita are not significant in these specifications. Columns (4)-(6) show results for the policy rate cuts. Here the GDP per capita level is significant at the 1 percent level in models (5) and (6) but

Table A.4.2.2 APPs and Rate Cuts in Emerging Markets: Policy Frameworks

	(1) APP dummy	(2) APP dummy	(3) APP dummy	(4) Percent policy rate cut during COVID-19	(5) Percent policy rate cut during COVID-19	(6) Percent policy rate cut during COVID-19
Real GDP pc, PPP	-0.000007	-0.000001	-0.0000001	-0.000158	0.000436***	0.000631***
	(-0.10)	(-0.06)	(-0.01)	(-0.28)	(2.73)	(3.17)
Floating and Free floating dummy	3.578***			19.24**	5.638	6.338
	(3.10)			(2.53)	(0.83)	(0.86)
Number of numerical rules in place	0.592**			4.789*		
	(2.03)			(1.97)		
Inflation targeting dummy		2.287***			18.19***	
		(4.27)			(2.71)	
Transparency Index			0.396***			2.220*
			(3.38)			(1.79)
Constant	-3.939**	-2.047***	-3.612***	0.239	1.028	-6.971
	(-2.49)	(-3.53)	(-3.42)	(0.02)	(0.26)	(-0.86)
Observations	41	96	72	39	92	70
R^2				0.211	0.249	0.216

t statistics in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.4.2.3 APPs and Rate Cuts in Emerging Markets: Fiscal Position

	(1) APP dummy	(2) APP dummy	(3) APP dummy	(4) Percent policy rate cut during COVID-19	(5) Percent policy rate cut during COVID-19	(6) Percent policy rate cut during COVID-19
Real GDP pc, PPP	-0.000046	-0.00003	0.000012	0.00037	0.000479***	0.000194
	(-0.88)	(-0.87)	(0.42)	(1.38)	(2.67)	(0.74)
Floating and free floating dummy	2.460***	2.044***	3.049***	7.887	16.43***	12.89
	(2.79)	(3.51)	(3.12)	(1.02)	(2.78)	(1.54)
Fiscal space 'at risk' or 'some'	2.397**			3.257		
	(2.10)			(0.34)		
S&P investment grade dummy		1.296**			(0.648)	
		(1.99)			(-0.11)	
Fiscal balance deterioration			0.0102			-0.156
			(0.88)			(-0.75)
Constant	-2.541*	-1.798***	-2.901**	14.15	3.676	15.57*
	(-1.94)	(-2.76)	(-2.45)	(1.23)	(0.85)	(1.86)
Observations	39	96	45	39	92	43
R^2				0.077	0.16	0.083

t statistics in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[13] The tables in this Annex report the estimated coefficients β and not the marginal effect of the regressors, which are instead shown in the figures in the main body of the chapter.

loses significance in model (4) (this could be related to the rather small sample size).

Columns (1)-(3) and columns (4)-(6) in Table A.4.2.3 show the role of the *fiscal position* variables "intermediate fiscal space", an "investment grade rating" and of the "deterioration in the fiscal balance". Contrary to the APP regression, in the interest rate regressions none of the variables are statistically significant.

Table A.4.2.4 shows the regression results corresponding to Figure 4.16 in the chapter and Table A.4.2.5 provides the "Taylor rule" estimate for Figure 4.18 in the chapter.

Table A.4.2.4 APPs in Emerging Markets: Other instruments

	(1) APP dummy
Real GDP pc, PPP	-0.0000219 (-0.93)
Percent policy rate cut during COVID-19	0.0254** (2.46)
Foreign exchange intervention dummy	1.090** (2.01)
Constant	-1.652*** (-3.13)
Observations	92

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.4.2.5 Policy Rate Cuts in Markets: Domestic Conditions

	(1) Percent policy rate cut during COVID-19
Real GDP pc, PPP	0.0000858 (0.46)
Floating and free floating dummy	15.92*** (3.30)
COVID cases per 1000 inhab., Sep 1 2020	0.770** (2.31)
CPI inflation YOY	-0.665* (-1.97)
Manufacturing contribution to GDP	1.073*** (3.57)
Constant	-3.035 (-0.56)
Observations	83
R^2	0.344

t statistics in parentheses,

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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